КАЗАНСКИЙ ФЕДЕРАЛЬНЫЙ УНИВЕРСИТЕТ
ИНСТИТУТ МЕЖДУНАРОДНЫХ ОТНОШЕНИЙ
ВЫСШАЯ ШКОЛА ИНОСТРАННЫХ ЯЗЫКОВ И ПЕРЕВОДА

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ENGLISH FOR UNDERGRADUATES OF PHYSICS

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для магистрантов Института физики

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Данное пособие предназначено для магистрантов Института физики, содержит материалы, дополняющие основной курс английского языка и способствующие развитию навыков и умений научно-профессиональной коммуникации на английском языке. Пособие может быть использовано как для аудиторной работы, так и для самостоятельной работы студентов.

Предисловие

Настоящее учебное пособие предназначено для занятий с магистрантами Института физики Казанского (Приволжского) федерального университета. Цель данного пособия повысить уровень владения академическим иностранным языком, достигнутый на предыдущей ступени образования, и овладение студентами необходимым уровнем иноязычной коммуникативной компетенции в профессиональной области.

В задачу пособия входят совершенствование навыков и умений самостоятельно работать с аутентичными текстами на английском языке с целью получения информации, поддержания научных и профессиональных контактов. Критерием отбора текстового материала является информативная ценность аутентичных текстов. Некоторые тексты подвергались адаптации и сокращению. Также, пособие включает в себя упражнения и задания, направленные на развитие устных коммуникативных навыков.

Пособие состоит из 10 разделов, каждый из которых содержит тематический текст и задания для полного и точного понимания текста, а также задания по развитию коммуникационных компетенций. Мониторинг осуществляется через репродуктивные, продуктивные и творческие задания, которые способствуют усвоению и запоминанию специальных терминов в области направления обучения студентов. Письменные задания нацелены на отработку навыков перевода и позволяют совершенствовать навыки письменной коммуникации. Пособие содержит материалы и задания, которые можно использовать в качестве дополнительного учебного материала магистрам уровней Intermediate – Advanced. Разноуровневость заданий позволяет осуществлять дифференцированный подход в обучении.

Пособие дополнено глоссарием терминов по физике ***Glossary of Physics Terms*** и глоссарием терминов по высшему образованию ***Academic English Glossary.***

Contents

Unit 1. WHAT ARE YOUR CAREER GOALS?

Reading skills

Text

1. People seek careers in science or engineering for many reasons. Some have specific goals: they wish to cure diseases or combat hunger or reduce pollution; or they dream of developing the next laser, transistor, or vehicle for space travel; or they imagine building companies that capitalize on new engineering capabilities. Some choose careers in science or engineering because they are curious about the natural world. Others are motivated by the excitement and beauty of the intellectual world and hope to formulate theories that will lead to new ways of thinking about the world. Still others imagine educating people about science or engineering in schools or through the media; they want to provide counsel or shape public policies on issues of direct relevance to science or engineering. Each of these motivations is legitimate, each is valuable, and each flows naturally from an education in science and engineering.
2. Careers in science and engineering are essentially hope-filled endeavors that can improve people's lives and result in knowledge that all people can share. As the techniques and products of science and technology have become more central to modern society, a background in science and engineering has become essential to more and more careers. In fact, degrees in science and engineering are becoming as fundamental to modern life as the traditional liberal-arts degree. The contributions of scientists and engineers already extend beyond research and development and throughout the realms of teaching, business, industry, and government. People with bachelor's, master's, and doctoral degrees in science or engineering are forming companies, managing businesses, practicing law, formulating policy, consulting, and running for political office. They are forming global communities of common interests that transcend the differences among individuals, corporate endeavors, or nations.
3. But if you are contemplating a career in science or engineering, how can you begin your planning most effectively? If you are an undergraduate or beginning graduate student – the groups for whom this guide is primarily designed – how well do your own skills and personality match the career you imagine? It is important to remember that science-oriented students are not all alike, any more than all artists or all politicians are alike. Your success will depend on going where your particular interests lead you. Are you exhilarated by the challenge of a new problem or puzzle or need? Does the complexity of the natural world prompt a desire to understand it? If so, science and engineering study – rigorous though it is – will provide you with the tools and concepts that you need to achieve your goals.
4. Your own goals will determine which academic degree is most appropriate for you. Many people find satisfying careers in a variety of positions after the bachelor's degree. Others, notably engineers, find that a master's degree equips

them well for professional careers. For those who hope for careers conducting research and/or teaching at the university level, a PhD will probably be required. No degree guarantees lifetime employment. Like professionals in other fields, you might still have to change jobs and even careers during your life – perhaps more than once. It is the purpose of this guide to help you lay the foundation for your journey, no matter how many turns your path takes.

5. Just how rigorous is the path to a scientific or engineering career? Graduate study, in particular, is demanding mentally, physically, and emotionally. Not everyone has the perseverance to complete years of concentrated study. But the experience of doing scientific or technical work is supremely exhilarating for those with sufficient interest and determination. And many people will be willing to help you along the way and assist you over difficult hurdles as you gain the confidence to think and work independently.

6. Are you bright enough to become a scientist or engineer? Again, there is no standard against which to measure yourself; no kind of intelligence applies across all the many fields of science and engineering. But you can do no better than to trust in your deepest feeling. If your enjoyment of mathematics and science is real, you will probably want to understand, use, and explore them on a deeper level.

One of the most helpful guides to doctoral study in both science and engineering is a slim book by scientist and writer Peter Medawar titled Advice to a Young

7. Scientist Medawar writes: "A novice must stick it out until he [or she] discovers whether the rewards and compensations of a scientific [or engineering] life are for him [or her] commensurate with the disappointments and the toil; but if once a scientist [or engineer] experiences the exhilaration of discovery and the satisfaction of carrying through a really tricky experiment ... then he [or she] is hooked and no other kind of life will do." And again Medawar is helpful: "One does not need to be terrifically brainy to be a good scientist. ... Common sense one cannot do without, and one would be the better for owning some of those old-fashioned virtues . . . application, diligence, a sense of purpose, the power to concentrate, to persevere and not be cast down by adversity." (Medawar 1979).

8. Make a list of reasons why you like to study science and engineering and a list of reasons why you don't. Compare the two lists. Make a list of the positive and negative aspects of various careers which you are interested in. Seek out people with science and engineering backgrounds who work in careers which you are interested in and ask them to have lunch with you so that you can ask them about their work and how they got where they are today. How do they spend their time? What do they find most satisfying and most disagreeable? Does the life that they describe appeal to you?

9. If you're an undergraduate, talk with several graduate students; if you're a beginning graduate student, talk with several advanced students or postdoctoral students. Ask them what they have learned that they wish they had known early in their careers.

Adapted from: https://www.nap.edu/read/5129/chapter/2
Accessed: 11.08.2020

After text tasks

1. **Look through the following words from the text and try to find some other meanings of them. Which meaning of these words matches the translation of this text?**

1. goal [gəʊl] цель
2. disease [dɪˈziːz] болезнь
3. combat [ˈkɔmbət] бороться
4. pollution [pəˈluːʃn] загрязнение
5. reduce [rɪˈdjuːs] сокращать, уменьшить
6. capability [keɪpəˈbɪlɪtɪ] возможность
7. products [ˈprɒdʌkts] зд. средства
8. endeavor [ɪnˈdevə] пытаться
9. background [ˈbækgraʊnd] фон
10. transcend [trænˈsend] преодолевать, превзойти
11. alike [əˈlaɪk] похожий
12. exhilarate [ɪgˈzɪləreɪt] оживлять
13. prompt [prɔmpt] быстрый
14. achieve [əˈʧiːv] достигать, добиваться
15. appropriate [əˈprəʊprɪɪt] соответствующий, подходящий
16. satisfying [ˈsætɪsfaɪɪŋ] удовлетворяющий
17. employment [ɪmˈplɔɪmənt] занятость, работа
18. purpose [ˈpɜːpəs] цель, задача
19. hurdle [hɜːdl] препятствие, барьер
20. reward [rɪˈwɔːdz] награда

2. Translate the following word combinations into Russian.

1. career goals
2. reduce pollution
3. space travel
4. natural world
5. through the media
6. demanding mentally
7. global communities
8. sufficient interest
9. helpful guides
10. primarily designed

3. Read the text and answer the following questions:

1. What examples of career goals are mentioned in the text?
2. What will define which academic degree is the most suitable for you?
3. Who forms global communities of common interests that transcend the differences among individuals, corporate endeavors, or nations?
4. What level of education guarantees lifetime employment?

5. Whose helpful guide for doctoral studies in science and engineering is presented in the text?

4. Find the English equivalents to the following word combinations in the text. Make up your own sentences with these phrases.

1. надежные усилия
2. политическая сфера
3. различия между людьми
4. глубокий уровень
5. транспортное средство для космических путешествий

5. What is the main idea of the text? Choose the correct answer. Offer your own version of the main idea of the text.

a) Most people are looking for a career in science or technology.
b) People with bachelor's, master's, and doctoral degrees in science or engineering are capable to form companies and managing businesses.
c) People seek careers in science or engineering for many reasons.

6. Mark true (T) or false (F) sentences.

a) People never find satisfying careers in a variety of positions after the bachelor's degree.
b) Some people are motivated by the excellence and beauty of the intellectual world and hope to formulate theories that will lead to new ways of thinking about the world.
c) People with a bachelor's, master's and doctor's degrees in science or technology do not have enough skills and knowledge to form companies, manage business.
d) It is useful to look for people with scientific and engineering knowledge who work in the career in which you are interested.
e) One does not need to be terrifically brainy to be a good scientist.

7. In what paragraph is it written about the contribution of scientists and engineers in science and technology?

a) 1; b) 2; c) 3.

8. Put the names of the paragraphs 1, 2 and 3 in the correct order.

Titles	Number
a) Effective planning of a career in science or engineering	
b) The reasons why people are looking for a career in science or technology	
c) Contribution of scientists and engineers to the development of science	

9. Choose the correct answer to the given question. Make your own question to the text with the question word "Why". Ask your partner this question.

What can help you to choose the most appropriate Academic degree for you?

a) Parents` recommendations

b) Own goals

c) Teachers` advice

10. Translate the sentence into Russian

Each of these motivations is legitimate, each is valuable, and each flows naturally from an education in science and engineering.

11. Match column A and B

A	B
1. hurdle	a. задача
2. products	b. средства
3. disease	c. фон
4. background	d. препятствие
5. purpose	e. болезнь

12. Complete the sentence.

If your enjoyment of mathematics and science is real, you will probably … .

13. Choose the sentence with the correct word order.

a) Some choose science or engineering careers because they are curious about the natural world.

b) Some science or engineering choose in the careers because natural world about they are curious.

c) Because curious about the natural world, they are choose some careers in science or engineering.

Communication skills

(Adopted from: Armer T. Cambridge English for scientists. Cambridge University Press. https://portal.tpu.ru/SHARED/m/MALORISS/studentam/SelfStudy/Tab2/Posobie5cours.pdf)

1. In pairs, discuss the following questions. Explain your answer. Express your attitude to the received response, your agreement or disagreement with the partner's opinion.

1. Why did you choose a career in science?

2.What field of science are you currently working or studying in?

3. What would you like to do next in your work or studies?

2. Make a comparative table of higher education in the United States and Russia, and then answer the following questions.

Higher education for science in the Russian Federation

Qualification	Category	Duration	Place of study

1. Is science education in the US similar to science education in your country?
2. If you decided to study in the US, which qualification would be best for you?

3. Write a short essay on the suggested topics. Suggest some other relevant essay topics:

• what you enjoy most about working in your scientific field.
• what you would like to do (and not like to do) next in your career.
• which of your past and present experiences are most relevant to your future in science.

4. In pairs, take turns to interview your partner about his/her career path in science. What questions do you think are the most relevant?

5. Look at the application form (1-10) and add the information you need to provide when applying for a grant.

APPLICATION FORM

1. Applicant
2. Current appointment and address
3. Location of proposed study
4. Sponsor's recommendation
5. Departmental support
6. Project title
7. Project summary
8. Details of proposed research
9. Budget
10. Nominated referee with personal knowledge of applicant

6. In pairs, discuss the following questions.

1. Have you ever applied for a job in science? If not, what kind of job would you like to apply for in the future?
2. Which of the following documents are job applicants usually asked for in your country?
• application form
• biodata
• cover letter (covering letter)

• resume or CV (curriculum vitae)
3. Have you ever written one of these documents in English?
4. Do you think that the information you include and the way you organize a resume or CV in English will be the same as a resume or CV in your own language?

7. Complete the advice for interviews using the words and phrases given below.

application form, comfortable position, facing, late, phone number, questions, see, shuffle (шуршать), thank, tone of voice

Before your interview

Find out exactly who you will be talking to. Check whether they will be able to (1)_____you or just hear you. Check the date, time, the (2)_____ to dial in on, and the right code to access the conference call Read your CV and (3)_____ again. Practise answering questions you might be asked. Prepare (4)_____ to ask the interviewer.

During your interview

- Don't be (5)_____ .
- Use your (6)_____ . to sound confident and enthusiastic
- Do not (7)_____papers (this will make a noise)
- Sit in a (8)_____ – do not move about too much
- Speak very clearly, (9) _____ the microphone
- When the interview is over (10) _____ the interviewer(s) and end positively

UNIT 2. INTERNATIONAL SCIENTIFIC COLLABORATION

Reading skills

Text 1. International Scientific Collaboration

1. Most developing country governments recognize that science and technology can bring economic and social benefits to their country. But the value of encouraging collaboration between their own scientists and technologists and those of other countries is less obvious to them. Furthermore, the degree to which governments have recognized the connection between investment in science and technology, and the benefits that such investment can bring, varies greatly in the developing world. The leaders of many of the least developed countries in Africa, for example, are still looking for a compelling analysis to show that science and technology are relevant to their needs. Within this context, however, there is a growing awareness that the return on investment in science and technology in developing countries can be significantly increased if part of that investment is used to promote collaboration with researchers in other countries.

2. As a result of this realization, the form that collaboration in science and technology should take, the conditions under which it is likely to succeed, the risks that collaborative projects can face – especially when collaboration takes place between partners of unequal scientific strength – and the potential barriers that can stand in their way, have each become major topics within the research and development policies of both developed and developing countries.

This policy brief focuses on these issues in the context of international collaboration in scientific research – the process by which scientists in two or more countries collaborate to carry out research of mutual interest.

3. National research institutes and business firms also collaborate internationally to develop new technologies; indeed the rise of globalization has meant international technological cooperation has become a major component of the economic policies of many countries. But such collaboration raises different issues from those associated with international scientific collaboration, and will not be addressed in this paper. Neither does the paper address the funding of research in developing countries by international donors. This can be an important source of research funding for those countries, and indeed is sometimes referred to as international scientific collaboration. But it is more appropriately called 'science aid', and (apart from the funding of joint projects between researchers in developing countries) will not be explicitly addressed here.

4. What this policy brief does seek to do, however, is to summarize the issues that are likely to be faced by decision makers in both developed and developing countries when handling potential collaborative projects, as well as addressing the relevant institutional government policies and guidelines within which collaboration can take place. Included in this is a brief reference to the

increasingly important impact of information and communication technologies (ICTs) on collaboration, as well as some of the ethical issues that can arise. Finally, the policy brief suggests that national strategies are needed to maximize the benefits that collaboration can bring. To judge by the steadily rising percentage of scientific papers that list authors living and working in different countries, collaboration in scientific research has been increasing steadily in recent years. There are several ways in which the governments of developing countries can benefit from this trend.

5. First, most scientific knowledge and expertise is located in relatively few advanced countries. Collaboration between scientists working these countries and those in developing countries therefore provides an important channel for the latter to access this knowledge and expertise, and apply them to local problems. Second, working with foreign scientists – especially that from more scientifically advanced countries – provides a good way of enhancing domestic scientific capabilities through the exchange of knowledge and experience.

Another advantage is that collaborative research can provide access to scientific facilities that may not be available locally, for example, large computing facilities, or 'big science' facilities, such as particle accelerators, radiotelescopes and oceanographic research vessels.

6. One important value of collaborative research is that it can provide access to foreign sources of funding for researchers in developing countries. In addition, some donors, such as the International Development Research Centre (IDRC) in Canada, and the department for research cooperation of Sweden's International Development Cooperation Agency (Sida/SAREC), have contributed financially to the promotion of scientific collaboration between developing countries. This can be useful in particular where neighbouring countries often have similar research interests and common publication profiles. Furthermore, collaboration between countries can have useful political advantages. It can create trust and personal friendships between researchers, which can sometimes help diffuse tension and conflicts between the respective.

7. Another example is the way that the European Union has encouraged scientific collaboration between its member countries as a device to encourage European integration. Similar collaboration within developing country blocs, for example between countries in Central America or belonging to Mercosur in South America, has also led to closer political ties. An additional reason for encouraging collaborative research that is sometimes overlooked is that it provides a useful mechanism for engaging the talents of émigré researchers who have joined the brain drain, but still wish to stay in touch with their country of origin.

8. Finally, scientific collaboration between developing countries may be necessary in order to solve regional and global problems. Despite the various factors that favour collaboration, there can be circumstances in which these conflict – or at least are seen to conflict – with those that favour competition. This is particularly the case when the research is close to the market place.

Indeed, it is the need to manage the tension with competition rules and guidelines that leads both firms and governments to develop strategies on international scientific collaboration.
9. There are other potential disadvantages with collaboration that need to be recognized. Sometimes an element of exploitation can exist with a collaborative arrangement, particularly when partners of unequal scientific strengths are involved. The stronger partner, for example, may design the project, analyze the results, and take the lead in publishing the results, using the weaker partner merely as a research assistant to collect data.
10. Such an arrangement can provide little benefit to the weaker partner, with the result that little new capacity will have been created at the end of the project. Indeed collaborative projects can even be a way of encouraging the brain drain, if a researcher from the scientifically weaker country leaves to join the main research team once the project is ended.
11. A further potential disadvantage is that, if the partners are unequal, any commercial benefits from the research may be claimed by the stronger partner. Furthermore, the greater scientific strength of a country, the greater is the propensity to engage in international collaboration; this can lead to foreign scientists playing an excessively dominant role in setting the research agenda of a country that is scientifically weak.
12. Then there is the fact that mechanisms for supporting collaborative research have sometimes been deliberately used to gain access to politically-sensitive areas – such as geographical regions under military control. Alternatively, there may be fears that collaboration is being used to carry out unethical human medical trials, natural resource investigations, or even experiments in biological warfare that may be prohibited in the country of the stronger partner.
13. Finally, the administrative and other costs – referred to as the 'transaction costs' – of collaborating with partners in foreign countries can often be high. Such costs may be incurred by language differences and the resulting communication problems, by bureaucratic and management differences and styles, and by frustrations caused by travel restrictions and time taken to acquire visas. Each of these potential disadvantages of collaboration must be carefully weighed up against the potential benefits before any collaborative arrangement is agreed.

By Geoffrey Oldham
Adapted from: https://www.scidev.net/global/policy-brief/international-scientific-collaboration-a-quick-gui.html
Accessed:11.08.2020

After text tasks

1. **Look through the following words from the text and try to find some other meanings of them. Which meaning of these words matches the translation of this text?**

1. recognize [ˈrekəgnaɪz] признавать
2. benefit [ˈbenɪfɪt] выгода

3. awareness [əˈweə.nəs] осознание
4. issue [ˈɪʃuː] вопрос
5. mutual [ˈmjuːtʃuəl] взаимный, общий
6. joint [dʒɔɪnt] совместный
7. brief [briːf] краткий
8. explicitly [ɪkˈsplɪsɪt] явно, подробно, прямо
9. impact [ˈɪmpækt] воздействие, вклад
10. steadily [ˈstedɪli] неуклонно, стабильно
11. relatively [ˈrelətɪvli] относительно, соответственно, условно
12. advanced [ədˈvɑːnst] передовой, развитый, продвинутый
13. émigré [ˈemɪgreɪ] эмигрант
14. drain [dreɪn] утечка
15. disadvantage [dɪsədˈvɑːntɪdʒ] недостаток
16. particularly [pəˈtɪkjələli] в частности
17. excessively [ekˈsesɪv] чрезмерно
18. unethical [ʌnˈeθɪkəl] неэтично
19. warfare [ˈwɔːfeər] война
20. weigh up [weɪʌp] взвесить, решить

2. Translate the following word combinations into Russian. Make up your own sentences with these phrases.

1. social benefit
2. encouraging collaboration
3. within this context
4. mutual interest
5. policy brief
6. enhancing domestic scientific capabilities
7. trust and personal friendships
8. diffuse tension
9. research agenda
10. travel restrictions

3. Read the text and answer the following questions:

1. What countries recognize that science and technology can bring economic and social benefits?
2. In what way do national research institutes and business firms collaborate to develop new technologies?
3. What benefits of international collaboration?
4. Can scientific collaboration between developing countries solve regional and global problems?
5. Does scientific collaboration have any disadvantages?

4. Find the English equivalents to the following word combinations in the text.

1. развивающиеся страны
2. растущая обеспокоенность
3. иностранные ученые
4. механизмы поддержки
5. потенциальные недостатки

5. What is the main idea of the text? Choose the correct answer. Offer your own version of the main idea of the text.

a) Scientific collaboration can bring economic and social benefits to the world.
b) Scientific collaboration is the reason, causing the brain drain and providing local facilities for scientists.
c) Scientific collaboration is method of boosting the scientific and technological progress with its own advantages and disadvantages

6. Mark true (T) or false (F) sentences.
a) Most developing country governments recognize that science and technology can bring economic benefits.
b) National research institutes and business firms also collaborate internationally to develop new technologies
c) An element of exploitation can exist without a collaborative arrangement
d) If the partners are unequal, any commercial benefits from the research may be claimed by the stronger partner.
e) Collaboration between countries can't have useful political advantages.

7. In what paragraph is it written that scientific collaboration between developing countries can solve regional and global problems?
a) 1; b) 2; c) 3;

4. Put the names of the paragraphs 1,2 and 3 in the correct order.

Titles	Number
a) The benefits of international collaboration	
b) Introduction	
c) Possible disadvantages	

8. Choose the correct answer to the given question. Make your own question to the text with the question word "Why". Ask your partner this question.

What are potential disadvantages with collaboration that need to be recognized?
a) it can`t solve regional and global problems
b) an element of exploitation can exist with a collaborative arrangement
c) it can`t provide access to foreign sources of funding for researchers in developing countries

9. Translate the sentence.
Furthermore, the greater scientific strength of a country, the greater is the propensity to engage in international collaboration; this can lead to foreign scientists playing an excessively dominant role in setting the research agenda of a country that is scientifically weak.

10. Match column A and B.

A	B
1. Goal 2. Developing 3. Developed 4. Advanced 5. Problem	a) Цель b) Развитый c) Проблема d) Продвинутый e) Развивающийся

11. Complete the sentence.
Finally, scientific collaboration between developing countries may be necessary in order … .

12. Choose the sentence with the correct word order.
a) Similar collaboration developing within country blocs has also led to closer political ties.
b) Closer collaboration within blocs also has led to similar political developing country ties.
c) Similar developing within country collaboration blocs also has also led to closer political ties.

Communication skills

(Adopted from: Armer T. Cambridge English for scientists. Cambridge University Press. https://portal.tpu.ru/SHARED/m/MALORISS/studentam/SelfStudy/Tab2/Posobie5cours.pdf)

1. Read and remember methods of communication (1-6). What other modern methods of scientific communication do you know? Have you ever used these methods? In what situations do you think it is better to use this or that method?
1. an academic journal
2. a conference
3. an online forum or science blog
4. a popular science magazine
5. a popular science book
6. a newspaper

2. Answer the following question. Explain your answer. Express your agreement or disagreement with the partner's opinion.
Why is it important for scientists to keep in touch with:
a) other people in their field (e.g. biology)?
b) people in their specialism (e.g. molecular biology)?
c) people in other fields of science?

3. Read the following statements and say which form(s) of communication from Exercise l students should use to find the information they want.

1. I'm trying to learn more about the Hadron collider because it's big news, but it's not even close to my area so I'm finding the papers on it heavy-going.
2. At my university, I don't meet enough people in my field – I really need to network and build some connections with people working around the world.
3. I'm having a problem with one of my protocols. I've tried a few different things, but with no luck – I could do with some suggestions from other people of what to try next.

4. Read the following five extracts and then say which form (or forms) of communication from Exercise 1 each one comes from. Which form(s) of communication are not included in these extracts? How easy was it to decide where extracts came from? How did you decide on the right answer? Give reasons.

1. ... more people were pain-free when using the handheld device than those who had used an identical dummy device. Although the study by Lipton (2010) has reliable results, there are some points to consider when putting these findings into context. Importantly, the results will need to be verified in larger trials that directly compare ...
2. Tea and coffee drinkers have a lower risk of developing type 2 diabetes, a large body of evidence shows. And the protection may not be down to caffeine since decaf coffee has the greatest effect, say researchers in Archives of Internal Medicine. They looked at ...
3. ... can be rapidly generated by lentivirus mediated transgenesis. RNAi also holds great promise as a novel therapeutic approach. This report provides an insight into the current gene silencing techniques in mammalian systems.
4. Hi! Has anyone had any experiences with nanoparticles sticking to glassware? If so, does anyone know if there’s a suitable silylation protocol to pre-treat the glassware to do something about this annoying non-specific adsorption? Thanks!
5. Animal and in vitro studies suggest that aspirin may inhibit breast cancer metastasis. We studied whether aspirin use among women with breast cancer decreased their risk of death from breast cancer. This was a prospective observational study based on ...

5. In pairs, discuss the following questions.
1. When you have a problem at work, who do you usually ask for help?
2. Have you ever asked a question on a science or professional internet forum? If so, was your question answered?

6. Think of some material you often use in your lab. Write a brief lay summary of what the material is and what it will be used for. In pairs, discuss the following questions.
1. Does your place of work or study have similar rules to those in the email?
2. What kind of materials require a Material Transfer Agreement?
3. What kind of information would you expect to be asked for in an MTA?

7. Complete the form (to be completed when sending or receiving material):

Material Transfer Agreement

- Recipient Researcher: _____
- Recipient Institution & Address:
- Provider Researcher: _____
- Material Name: _____
- Is this work involved with existing commercial arrangements? (1) Yes/No
- Does the work involving the material have commercial potential? (2) Yes/No
- Is this material hazardous? (3) Yes/No
- Is BioSafety Committee Approval required? (4) Yes/No
- Is Ethics Committee Approval required? (5) Yes/No
- If required, has Ethics and/or Bio Safety Approval been received? (6) Yes/No
- Who will own the IP in any modifications to, or data collected on the material? (7) University/Other/Joint
- Will any University of the South students be involved in using the material? (8) Yes/No

UNIT 3. WHAT IS CRITICAL THINKING?

Reading skills

Text

1. Critical thinking is the ability to think clearly and rationally about what to do or what to believe. It includes the ability to engage in reflective and independent thinking. Someone with critical thinking skills is able to do the following:

- understand the logical connections between ideas

- identify, construct and evaluate arguments
- detect inconsistencies and common mistakes in reasoning
- solve problems systematically
- identify the relevance and importance of ideas
- reflect on the justification of one's own beliefs and values

Critical thinking is not a matter of accumulating information. A person with a good memory and who knows a lot of facts is not necessarily good at critical thinking. A critical thinker is able to deduce consequences from what he knows, and he knows how to make use of information to solve problems, and to seek relevant sources of information to inform himself.

2. Critical thinking should not be confused with being argumentative or being critical of other people. Although critical thinking skills can be used in exposing fallacies and bad reasoning, critical thinking can also play an important role in cooperative reasoning and constructive tasks. Critical thinking can help us acquire knowledge, improve our theories, and strengthen arguments. We can use critical thinking to enhance work processes and improve social institutions.

Some people believe that critical thinking hinders creativity because it requires following the rules of logic and rationality, but creativity might require breaking rules. This is a misconception. Critical thinking is quite compatible with thinking "out-of-the-box", challenging consensus and pursuing less popular approaches. If anything, critical thinking is an essential part of creativity because we need critical thinking to evaluate and improve our creative ideas.

3. Critical thinking is a domain-general thinking skill. The ability to think clearly and rationally is important whatever we choose to do. If you work in education, research, finance, management or the legal profession, then critical thinking is obviously important. But critical thinking skills are not restricted to a particular subject area. Being able to think well and solve problems systematically is an asset for any career.

4. Critical thinking is very important in the new knowledge economy. The global knowledge economy is driven by information and technology. One has to be able to deal with changes quickly and effectively. The new economy places increasing demands on flexible intellectual skills, and the ability to analyze information and integrate diverse sources of knowledge in solving problems. Good critical thinking promotes such thinking skills, and is very important in the fast-changing workplace.

5. Critical thinking enhances language and presentation skills. Thinking clearly and systematically can improve the way we express our ideas. In learning how to analyze the logical structure of texts, critical thinking also improves comprehension abilities.

6. Critical thinking promotes creativity. To come up with a creative solution to a problem involves not just having new ideas. It must also be the case that the new ideas being generated are useful and relevant to the task at hand. Critical thinking plays a crucial role in evaluating new ideas, selecting the best ones and modifying them if necessary

7. Critical thinking is crucial for self-reflection. In order to live a meaningful life and to structure our lives accordingly, we need to justify and reflect on our values and decisions. Critical thinking provides the tools for this process of self-evaluation.

8. Good critical thinking is the foundation of science and democracy. Science requires the critical use of reason in experimentation and theory confirmation. The proper functioning of a liberal democracy requires citizens who can think critically about social issues to inform their judgments about proper governance and to overcome biases and prejudice.

9. Some words about the future of critical thinking. In January 2020, the World Economic Forum issued a report "The Future of Jobs". It says: The Fourth Industrial Revolution, which includes developments in previously disjointed fields such as artificial intelligence and machine-learning, robotics, nanotechnology, 3-D printing, and genetics and biotechnology, will cause widespread disruption not only to business models but also to labour markets over the next five years, with enormous change predicted in the skill sets needed to thrive in the new landscape. The top three skills that supposed to be most relevant are thinking skills related to critical thinking, creativity, and their practical application. These are the cognitive skills that our website focuses on.

10. Critical thinking is a metacognitive skill. What this means is that it is a higher-level cognitive skill that involves thinking about thinking. We have to be aware of the good principles of reasoning, and be reflective about our own reasoning. In addition, we often need to make a conscious effort to improve ourselves, avoid biases, and maintain objectivity. This is notoriously hard to do. We are all able to think but to think well often requires a long period of training. The mastery of critical thinking is similar to the mastery of many other skills. There are three important components: theory, practice, and attitude.

11. If we want to think correctly, we need to follow the correct rules of reasoning. Knowledge of theory includes knowledge of these rules. These are the basic principles of critical thinking, such as the laws of logic, and the methods of scientific reasoning, etc. Also, it would be useful to know something about *what not to do* if we want to reason correctly. This means we should have some basic knowledge of the mistakes that people make. First, this requires some knowledge of typical fallacies. Second, psychologists have discovered persistent biases and limitations in human reasoning. An awareness of these empirical findings will alert us to potential problems.

12. However, merely knowing the principles that distinguish good and bad reasoning is not enough. We might study in the classroom about how to swim, and learn about the basic theory, such as the fact that one should not breathe under water. But unless we can apply such theoretical knowledge through constant practice, we might not actually be able to swim.

Similarly, to be good at critical thinking skills it is necessary to internalize the theoretical principles so that we can actually apply them in daily life. There are at least two ways. One is to do lots of good-quality exercises. Exercises include

not just exercises in classrooms and tutorials. They also include exercises in the form of discussion and debates with other people in our daily life. The other method is to think more deeply about the principles that we have acquired. In the human mind, memory and understanding are acquired through making connections between ideas.

13. Good critical thinking skills require not just knowledge and practice. Persistent practice can bring about improvements only if one has the right kind of motivation and attitude. The following attitudes are not uncommon, but they are obstacles to critical thinking:

- I prefer being given the correct answers rather than figuring them out myself.
- I don't like to think a lot about my decisions as I rely only on gut feelings.
- I don't usually review the mistakes I have made.
- I don't like to be criticized.

To improve our thinking we have to recognize that the importance of reflecting on the reasons for belief and action. We should also be willing to engage in debate, break old habits, and deal with linguistic complexities and abstract concepts.

14. The *California Critical Thinking Disposition Inventory* is a psychological test that is used to measure whether people are disposed to think critically. It measures seven different thinking habits listed below, and it is useful to ask ourselves to what extent they describe the way we think:

1. Truth-seeking – Do you try to understand how things really are? Are you interested in finding out the truth?
2. Open-mindedness – How receptive are you to new ideas, even though intuitively they do not agree with you? Do you give them a fair hearing?
3. Analyticity – Do you try to understand the reasons behind things? Do you act impulsively or do you evaluate the pros and cons of your decisions?
4. Systematicity – Are you systematic in your thinking? Do you break down a complex problem into parts?
5. Confidence in Reasoning – Do you always defer to other people? How confident are you in your own judgment? Do you have reasons for your confidence? Do you have a way to evaluate your own thinking?
6. Inquisitiveness
7. Maturity of Judgment – Do you jump to conclusions? Do you try to see things from different perspectives? Do you take other people's experiences into account?

Finally, as mentioned earlier, psychologists have discovered over the years that human reasoning can be easily affected by all kinds of cognitive biases. For example, people tend to be over-confident of their abilities, and focus too much on evidence that supports their pre-existing opinions. We should be alert to these biases in our attitudes towards our own thinking.

15. In a survey conducted by the UCLA Higher Education Research Institute, 99.6% of university teachers agreed that critical thinking is a "very important" or "essential" goal for undergraduate education. But how should

critical thinking be taught? There are lots of different issues to be investigated, such as:

- Should critical thinking be taught as a separate subject on its own, or should it be taught in combination with other specific subjects that the students are studying?
- Which are the topics that are most crucial? How useful are lessons in formal logic or Venn diagrams? How should we go about designing a curriculum?

Research from education psychology and cognitive science are very much relevant when designing an effective pedagogy for teaching critical thinking.

If you are interested in issues related to critical thinking in higher education, the following volume might be useful: Martin Davies and Ronald Barnett (2015) The Palgrave Handbook of Critical Thinking in Higher Education Palgrave.

16. There are different psychological tests that are used to evaluate critical thinking skills. The more popular ones are usually standardized tests that can be benchmarked against a larger sample.

- Watson-Glaser Critical Thinking Appraisal (WGCTA) – The standard version consists of multiple choice questions for an hour-long test. There are two versions (A & B) that are supposed to be equivalent and so can be used to measure changes in critical thinking over a period of time.
- California Critical Thinking Skills Test (CCTST) – A more recent test that can also be completed online, with sub-scores for different categories such as analysis, inference, induction, etc.
- California Critical Thinking Disposition Inventory (CCTDI) – Designed to "designed to measure the disposition to engage problems and make decisions using critical thinking."
- The Halpern Critical Thinking Assessment (HCTA) – Focuses on five dimensions of critical thinking: verbal reasoning, argument analysis, thinking as hypothesis testing, likelihood and uncertainty, and decision making and problem solving.
- Cornell Critical Thinking Tests – There are two levels. Assessment topics include: induction, deduction, credibility, identification of assumptions, etc.
- Related to the assessment of critical thinking, there is also the interesting Cognitive Reflection Test (CRT), which consists of only 3 short questions. It provides a measurement of rational and reflective thinking.

Adapted from: https://philosophy.hku.hk/think/critical/definitions.php
Accessed: 11.08.2020

After text tasks

1. **Look through the following words from the text and try to find some other meanings of them. Which meaning of these words matches the translation of the text?**

1. construct [kənˈstrʌkt] строить

2. inconsistency [ɪnkənˈsɪstənsɪ] непоследовательность
3. relevance [ˈrelɪvəns] значимость
4. accumulating [əˈkjuːmjʊleɪtɪŋ] накапливающий
5. to deduce [dɪˈdjuːs] выводить
6. to seek [siːk] искать
7. exposing [ɪkˈspəʊzɪŋ] выставляющий, разоблачающий
8. fallacy [ˈfæləsɪ] заблуждение
9. acquire [əˈkwaɪə] приобретать
10. strengthen [ˈstreŋθən] укреплять
11. to enhance [ɪnˈhɑːns] усиливать, повышать
12. hinders [ˈhaɪndə] препятствовать
13. misconception [ˈmɪskənˈsepʃn] недопонимание
14. compatible [kəmˈpætəbl] совместимый
15. consensus [kənˈsensəs] согласие
16. restricted [rɪsˈtrɪktɪd] ограниченный
17. flexible [ˈfleksəbl] гибкий, эластичный
18. diverse [daɪˈvɜːs] разнообразный, различный
19. promote [prəˈməʊt] способствовать, содействовать
20. comprehension [kɔmprɪˈhenʃn] понимание, осмысление

2. Translate the following word combinations into Russian. Make up your own sentences with these phrases.

1) logical connections
2) independent thinking
3) accumulating information
4) challenging consensus
5) diverse sources
6) process of self-evaluation
7) maintain objectivity
8) persistent biases
9) acquired through
10) human reasoning

3. Read the text and answer the following questions:
1) How critical thinking can help us?
2) Why doesn’t critical thinking hinder creativity?
3) Why critical thinking is very important in the new knowledge economy?
4) What are the top three skills that supposed to be most relevant?
5) How to describe the way we think?

4. Find the English equivalents to the following word combinations in the text:
1) оценка аргументов

2) вывести последовательности
3) довольно совместимый
4) гибкие интеллектуальные навыки
5) сознательное усилие

5. What is the main idea of the text? Choose the correct answer. Offer your own version of the main idea of the text.

a) Critical thinking is a metacognitive skill.
b) Critical thinking is the ability to think clearly and rationally about what to do or what to believe.
c) Critical thinking is a higher-level cognitive skill that involves thinking about thinking.

6. Mark true (T) or false (F) sentences.
a) Critical thinking should be easily confused with being argumentative or being critical of other people.
b) We can use critical thinking to enhance work processes and improve social institutions.
c) We often need to make a conscious effort to improve ourselves, avoid biases, and maintain objectivity.
d) Critical thinking skills are restricted to a particular subject area
e) In the human mind, memory and understanding are acquired through making connections between ideas.

7. In what paragraph is it written that critical thinking plays a crucial role in evaluating new ideas, selecting the best ones and modifying them if necessary?
a) 1; b) 2; c) 3.

8. Put the names of the paragraphs in the correct order.

Titles	Numbers
a) The importance of critical thinking	
b) The future of critical thinking	
c) Critical thinking is an important ability.	

9. Choose the correct answer to the given question. Make your own question to the text with the question word "Why". Ask your partner this question.

Why some people believe that critical thinking hinders creativity because?
a) Because, it is domain-general thinking skill.
b) Because, it is a metacognitive skill.
c) Because, it requires following the rules of logic and rationality.

10. Translate the sentence.
The proper functioning of a liberal democracy requires citizens who can think critically about social issues to inform their judgments about proper governance and to overcome biases and prejudice.

11. Match column A and B.

A	B
1. fallacy	a) выводить
2. to enhance	b) усиливать
3. consensus	c) заблуждения
4. to deduce	d) гибкий
5. flexible	e) согласие

12. Complete the sentence.
Similarly, to be good at critical thinking skills it is necessary… .

13. Choose the sentence with the correct word order.
a) The *California Critical* is *Thinking Disposition Inventory* are people that is used to measure a disposed psychological test whether to critically think.
b) The test *California Critical Thinking Disposition Inventory* is a psychological people that is to used measure to think critically whether are disposed.
c)The *California Critical Thinking Disposition Inventory* is a psychological test that is used to measure whether people are disposed to think critically.

Communication skills

(Adopted from: Armer T. Cambridge English for scientists. Cambridge University Press. https://portal.tpu.ru/SHARED/m/MALORISS/studentam/SelfStudy/Tab2/Posobie5cours.pdf)

1. Read the headlines and beginnings of two news articles reporting a recent scientific development. Then answer the questions below. Find 2 titles of articles from a scientific journal and a popular science magazine. What are their differences?

Headlines and beginnings

1.“The ‘Chocolate Cure For Emotional Stress”.
There may well be another important reason for giving your sweetheart sweets for Valentine’s Day ...
2.“New Evidence That Dark Chocolate Helps Ease Emotional Stress”
The 'chocolate cure' for emotional stress is getting new support from a clinical trial published ...

Questions

1. Do you think the claims made in the headlines seem likely or unlikely? Why?

2. In general, how can the science reported in the media differ from the actual science? Why do you think there is a difference?
3. If you wanted to learn more about the research you see reported in the newspaper, where could you look for more information?

2. You are a junior researcher and you are supervising a Physicist student. You have asked the student to investigate the claims in the headlines and then to write a critical review of the research. Complete the sentences below in your own words. Then in pairs, discuss your answers.
a) If you read research critically, it means that you ...
b) You should always read research critically because ...

3. Your friend has some questions about writing a critical review. In pairs, discuss questions 1-5 .
1. How long should my review be?
2. Can I write a critical review if I've only read the abstract?
3. How should I approach the reading? What should I read first?
4. Is it a good idea to think of questions I want answered?
5. Do I need to take notes or can I just highlight the relevant bits of the text?

4. Before reading a research paper, your group mate writes seven questions to help him. Match the questions (1-7) to the section of the research paper below where you would expect to find the answer.

Questions:

1. What variables were investigated?
2. How did the authors interpret the results?
3. What were the main findings?
4. Why is this research relevant?
5. Who/What was studied?
6. What procedure was used?
7. What was the hypothesis?

Sections of the research paper:

A. Introduction:
B. Method :___
C. Results:____
D. Discussion: _

5. Check the meaning of the following words.

Anxiety, assessment, classify, consumption, hormone, metabolic, microbiota, participant, trial, period, urine.

6. Read two extracts from your group mate's completed critical review and answer the question.

1. Which extract (A or B) ...

a) summarizes part of the research?

b) gives an evaluation?

A. 30 young healthy adults completed a pre-trial questionnaire to assess the anxiety levels and based on this, they were classified as either high or low anxiety. All participants ate 40 g of dark chocolate a day for 14 days. On days 1, 8 and 15 urine and blood samples were taken and changes in cortisol and catecholamine in the urine were analyzed, as well as energy metabolism and gut microbial activity. The research found that after 14 days, the level of stress hormones in the urine was reduced in all participants. In addition, there was less difference between the two groups in energy metabolism and gut microbial activity.

B. One problem with the research is the small sample size (only 30 people) which was further divided into smaller groups. There was also no control group in the study, making it impossible to conclude that chocolate was the cause of the changes seen rather than some other factor such as other food or drink, lifestyle change or activity level. Furthermore, only young healthy adults were investigated and so the results cannot be applied to those who are older or have pre-existing health issues.

7. Read and translate six extracts below from a critical review of another paper. What phrases should be used in the review of scientific articles? Suggest any other phrases.

a) A bad thing about this research is there were only 20 participants. Another problem is all the subjects were hospital employees.

b) Also, the blood flow in the brachial artery was measured before they drank the coffee, and 30 and 60 minutes after.

c) The researchers looked at how the blood flow changed.

d) The result of the research was that the people who drank caffeinated coffee had decreased blood flow to their upper arm.

e) The results might not be the same for the general population. There was also no measurement of the changes in blood pressure and blood flow after one hour, so we can't know when blood flow returns to normal.

f) 20 subjects, between the ages of 25 and 50, who usually drank little coffee, were given either a caffeinated or decaffeinated Italian espresso coffee. They gave blood before the coffee was drunk, and an hour later.

8. Put extracts a-f in the correct order to make two paragraphs. One paragraph should summarize part of the research; the other should give an evaluation.

9. Find a piece of published research you are interested in and then write two paragraphs of a critical review in an appropriate style.

Unit 4. How to Report on an Experiment

Reading skills

Text

1. A laboratory report should communicate, as clearly and concisely as possible, the rationale for the experiment, what was done, what the results were and what the results mean. On the basis of a report on an experiment a reader should, basically, be able to repeat it and get similar results. The report should be as short and simple as possible to accomplish these ends; it takes practice to learn how to write a technical report which does this well. Any report must have certain content to accomplish the above purpose and to facilitate the administration of the course. While the specific format outlined below is not essential for this, it is one way to accomplish it and students should find following it to be useful and instructive. However, as long as the objectives above are accomplished, this scheme may be reasonably modified for certain labs if desired. For instance, if an experiment has several parts which use different apparatus or if the same apparatus is used to do several different experiments, the material in some sections may need to be repeated for the various different situations and this should be organized in the most suitable way.

2.Heading

Identify the experiment by name and give the date performed, your name (first and underlined) and that of your lab partner(s), and lastly the name of your TA.

Abstract

Give an extremely short (only a few sentences) description of the object of the experiment and a statement of your principal results.

Theory

Start with the motivation (or reason) for the experiment. Follow this with the theory behind the experiment. Give a brief presentation, in your own words, of the essential ideas behind the experiment. Include only the most important formulae (explaining the meaning of any symbols used). Do not give any derivations unless they are original. The purpose is just to establish the context of the experiment and state, for reference, the relations you will be using in analyzing your data. (The proverbial interested reader should be able to look up details elsewhere on the basis of your outline.) One paragraph, in good English, should suffice.

3. Experiment. Succinctly describe, in your own words, the apparatus used and the procedures followed to get your results. It is best to do this without reference to the lab manual. Relying on your own memory is more authentic and provides

practice for your powers of observation. Tell what you did so that someone else could duplicate it from your description. Obviously, neither your TA nor the other students need this exposition (anymore than they need your solutions to the homework problems for the lecture part of the course); they all know about the experiment. This is an instructive exercise, for your benefit, in attending to and understanding facts in a scientific manner and to give you practice in describing them intelligibly. Think of your reader as an intelligent physics student who has not done the experiment. You should demonstrate clearly to your TA that you know and understand what you did and can articulate it simply. Often the simplest and clearest way to explain something is to give a schematic drawing. This means a drawing without the details that are not essential to the point you are trying to communicate. It is important to gain the skill of realizing and illustrating the essence of a situation. This will also make it easier for the TA to read and understand what you write. So you are encouraged to use such drawings and you should include one of the apparatus used. However, do not copy the detailed diagrams in the lab manuals directly, a rough sketch of the apparatus showing the relevant physical variables (e.g. x, y, [[theta]], etc.) is appropriate. Emphasize sketches of the equipment but three dimensional artist's sketches are inappropriate. Such a drawing should illustrate what *you* have to say.

4. Data Analysis. Give one example of each calculation made; it should be clear that you understand what you are doing. You may do the other calculations separately and include only the final results. For your own benefit (and for the instructor's sanity): **BE NEAT!** Calculate errors and show any error formulae used; again, include one sample calculation. Clearly state the results you obtain. Data should be presented in an organized form, such as in tables, charts and graphs, and stated in correct *SI* units. Do not use the tables from your original data sheets for this purpose. All data is to be recopied and reformatted in the Data Analysis section of the write-up. Experimental data should be compared to theoretical predictions and calculations. Include the error analysis (such as standard deviations and uncertainties) in your tables and with your final results. For help on error analysis, see the *Error Analysis* section in the lab manual. See the section on *Graphs and Curve Fitting* in the lab manual for an explanation on obtaining results from your graphs and data. If a book value for the measurement is available, state the number of standard deviations that your result differs from the accepted value.

5. Conclusion. Summarize, in a paragraph or two, what you conclude from the results of your experiment and whether they are what you expected them to be. Compare the results with theoretical expectations and include percent error when appropriate. Don't use terms such as "fairly close" and "pretty good;" give explicit quantitative deviations from the expected result. Evaluate whether these deviations fall within your expected errors and state possible explanations for unusual deviations. Discuss and comment on the results and conclusions drawn,

including the sources of the errors and the methods used for estimating them. Include brief answers to the specific questions asked in the lab instructions.

6. Remarks

Please critique the experiment as presented in the lab manual. Could the lab be done in a better way? Do you have some other or original method for obtaining the same results? Your suggestions are encouraged and are used to improve the lab manual.

Data

Attach a copy of the initialed data which you took in the lab to the back of your lab write-up.

Adapted from: http://teacher.pas.rochester.edu/PHY_LABS/Write_Report/Write_Report.html
Accessed: 11.08.2020

After text tasks

1. **Look through the following words from the text and try to find some other meanings of them. Which meaning of these words matches the translation of this text?**

1. result [rɪˈzʌlt] результат
2. attach [əˈtætʃ] прикреплять
3. data [ˈdeɪtə] данные
4. experiment [ɪksˈperɪmənt] эксперимент
5. critique [krɪˈtiːk] критика
6. conclude [kənˈkluːd] заключить
7. summarize [ˈsʌməraɪz] резюмировать
8. possible [ˈpɔsəbl] вероятный
9. chart [ʧɑːt] диаграмма
10. obtain [əbˈteɪn] получать
11. explanation [eksplәˈneɪʃn] объяснение
12. deviation [diːvɪˈeɪʃn] отклонение
13. sheet [ʃiːt] лист
14. value [ˈvæljuː] значение
15. available [əˈveɪləbl] доступный
16. illustrate [ˈɪləstreɪt] иллюстрировать
17. benefit [ˈbenɪfɪt] выгода
18. encouraged [ɪnˈkʌrɪʤd] поощренный
19. explain [ɪksˈpleɪn] объяснять
20. essence [esns] сущность

2. Translate the following word combinations into Russian.

1. Laboratory report
2. Technical report
3. Extremely short

4. Intelligent physics student
5. Scientific manner
6. Detailed diagrams
7. Theoretical predictions
8. Specific questions
9. Instructive exercise
10. Important formulas

3. Read the text and answer the following questions:

1. How should data be presented?
2. What is the purpose of the experiment?
3. What are the stages of an experiment?
4. What do you expect from the results of the experiment?
5. Why do you need a report which must have certain content to accomplish?

4. Find the English equivalents to the following word combinations in the text. Make up your own sentences with these phrases.

1.Лабораторный отчет
2.Описание объекта эксперимента
3.Навык осознания
4.Используемые формулы
5.Теоретическими прогнозами

5. What is the main idea of the text? Choose the correct answer. Offer your own version of the main idea of the text.

a) It is necessary to report on an experiment correctly using special rules.
b) An experiment has several important parts which use different apparatus.
c) The timeframe of speaking about the experiment is very limited.

6. Mark true (T) or false (F) sentences.

a) It is important to gain the skill of realizing and illustrating the essence of a situation.
b) A laboratory report should reveal real and clear results of the experiment.
c) A report sometimes has certain content to accomplish the above purpose and to facilitate the administration of the course.
d) A researcher should summarize, in a paragraph or two, what he/she conclude from the results of the experiment.
e) You should never critique the experiment.

7. In what paragraph is it written that you should give a brief presentation, in your own words, of the essential ideas of the experiment?

a) 1; b) 2; c) 3.

8. Put the names of the parts 1, 2 and 3 in the correct order.

Titles	Number
a) How to describe an experiment?	
b) What a laboratory report should be like?	
c) What are major parts of the report?	

9. Choose the correct answer to the given question. Make your own question to the text with the question word "Why". Ask your partner this question.

What are the most important things about a laboratory report?
a) The report should be long and difficult.
b) The report should be as short and simple as possible to accomplish these ends.
c) The report should be understandable even for children.

10. Translate the sentence.
For instance, if an experiment has several parts which use different apparatus or if the same apparatus is used to do several different experiments, the material in some sections may need to be repeated for the various different situations and this should be organized in the most suitable way.

11. Match column A and B.

A	B
1. experiment 2. purpose 3. concisely 4. essential 5. rationale	a) кратко b) эксперимент c) цель d) важный e) обоснование

12. Complete the sentence.
On the basis of a report on an experiment a reader should … .

13. Choose the sentence with the correct word order.
a) While the specific format outlined is not below essential for this, it is one way to accomplish it and students should find following it to be useful and instructive.
b) While the specific way to find accomplish it format outlined below is not essential for this, it is one and students should following it to be useful and instructive.

c) The specific format while outlined below is not essential for students find should following it this; it is one way to accomplish it and to be useful and instructive.

Communication skills

(Adopted from: Armer T. Cambridge English for scientists. Cambridge University Press. https://portal.tpu.ru/SHARED/m/MALORISS/studentam/SelfStudy/Tab2/Posobie5cours.pdf)

1. Do you agree that the scientific method is a process in which experimental observations are used to answer questions? Complete the collocations for describing the stages in the scientific method using given words and phrases.

a hypothesis – an experiment (x2) – conclusions – data (x3) – the question

1. analyse _____
2. collect _____
3. conduct (or run) _____
4. define _____
5. design _____
6. draw _____
7. form _____
8. interpret _____

2. Number stages (1-8) in the order you would normally do them. Read this extract from a student website and check your answers to the exercise.

The scientific method is a process in which experimental observations are used to answer questions. Scientists use the scientific method to search for relationships between items. That is, experiments are designed so that one variable is changed and the effects of the change observed. While the exact methodologies used vary from field to field, the overall process is the same. First, the scientist must define the question – what exactly they are trying to find out. Next the formation of a hypothesis comes, which is an idea or explanation for a situation based on what is currently known. The next stage of the method is the design of an experiment which will allow this hypothesis to be tested. Usually a primary run of the experiment is conducted, and any changes to the experimental setup made. In each experimental run, data collection takes place, followed by data analysis.
Finally the data is interpreted and from this, the scientist is able to draw conclusions.

3. Read the extract again to find the noun forms of the following verbs. Which word(s use(s) the same form for the verb and the noun?

Analyze, collect, design, explain, form, observe, relate, run, vary.

4. Below are the summaries of five experiments. Read each summary and then choose which word correctly completes the heading.

Practical / Theoretical research
Murray Gell-Mann and George Zweig proposed that particles such as protons and neutrons were not elementary particles, but instead were composed of combinations of quarks and antiquarks.
Field / Laboratory experiment
Mark-and-recapture models were used to measure seasonal and habitat changes in house mouse densities on sub-Antarctic Marion island.
External / Internal validity
The students were carefully matched for social status, subject area, ethnicity, education level, parental smoking, and exposure to targeted advertising
Descriptive / Experimental study
The amount of soy products eaten by each participant was assessed at the start of the study. During the 30 years of the study, the women's incidence of breast cancer was recorded.
Qualitative / Quantitative research
To investigate the effect of eating dark chocolate on stress levels, a blood sample was taken and the levels of stress hormones measured. After eating the chocolate, a second sample was taken and hormone levels measured again.

5. Can you think of examples of experiments which describe the headings in Exercise 4?

6. You are a research assistant working as part of a team investigating methods of storing some chemical substance for use as an energy source. In pairs, discuss the following questions.
1. What do you think are the benefits of using this **chemical substance** as an energy source?
2. In what situations or applications could this **chemical substance** fuels be used?

6. Hydrogen could be an ideal energy source, but is difficult to store. In pairs, look at three possible methods of hydrogen storage below and discuss what you think the advantages and disadvantages of each one might be.
a) contained as a gas in a high-pressure tank
b) condensed into a liquid and stored in a tank
c) adsorbed onto a porous material

7. Complete the following summary on variables using given below words.

Affects, collecting, controlled, data, dependent, independent.

How much a variable (1) _____ a relationship can be discovered by (2) _____ experimental (3) _____ on changes to the relationship as the variable is changed. In an experiment, there will be:

• one (4) _____ variable - this is the feature you are measuring;

• one or more (5) _____ variables – these are the variables which you change;

• one or more (6) _____ variables - these are not being tested and so they stay the same.

8. You want to investigate the effect of different chemicals on the substance adsorption in the carbon fibers.

1. In this investigation, which of the following variables will be **independent** and which **controlled?**

- carbonization temperature
- type of substance
- heating rate
- nitrogen flow rate
- ratio of substance to carbon fibers

2. What will be the dependent variable?

9. In pairs, role play a discussion between a researcher and a supervisor about your experiment. First, decide which type of experiment (from Exercise 4) should be used to investigate the problem. Then discuss what the variables in the experiment might be. Use the language you studied

Unit 5. DEVELOPING CONFIDENCE TO COMMUNICATE

Reading skills

Text

1. Research higher degree students are often invited or required to give presentations on their current or proposed research at a department seminar, a conference, or a similar forum. Clear as well as complex communication material is a key aspect of professional development. But students are often understandably nervous when faced with the challenge of presenting. So it's important to think carefully of how successful presentations come about.

2. Why are you presenting? Are you outlining a particular method or approach? Are you emphasizing the practical application of your research? Are you providing an overview of your work-in-progress? You need to provide information that your audience will remember later. But avoid trying to cover every small detail. Keep in mind your reason for presenting.

3. Even when presenting to your department, make a realistic appraisal beforehand of how much relevant knowledge or understanding your audience already has. Ask yourself:

- What kind of prior knowledge of my field does my audience probably have?
- How familiar are they with recent research in this area?
- How much technical knowledge do they possess?
- Do any of them use English as a second language? If so, will this affect my presentation?
- Are there any technical terms that you need to define for your listeners? You need to be able to present your research in a way that will engage and inform all of your audience, not just your supervisor. Think carefully about all these points as you compose your slides and decide how to pace your talk.

4. The timeframe of your talk is a key consideration. A short talk (10-20 minutes) needs to address the topic clearly and directly. It is very important not to exceed your allotted time or, even worse, to have to leave your talk unfinished. So be selective about what you say. Consider adopting the following structure: What you're doing – *Introduce*:

- yourself;
- your topic and the broader context of your research;
- the main hypothesis or research question;
- methods of data collection; and
- the key points your talk will cover. What you've found (or expect to find) – *Include*:
- key findings, trends in your data, progress to date;
- any difficulties with your method.

Why this is important /relevant – *Specify*:

- whether your results confirm your hypotheses;
- whether you may need to redesign any aspect of the research;
- likely implications, or possible applications

5. Well-designed, professional-looking PowerPoint slides can complement most presentations. They can reinforce key statements, help maintain interest and concentration, illustrate concepts that are difficult to explain, and serve as a guide for you, the presenter. However, if you're planning to use a PowerPoint, you need to consider the contents and organization of your slides carefully. To start with, identify your major concepts and principal points. Which ones will require a slide? Ensure the slides are not too cluttered (no more than 8-10 lines of the text); use large font size (24 pt is recommended) and present one topic per slide. Don't simply read out your slides verbatim! The slides should just list key points for you to expand on as you talk.

6. Slides must be discussed and integrated into the flow of your presentation. Your audience should know exactly why the slides have been used. So, if you're presenting pictures, diagrams, tables or graphs, you need to point out their significant features. This takes time. A good guideline is to spend two to three

minutes to talk through the points on a slide. If you're presenting for 20 minutes – and you need to allow a few minutes at the end for questions – you may only have time to present a title slide and seven or eight other slides. Practice your presentation with a friend or sympathetic peer, to help you gauge if you have the right amount of material for the time allowed. Also practice your conclusion – to provide a summary for your audience and end your presentation on a strong note. PowerPoint slides can be a means of support, both for the speaker and audience. Don't allow them to take over and detract from the whole presentation. Ensure that your slides are clear, easy to read, and relevant. Avoid unnecessary "special effects"!

7. Visual presentations need to present information simply and clearly. If you overwhelm your audience with information, they will be tempted to read rather than listen. A graph that you've prepared for your thesis, or a screen snapshot copied from a website, may be too detailed for your audience to see clearly or understand. Quantitative information can be presented as a graph or simple table. However, graphs should have bold lines with simple, clearly numbered axes, and strong contrast. Similarly, if you're presenting information in the form of a bar chart with more than five categories that need to be differentiated, the chart will be difficult to read. In this case, reduce the amount of information in your slide; perhaps you can make two or more slides to indicate different trends in the data. Visuals containing mathematical equations can also be problematic for the audience. They should have ample white space; figures must be bold and large, as well as neat and accurate. Animated effects in PowerPoint can be useful for presenting data. You can set up your slide show so that each set of data appears with a mouse click, allowing you to speak about each data set before, or while, displaying it. This helps to keep your audience engaged. To simplify the data for your presentation you could prepare a subset of slides containing additional information, which could be shown later in response to questions. An alternative would be to include complex or detailed technical information on a handout that your audience can examine more closely afterwards. But distribute these handouts after the presentation or your audience will read them during your talk, instead of listening to you!

8. Many students feel nervous at the prospect of being asked questions about their research. However, a good presentation will naturally encourage discussion and interesting questions. Always spend some time before your presentation to consider those aspects of your research on which you might be questioned. Is your method or approach unusual? Are there any aspects of your work that are problematic or controversial? What are its practical applications, if any? Generally, you should be able to predict about 75% of the questions you may be asked. You can prepare and practice possible responses. Listen attentively to your questioner. Paraphrase, or repeat, the question or comments, as in the following examples: "So, what you are asking is …" "So, you'd like to know more about …" This clarifies what has been asked. It also gives you some thinking time. It's perfectly acceptable to take a short pause to think before

responding to a question. If you can't provide an answer, first acknowledge the question and say you don't know, or: "Thank you for asking that question. I can't answer that question at this point in my research." or: "Unfortunately, I don't have that information with me." You can perhaps offer to find out the answer, or to refer to other sources where the information may be found. There is no shame in not being able to answer every question. Consider yourself a research apprentice. If you knew everything about your topic, you wouldn't need to be undertaking research in the area.

Adapted from:
https://services.unimelb.edu.au/__data/assets/pdf_file/0005/470075/Presenting_your_research_Update_051112.pdf
Accessed: 11.08.2020

After text tasks

1. **Look through the following words from the text and try to find some other meanings of them. Which meaning of these words matches the translation of this text?**

1. the challenge of presenting [ðiː] [ˈtʃælɪndʒ] [of 'prez(ə)ntiŋ] задача представления
2. important [ɪmˈpɔːtənt] важный
3. calmly [ˈkɑːmlɪ] спокойно
4. emphasizing [ˈemphəsaiziŋ] подчеркивание
5. practical [ˈpræktɪkəl] практический
6. providing [prəˈvaɪdɪŋ] обеспечение
7. audience [ˈɔːdjəns] аудитория (слушатели)
8. knowledge [ˈnɔlɪdʒ] знание
9. consider [kənˈsɪdə] рассматривать
10. allot [əˈlɔt] предоставлять
11. unfinished [ˈʌnˈfɪnɪʃt] незаконченный
12. guideline [ˈgaɪdlaɪn] директива
13. verbatim [vəːˈbeɪtɪm] дословный
14. sympathetic [ˌsɪmpəˈθetɪk] сочувствующий
15. significant [sɪgˈnɪfɪkənt] значительный
16. feature [ˈfiːtʃə] особенность, свойство
17. gauge [geɪdʒ]] измерительный прибор
18. selective [sɪˈlektɪv] отборный
19. expand [ɪksˈpænd] расширяться
20. research [rɪˈsəːtʃ] исследование

2. Translate the following word combinations into Russian. Make up your own sentences with these phrases.

1. particular method
2. provide information

3. relevant knowledge
4. main hypothesis
5. prior knowledge
6. research question
7. principal points
8. broader context
9. naturally encourage discussion
10. key statements

3. Read the text and answer the following questions:

1. How important is the amount of information in the presentation?
2. What points are to be focused on while preparing for a presentation?
3. How to overcome uncertainty?
4. What questions do you need to ask yourself to make a presentation?
5. How should you finish the act of communication?

4. Find the English equivalents to the following word combinations in the text.

1. понимать зрителя;
2. временной период рассказа;
3. практическое применение;
4. основные понятия;
5. информация на раздаточном материале.

5. What is the main idea of the text? Choose the correct answer. Offer your own version of the main idea of the text.

a) Speaking to the audience may be interesting and exciting.
b) The main tips to be considered in making presentations.
c) The ways of becoming a good listener.

6. Mark true (T) or false (F) sentences.

a) Before the presentation some time should be devoted to considering those aspects of the research on which the presenter might be questioned.
b) Animated effects in PowerPoint can spoil the presenting data.
c) A good guideline is to spend two to three minutes to talk through the points on a slide.
d) When having too much information, reduce it in your slide; perhaps you can make just one slide to indicate different trends in the data.
c) Sometimes it is admitted to present several topics per slide.

7. What paragraph informs the audience about the importance of pointing out the presentation's purpose?

a) 1; b) 2; c) 3; d) 4; e) 5; f) 6; g) 7; h) 8.

8. Put the titles of the paragraphs in the correct order.

Title	Number
a) Clear communication of technical or complex material is a key aspect of professional development.	
b) Presenting technical material visually.	
c) Using PowerPoint slides	
d) Consider your purpose	
e) Dealing with questions.	
f) The way of organizing slides	
g) Consider the structure	
h) Consider your audience	

9. Choose the correct answer to the given question. Make your own question to the text with the question word "Why". Ask your partner this question. Express your agreement or disagreement with the partner's response.

How can slides contribute to improving your presentation?
a) The slides should consider only the audience' possible questions.
b) The slides should only draw the audience' attention.
c) The slides should consider only the key points of the presentation material.

10. Translate the sentence.
Many students feel nervous at the prospect of being asked questions about their research.

11. Match column A and B.

A	B
1. to refer 2. to predict 3. be tempted 4. to cover 5. to provide	a) предсказывать b) ссылаться c) покрывать d) предоставлять e) искушаться

12. Complete the sentence.
Well-designed, professional-looking PowerPoint slides can complement … .

13. Choose the sentence with the correct word order.
a) However, graphs should have bold lines with simple, clearly numbered axes, and strong contrast.
b) Graphs, however, should have clearly with simple, numbered bold lines, bold axes, and strong contrast.

c) Clearly numbered axes graphs lines with simple, should, however, have bold, and strong contrast.

Communication skills ….

(Adopted from: Armer T. Cambridge English for scientists. Cambridge University Press. https://portal.tpu.ru/SHARED/m/MALORISS/studentam/SelfStudy/Tab2/Posobie5cours.pdf)

1. Read the following extract from a website and then, in pairs, answer the questions below.

Extract from a website

The American Research Fellowship (ARF) aims to develop science in the US by attracting outstanding scientists in their field to continue their research in Yale university or research institution. ARF fellowships are awarded to individual scientists with future potential for leadership in their field. Successful applicants receive a 5-year grant covering salary, travel and relocation costs.

Questions

1. Can an organization apply for this scholarship?
2. Would you be interested in applying for ARF? Why/why not?
3. What information might you need to include on your application form?
4. What are the advantages of attracting scientists 'with future potential for leadership in their field' to a country?

2. Think about a research project in your area. In pairs, take turns to summarize the project following the instructions (1-6) below.

Instructions

1. State the aims of your research.
2. Define what the problem is.
3. Explain why your topic is worth researching.
4. Say what the expected outcomes of the research are.
5. Outline the procedures you will follow.
6. Outline how you will limit your investigation.

3. Read your group mate's completed project summary then say what you think the commercial applications of the research might be.

4. Read the Project summary. Make up a brief summary of aims, significance and expected outcomes of the research plan.

A 3-D odour-compass for odour-detecting robots

1. Odour-sensing robots offer many benefits over the current use of animals in similar roles, including safety, efficiency and durability. [A] **However, the robots which have been developed** to date are limited by the fact that they can only accurately detect and navigate towards odour plumes if they are within direct 'sight' of the chemical source. Clearly, in real world situations, obstacles may well impede the robot's detection ability, and at present, odour-sensing robots are therefore only of limited use. [B] **The proposed research will concentrate on developing** a robot which is able to gather readings in three dimensions and therefore overcome the limitations of current models in odour-detection. [C] **This technology will make robots a more effective substitute for animals**.
2. [D] **This research aims to develop** existing robotic technology to create a three-dimensional (3-D) odour compass to be used as a navigation tool in searching for an odour source. [E] **This will then be tested experimentally** in simulated environments where wind direction is not stable or where obstacles interfere with odour distribution. A second stage in the research will be to develop the robot's environmental sensors, thus allowing it to safely negotiate the terrain to reach the source of the odour. [F] **This should produce a robot** which is able to both detect and move to the source of an odour, even on difficult terrain.

5. Complete the following sentences.
1. My main research focus was to … .
2. During my project, I focused on … .
3. As part of the Cell Wall Genomics team, I have developed …. .
4. I have been involved in investigating …. .

6. Make a presentation of your project.

Unit 6. HOW TO IMPROVE YOUR WRITING SKILLS IN SCIENCE

Reading skills

Text

1. Use active instead of passive voice. One of the most common manifestations of bad writing is overuse of the passive voice. In English, the most basic sentence structure is S-V-O: Subject–Verb–Object. "*The zombie bit the man*" is an example of this sentence structure. The passive voice can cause confusion by putting the object first: "*The man was bitten by the zombie.*" It usually requires more words and use of a "to be" verb form, which can suck the energy out of your writing. Learn to avoid these constructions as much as you can. Using the passive voice isn't always bad. Sometimes there is no clear way to make a statement active, or sometimes you want the lighter touch a passive construction allows. But learn to follow this rule before you start making exceptions. The

main exception to this is science writing, which conventionally uses the passive voice to put the emphasis on the results, rather than the researchers (although this is changing, so check the guidelines before you write). For example, "*puppies fed with spicy dog food were found to have more upset stomachs*" puts the emphasis on the finding rather than the person doing the finding. Cut the chaff. Good writing is simple, clear and direct. You don't get points for saying in 50 words what could be said in 20, or for using multi-syllable words when a short one does just as well. Good writing is about using the right words, not filling up the page. It might feel good at first to pack a lot of ideas and details into a single sentence, but chances are that sentence is just going to be hard to read. If a phrase doesn't add anything valuable, just cut it. Adverbs are the classic crutch of mediocre writing, and they often serve only to clutter up a sentence. A well-placed adverb can be delightful, but much of the time the adverbs we use are already implied by the verb or adjective – or would be if we had chosen a more evocative word. Don't write "*screamed fearfully*" – "scream" already suggests fear. If you notice that your writing is filled with "-ly" words, it might be time to take a deep breath and give your writing more focus. Sometimes cutting the chaff is best done at the editing stage. You don't have to obsess about finding the most concise way to phrase every sentence; get your ideas down on paper however you can and then go through to edit out unnecessary stuff. Your writing doesn't just exist in a vacuum – it's experienced in conjunction with the reader's imagination. You don't need to describe every detail if a few good ones can spur the reader's mind to fill in the rest. Lay down well-placed dots and let the reader connect them.

2. Show, don't tell. Don't tell your readers anything that could be shown instead. Instead of just sitting your readers down for a long exposition explaining a character's background or a plot-point's significance, try to let the readers discover the same ideas through the words, feelings and actions of your characters. Especially in fiction, putting this classic piece of writing advice into practice is one of the most powerful lessons a writer can learn. For example, "*Sydney was angry after reading the letter*" tells the reader that Sydney felt angry, but doesn't give us any way to see it for ourselves. It's lazy and unconvincing. "*Sydney crumpled the letter and threw it into the fireplace before she stormed from the room*" shows that Sydney was angry without having to say it outright. This is far more effective. Readers believe what we see, not what we're told. Avoid clichés. Clichés are phrases, ideas or situations that have been used so often that they've lost any impact they once had. They're also usually too general to leave a lasting impression on your reader.

3. Whether you're writing fiction or nonfiction, cutting clichés out of your work will make it better. "*It was a dark and stormy night*" is a classic example of a clichéd phrase – even now a clichéd concept. Compare these similar weather-related opening lines: "*It was a bright cold day in April, and the clocks were striking thirteen.*" – 1984, by George Orwell. It's not dark, nor stormy, nor night. But you can tell right from the start something's not quite right in 1984. "*The sky*

above the port was the color of television, tuned to a dead channel." – Neuromancer, by William Gibson, in the same book that gave us the word "*cyberspace.*" This not only gives you the weather report, it does so in such a way that you are immediately placed into his dystopian world. "*It was the best of times, it was the worst of times, it was the age of wisdom, it was the age of foolishness, it was the epoch of belief, it was the epoch of incredulity, it was the season of Light, it was the season of Darkness, it was the spring of hope, it was the winter of despair, we had everything before us, we had nothing before us, we were all going direct to Heaven, we were all going direct the other way – in short, the period was so far like the present period, that some of its noisiest authorities insisted on its being received, for good or for evil, in the superlative degree of comparison only.*" – A Tale of Two Cities, by Charles Dickens. Weather, emotion, damnation, and despair – Dickens covered it all with an opening line that leaves the reader ready for anything.

4. Clichés are also important to avoid when you're writing about yourself. Saying you're a "*people person*" says nothing definite about you. Saying you're able to communicate well with a variety of people because you grew up in a bilingual family and lived in six countries growing up lets your reader know you're a "people person" without you relying on lazy language.

5. Avoid generalizations. One of the hallmarks of sloppy writing is broad generalizations. For example, an academic essay might say something like "*In modern times, we are more progressive than people a hundred years ago.*" This statement makes a host of unfounded assumptions and doesn't define important ideas like "*progressive.*" Be precise and specific. Whether you're writing a short story or a scholarly essay, steering clear of generalizations and universal statements will improve your writing. This applies to creative writing, too. Don't allow yourself to assume anything without examining it. For example, if you're writing a story about a female character, don't assume that she would automatically be more emotional than a man or more inclined to be gentle or kindly. This kind of non-examined thinking keeps you in a creative rut and prevents you from exploring the variety of possibilities that real life presents.

6. Back up what you say. Don't speculate without providing evidence for your assertions. In creative writing terms, this is similar to the "*show, don't tell*" principle. Don't just say that without a strong police force society as we know it would break down. Why is that true? What evidence do you have? Explaining the thinking behind your statements will allow readers to see that you know what you're talking about. It will also help them determine whether they agree with you. Use metaphors and similes with caution. While a good metaphor or simile can give your writing punch and vigor, a bad one can make your writing as weak as a baby. (That, by the way, was a weak simile). Overusing metaphors and similes can also suggest that you aren't confident with what you're saying and are relying on figures of speech to explain your ideas. They can also become clichéd really quickly. A "*mixed*" metaphor mixes two metaphors so that they don't make sense. For example, "*We'll burn that bridge when we come to it*"

mixes the common metaphor "*We'll cross that bridge when we come to it*" and "*Don't burn bridges.*" If you're not sure how a metaphor goes, look it up – or skip it altogether.

7. Break the rules. The best writers don't just follow the rules – they know when and how to break them. Everything from traditional grammar to the writing advice above is up for grabs if you know a transgression will improve your piece. The key is that you have to write well enough the rest of the time that it's clear you are breaking the rule knowingly and on purpose. As with everything, moderation is key. Using one rhetorical question to create a punchy opening can be very effective. Using a string of six rhetorical questions would quickly diminish their effect. Be choosy about when and why you break the rules. Edit, edit, edit. Editing is one of the most essential parts of writing. Once you finish a piece of writing, let it sit for a day and then read it over with fresh eyes, catching confusing bits or scrapping whole paragraphs – anything to make your piece better. Then when you are through with the writing, give it another read, and another. Some people confuse "editing" with "proofreading." Both are important, but editing focuses on considering what your content is and how it works. Don't become so attached to your wording or a particular idea that you aren't willing to change it if you discover that your ideas would be clearer or effective presented in another way. Proofreading is more technical and catches errors of grammar, spelling, punctuation, and formatting.

Adapted from: https://www.wikihow.com/Improve-Your-Writing-Skills
Accessed: 25.02.2018

After text tasks

1. **Look through the following words from the text and try to find some other meanings of them. Which meaning of these words matches the translation of this text?**

1. adverb [ˈædvəːb] наречие
2. editing [ˈedɪtɪŋ] редактирование
3. background [ˈbækgraʊnd] задний план
4. statement [ˈsteɪtm(ə)nt] заявление
5. especially [ɪˈspɛʃ(ə)li] особенно
6. generalization [dʒɛn(ə)rəlaɪˈzeɪʃ(ə)n] обобщение
7. metaphor [ˈmɛtəfə] метафора
8. proofreading [ˈpruːfriːdɪŋ] читка корректуры
9. rhetorical [rɪˈtɒrɪk(ə)l] риторический
10. persuasive [pəˈsweɪsɪv] убедительный
11. conventionally [kənˈvɛnʃ(ə)nəli] условно
12. essential [ɪˈsɛnʃ(ə)l] необходимый
13. diminish [dɪˈmɪnɪʃ] уменьшать
14. spelling [ˈspɛlɪŋ] правописание
15. punctuation [pʌŋ(k)tʃʊˈeɪʃ(ə)n] пунктуация
16. format [ˈfɔːmæt] формат
17. possibility [ˌpɒsɪˈbɪlɪti] возможность

18. important [ɪmˈpɔːt(ə)nt] важный
19. skill [skɪl] навык
20. automatically [ˌɔːtəˈmætɪkli] автоматически

2. Translate the following word combinations into Russian.
1. passive voice
2. skills in science
3. break the rules
4. crutch of mediocre writing
5. catch errors
6. editing focuses
7. finish a piece of writing
8. most powerful lessons
9. long exposition
10. relying on figures

3. Read the text and answer the following questions:
1. What is one of the hallmarks of sloppy writing?
2. What writing rules should be observed?
3. What is one of the most important parts of the writing?
4. What is one of the most common manifestations of bad writing?
5. Do we need adverbs while writing? Why?

4. Find the English equivalents to the following word combinations in the text. Make up your own sentences with these phrases.

1. улавливать ошибки грамматики;
2. хорошо общаться с разными людьми;
3. чрезмерное использование пассивного залога;
4. один из отличительных признаков;
5. начиная с традиционной грамматики.

5. What is the main idea of the text? Choose the correct answer. Offer your own version of the main idea of the text.

a) A scientific writing traditionally uses the passive voice to put the emphasis on the results, rather than the researchers.
b) The importance of improving your writing skills in science.
c) Editing is one of the most essential parts of writing.

6. Mark true (T) or false (F) sentences.
a) One of the most common manifestations of bad writing is overuse of the passive voice.

b) The best writers follow the rules - they never break them.
c) A "*mixed*" metaphor mixes two metaphors so that they make sense.
d) One of the hallmarks of sloppy writing is broad generalizations.
e) Sometimes cutting the chaff is best done at the editing stage.

7. In what paragraph is it written that using one rhetorical question to create a punchy opening can be very effective?
a) 1; b) 2; c) 3; d) 4; e) 5; f) 6; g) 7.

8. Put the names of the paragraphs in the correct order.

Title	Number
a) Avoiding cliches and generalizations	
b) Using an active, not a passive voice	
c) Editing is one of the most essential parts of writing	
d) Breaking the rules	
e) Cutting the chaff	
f) Backing up what you say	
g) Show, don't tell	
h) Being precise and specific	

9. Choose the correct answer to the given question. Make your own question to the text with the question word "Why". Ask your partner this question. Express your agreement or disagreement with the partner's response.

What is an adverb?
a) Adverbs are an invariable part of speech: they are easily declined and conjugated, they do not have endings, and they are not changed in gender and number.
b) Adverbs are the classic crutch of mediocre writing, and they often serve only to clutter up a sentence.
c) Adverb is an independent part of speech, which denotes the state, action and the number of objects.

10. Translate the sentence.
The main exception to the choice of the passive voice is science writing, which conventionally uses it to put the emphasis on the results, rather than the researchers (although this is changing, so check the guidelines before you write).
11. Match column A and B.

A	B
1. discover 2. metaphor 3. concise	a) заявление b) краткий c) обнаружить

4. statement 5. assumption	d) предположение e) метафора

12. **Complete the sentence.**
Once you finish a piece of writing … .

13. Choose the sentence with the correct word order.
a) A few good ones don't need to describe every detail mind you to fill in the rest if can spur the reader's.
b) Don't need to describe every detail if you can spur the reader's a few good ones mind to fill in the rest.
c) You don't need to describe every detail if a few good ones can spur the reader's mind to fill in the rest.

Communication skills

(Adopted from: Armer T. Cambridge English for scientists. Cambridge University Press. https://portal.tpu.ru/SHARED/m/MALORISS/studentam/SelfStudy/Tab2/Posobie5cours.pdf)

1. Match the beginnings to the endings of the questions. What other questions would you ask a young researcher?

Beginnings

1. What was your…
2. Why was it…
3. What was already…
4. How did you …
5. What did you…

Endings

a)… approach the problem?
b)…already important?
c) …expect to know after doing the research?
d) … investigating?
e)…known about the subject of my research?

2. Read five extracts from the introduction to the paper. Which question from Exercise 1 is each extract answering? Write the questions above the extracts.

1._____
Potential habitability in the subsurface would increase if the overlaying material did play a protective role.
2._____

We report here on our studies of protection by Rio Tinto Basin iron oxides and hydroxides on two microorganisms, Acidithiobacillus ferrooxidans and Deinococcus radiodurans, under simulated Mars surface conditions.
3.
_____
A number of studies have investigated different extreme Martian surface conditions on terrestrial microorganisms. Nicholson and Schuerger (2005) reported that the spores of Bacillus subtilis were able to survive for 19 days under Mars atmospheric pressure and composition. Saffary et al. (2002), however, found that survival decreased due to ...
4.
_____
Such an extreme environment was thought to be uninhabitable, but microbial ecology studies reported the presence of microorganisms (Amaral-Zettler et al., 2002). Could the surface composition of Mars protect life against radiation?
5._____
For many years now, scientists have speculated about the possibility of life on Mars (Klein et al., 1976; McKay, 1997). The discovery of liquid water on Mars would increase its habitability ...

3. In pairs, discuss the following questions. Express your agreement or disagreement with the partner's opinion. Give reasons.
1. What is the purpose of an abstract?
2. How can an abstract help a researcher choose which papers to read?
3. What information does the abstract usually include?
4. Why do some people think a good abstract is even more important in the Internet age than it was before?

4. An abstract usually contains one or two key sentences from each section of a paper. Read the following extracts from the abstract. Match the sections (1 - 4) to the extracts (A-D).

Abstract section names

1. Introduction_____ 3. Results_____
2. Method_____ 4. Discussion_____

Extracts from the abstract

A
With the aim of evaluating this possibility two microorganisms, Additbiobacillus fetrooxidans, an acidophile, and Deinococcus radiodurans, a radiation-resistant microorganism, were exposed to simulated Mars conditions; that is, 95% CO, 2.7% N, 1.6% Ar and 0.6% H, 0 with a pressure of 7 mbars.

Temperature was set at 150 K and ultraviolet radiation was in the wavelength range of 200-400 nmat. Exposure was for different times under the protection of 2 and 5 mm layers of oxidised iron minerals. Survival was evaluated by growing the organisms on fresh media.

B

The resistance of organisms to extreme conditions like the conditions which exist on the surface of Mars under the protection of a thin material layer increases the possibility that life could exist on Mars.

C

Here we report that both the 2 and 5 mm thick layers provided enough protection against radiation and Mars environmental conditions for the bacteria to survive.

D

Current surface conditions on Mars are extremely challenging for life. However, Nicholson and Schuerger (2005) reported that Bacillus subtihs was able to survive for 19 days under Mars atmospheric pressure and composition. The question is whether there are any features on Mars that could provide protection against the surface conditions. One possibility is that the surface material plays a protective role due to the fact that it is composed of iron oxides and hydroxides.

5. Read the titles of six research papers. In pairs, decide which titles you think are most helpful for the reader.

- Staphylococcus Aureus Host Cell Invasion
- Increase in Fruit Size of a Spontaneous Mutant of 'Gala' apple (Malus x domestica Borkh.) is Facilitated by Altered Cell Production and Enhanced Cell Size
- Large Colonial Organisms Many Years Ago
- Does Warming Alter the Metabolic Balance of Ecosystems?
- Cat Nap: A Study of Mammalian Sleep Dynamics
- Genetic Signatures of Exceptional Longevity in Humans

6. Read seven suggestions for writing the title of a research paper. Which suggestions should you use to write a good title? Which suggestions don't give good advice?

a) Make it about 50 words long
b) Write it as a question
c) Begin with a phrase like '*A study of ... or An Investigation into ...*'
d) Include a joke or play on words
e) Include important key words for internet search tools
f) Include information such as the species studied, the treatment used, etc.
g) Present the key result

7. Your group mate is deciding on a title for his paper and has written four alternatives. In pairs, decide which title you think is the best.

1. Is There Life on Mars?
2. Are There Any Features on Mars That Could Provide Protection Against the Harsh Surface Conditions?
3. An Investigation into Whether Mars's Surface Material Could Provide Protection for Organisms.
4. Protection for Acidithiobacillus Ferrooxidans and Deinococcus Radiodurans Exposed to Simulated Mars Environmental Conditions by Surface Material Unit.

8. You use the order of your visual data to organize the text of the results section. Put the words in brackets in the correct order to complete the extracts from the results (1-4).

1. (shown / as / Fig. 1 a / in), for a pure monolayer of graphene, the Fermi level is located about 0.42 eV above the Dirac point.
2. (shows / as / Fig. 1 d), when a 0.8 nm-thick layer of molecules was deposited, charge neutrality was reached.
3. (be / in / Fig. 3d / observed / it / that / can) as the temperature increased above 75 °C, the difference between the Dirac energy and the Fermi energy also increased.
4. (that / Fig. 3d / shows) the difference returned to the level of a pure graphene layer at 230 °C.

9. Your group mate wants to compare and contrast the doping effects of TCNQ and F4-TCNQ. Read the following draft paragraph and underline the phrases he uses to describe a comparison or a contrast. Make up your own sentences to compare and contrast some other experimental results in your scientific area.

In contrast to F4-TCNQ, the nonfluorinated version, TCNQ, showed a far less effective charge transfer, even though the fluorine atoms are not directly involved in the charge-transfer process. In the case of TCNQ, the electron affinity was 2.8 eV compared to 5.24 eV for F4-TCNQ. While charge neutrality was reached for F4-TCNQ, with TCNQ the Fermi energy remained at least 0.25 eV above the Dirac point, as shown in Fig. 4. The maximum shift of the band structure was obtained for a TCNQ coverage of 0.4 nm (see Fig. 4d), half that of F4-TCNQ, and no additional shift was observed for higher amounts of deposited molecules.

10. The phrases in bold describe the results of a number of other experiments. Match the beginnings (1-8) to the endings (a-h) to complete extracts from eight different research papers.

Beginnings

1. At high temperature and high pressure, an olivine **showed a noticeable …**
2. The carbon nanotubes **had an extremely …**
3. For the hydroxide-to-fiber ratio of 4:1, I c **slight …**

4. TAGH **had only a minor …**
5. The anxiety-related metabolic differences observed in urine **were significantly…**
6. **There were only marginal …**
7. The robot demonstrated looping behaviour that was similar to that of the …
8. When running horizontally on the high-h friction surface T mauritanica's average speed **was considerably…**

Endings

a) **… differences were seen between** the activation efficiency of NaOH and KOH.
b) … differences in the pH and temperature over the 3-month **period**,
c) **… effect on DNA** synthesis and did not interact with the EGF receptor,
d) **… high** capacity.
e) **… reduced** following 1 and 2 weeks of dark chocolate consumption,
f) **… slower than** C. draconoides.
g) **… drop in** strength.
h) **… successful at** locating the odour source.

11. Look at the phrases above and find adjectives and adverbs which express:
a) a large degree
b) a small degree

12. Complete the paragraphs from the results section of a paper using given words and phrases in the box.

Noticeably thicker, as can be seen in, resulted in, a longer, while, considerably contrast to

During the rapid heating, the Ni near the Ni/SiC interface reacted with the SiC, which resulted in carbon atoms moving into the Ni. The carbon atoms then separated onto the surface of the Ni during the cooling procedure, forming graphene layers (1) _____Fig. 1b. In (2) _____the grapheme generated using single-crystalline SiC, the graphene synthesised by this process is (3) _____ easier to remove from the SiC surface. A slower heating rate (4) _____ process. As shown in Fig. 4, more carbon atoms were released into the Ni in a long process. Higher carbon concentration in the Ni produced a (5) _____ carbon nanofilm on the Ni surface, (6) _____a lower carbon concentration reduced the thickness of the carbon nanofilm and formed graphene.

Unit 7. How to Present Your Research Paper Ideas

Reading skills

Text

1. In this text you will learn the proven way to fascinate your professor and classmates while presenting your research paper topic. You will also find useful tips on how to build your speech and use your strong points. You may write a splendid, award winning research paper with an eye catching research paper topic, brilliant research paper ideas, and reliable evidence. But, if you are unable to present it in a bewitching way to the audience, you will not get the results you deserve. The way you present a research paper stands for 50% of your success. Hesitation, trembling voice, uncertain body language can greatly hinder your presentation and spoil the net result. Once you appear to be persuasive, confident, and eloquent enough to get your research paper topic and research paper ideas across to the public, you may be sure to get the highest reward. Therefore, you should remember that writing research papers involves far more than information search, doing the research and putting down its results. By the end of the research, spend some time preparing to present your research paper in the most appropriate way. Usually students are required to present their college research papers in 15-20 minutes maximum. If you have a gift of the gab, it might seem that 20 minutes won't be enough to give the clear outline of your research paper; and if you are one of those reticent students, you might think 20 minutes is far too much for your research paper. In both cases you should learn to keep within the limited time period and present the key points of your research paper at a time. For that purpose, be sure to practice the presentation of your research paper at home or where you can be at ease and comfortable, for example, in front of a mirror, your family, friends or colleagues. If possible, use a tape-recorder and listen to yourself. This way you will come to know your strong and weak points and will be able to emphasize your strong points during your presentation and get the research paper ideas across to the audience. The preliminary steps for preparing an oral presentation include a thorough choice of your clothes, which should be appropriate for the occasion. How you are perceived is very important. Thus, present the desired image to your audience so that they will get interested in your research paper topic.

2. Oral presentation requires an outline of the main research paper ideas you want to deliver in front of the audience. Put them down so that to have a backup in case you lose the track of ideas. Do not read your research paper. It is much better to present its ideas personally by explaining the key points. Of course, you do not need to memorize your research paper by heart, simply put down the points you want to dwell upon and organize your speech around them. The way you begin your presentation and end it counts most. So, make sure to make a fascinating introduction and conclusion. A good introduction should capture the audience's attention and warm you up. Some say that the best way to start the presentation is by introducing a joke, but you are rescuing seriously if your joke falls flat. It is much better to start on a genuine note. It will be good introduction if you:

- recollect some recent events or refer to a local event;
- tell a personal story, preferably one that is humorous;
- start with a good quote;
- ask a rhetorical or factual question;
- refer to something that has happened in class;
- state the reason why you chose this particular research paper topic.

You can choose any of these approaches, but make sure it is tied to your research paper topic. Once you have interested the audience, you can dwell on the body of your research paper. However, you should remember that you do not have much time to report your results in detail. That is why, summarize, give the main points, and hit the highlights. Interpret your results, talk about their significance, and only then clearly state your conclusions. It is also important to remember that your presentation should not replace your research paper, but rather whet the audience appetite for it. Thus, it is commonly useful to allude to information in the paper that can't be covered adequately in the presentation.

3. As it was pointed earlier, your conclusion should be as strong as the introduction. Either end research paper presentation with a concluding statement or invite questions, or both. When you reach the end of your presentation, use the words "*in conclusion*", "*finally*", or "*one more thing*." Do not end your speech suddenly without recalling what you have said. By the end of the speech, say "*Thank you*" or "*Thanks for your attention*" or something like that, not "*Well, I guess that's about all I have to say*" or by just quitting. It is embarrassing when someone just stops without saying a word of conclusion. In this case people don't know whether you're done and it's time to clap or if you are going to continue. In order to charm the audience be sure to talk to the listeners, not the screen or the blackboard and try to establish the dialogue with the audience. Maintain eye contact, but not with just one person. This will make the whole experience feel more natural. You should get rid of distracting mannerisms like slapping your leg, playing with the keys in your pocket, pulling at your ear, nose, shuffling your notes, playing with the projector cord, or whatever. Body language plays an important role in everyday communication, and even greater in conference talks. If you are experiencing stage fright, take a deep breath before taking the floor. Try to gather your research paper ideas together. Walk slowly to the front, pause and look at the audience before speaking. Remain calm. And off you go to the victory!

Adapted from: http://www.articlesfactory.com/articles/advice/how-to-present-your-research-paper-ideas.html
Accessed: 11.08.2020

After text tasks

1. **Look through the following words from the text and try to find some other meanings of them. Which meaning of these words matches the translation of this text?**

1. fascinate [ˈfæsɪneɪt] – увлечь
2. persuasive [pəˈsweɪsɪv] – убедительный
3. appropriate [əˈprəʊpriət] – подходящий
4. emphasize [ˈɛmfəsaɪz] – подчеркнуть
5. preliminary [prɪˈlɪmɪn(ə)ri] – предварительный
6. desired [dɪˈzaɪəd] – желаемый
7. perceive [pəˈsiːv] – воспринимать
8. outline [ˈaʊtlʌɪn] – набросок
9. require [rɪˈkwʌɪə] – требовать
10. speech [spiːtʃ] – речь
11. event [ɪˈvɛnt] – события
12. quote [kwəʊt] – цитата
13. paper topic [ˈpeɪpə ˈtɒpɪk] – тема исследования
14. summarize [ˈsʌməraɪz] – обобщать(резюмировать)
15. conclusion [kənˈkluːʒ(ə)n] – заключение
16. attention [əˈtɛnʃ(ə)n] – внимание
17. charm [tʃɑːm] – очаровать
18. distracting [dɪˈstræktɪŋ] – отвлекающий
19. gather [ˈgæðə] – объединить
20. victory [ˈvɪkt(ə)ri] – победа

2. Translate the following word combinations into Russian.
1. eloquent enough
2. highest reward
3. in both cases
4. the preliminary steps
5. backup in case
6. a genuine note
7. preferably one that is humorous
8. particular research
9. concluding statement
10. weak points

3. Read the text and answer the following questions.
1. Which problems can greatly hinder your presentation?
2. What is one of the best ways to start a presentation?
3. What manners should you show, if you want to charm auditory?
4. How much time should you take to present your result?
5. What should you say in conclusion?

4. Find the English equivalents to the following word combinations in the text. Make up your own sentences with these phrases.

1. глубокий вдох
2. достаточно красноречивый
3. исследовательский документ
4. фактический вопрос
5. вспоминая сказанное

5. What is the main idea of the text? Choose the correct answer. Offer your own version of the main idea of the text.

a) Writing a splendid research paper topic is very important for a speaker.
b) Tips for making a good presentation.
c) Body language plays an important role in making a good presentation.

6. Mark true (T) or false (F) sentences:
a) Students are required to present their college research papers in 25-30 minutes maximum.
b) It doesn't matter, which way you are going to present the topic.
c) It's a good decision to get rid of distracting mannerisms like slapping your leg.
d) Once you have interested the audience, you can dwell on the body of your research paper.
e) It's important to remember that your presentation should replace your research paper.

7. In what paragraph is it written that the best way to start the presentation is by introducing a joke?
a) 1; b) 2; c) 3.

8. Put the names of the paragraphs in the correct order.

Titles	Number
a) The importance of making a good conclusion in your report	
b) Preparing yourself and preparing to present your research paper	
c) Present directly your research paper to auditory	

9. Choose the correct answer to the given question.
What should you do to charm your auditory?
a) Tell your report without errors.
b) Pay attention to details in presentation.
c) Talk to the listeners, not the screen or the blackboard.

10. Translate the sentence.
As it was pointed earlier, your conclusion should be as strong as the introduction.

11. Match column A and B.

A	B
1. shuffling	a) выучить наизусть
2. embarrassing	b) заявление
3. establish	c) затруднительный
4. statement	d) шарканье
5. memorize	e) установить

12. Complete the sentence.
Some say that the best way to start the presentation is … .

13. Choose the sentence with the correct word order.
a) Usually students in 15-20 minutes maximum are required to present their college research papers.
b) Students are required to present their college research papers in 15-20 minutes maximum usually.
c) Usually students are required to present their college research papers in 15-20 minutes maximum.

Communication skills

(Adopted from: Armer T. Cambridge English for scientists. Cambridge University Press. https://portal.tpu.ru/SHARED/m/MALORISS/studentam/SelfStudy/Tab2/Posobie5cours.pdf)

1. Match the beginnings (1 -9) to the endings (a-i) to make definitions of the words in bold. Define 10 important scientific concepts from your field.

Beginnings

1. A biodegradable substance is one which _____
2. **A nanocapsule** is a capsule which has _____
3. **A removable object** is one which _____
4. **Endocytosis** is a process by which _____
5. If **a cell** overexpresses a protein, it expresses _____
6. If someone is given multiple doses of **a drug**, they receive _____
7. **Intercellular communication** is communication which happens _____
8. When **a drug is encapsulated**, it is _____
9. If you **ingest a substance**, you take it _____

Endings

a) can be put in one place then taken away.
b) into your body.
c) between cells in the same organism.
d) decays naturally.
e) put inside something else.
f) it many times.
g) molecules can move inside cells.

h) a diameter smaller than 200 x 109 meters.
i) too much of it.

2. In pairs discuss the following questions. Express your agreement or disagreement with the partner's opinion. Give reasons.
1. What is nanotechnology?
2. What commercial applications could research in nanotechnology have?

3. A teacher asks you to explain what happens during the process. Complete the following extracts from your conversation using the words in the box.

Attach, by, coat, dissolves, encapsulated, in, internalized, to, with

1. To do this, first we _____the surface of the tube _____a chemical receptor.
2. If we want to target a tumor which over expresses folic acid, then we _____ folate receptors_____the surface of the nanotube.
3. And then we encapsulate the drug _____ the tube.
4. Once the drug is _____, we use a cap to close the open end so the drug can't escape.
5. After that, the capsule is _____ the cell.
6. I use biodegradable caps. The cap _____ and then ...

4. Read the questions below, check the meaning of the unknown words and read all possible answers correctly.
1. What was the dosage of fluoride per kilogram of body weight?
a) 0.166 b) 0.16 c) 0.616
2) What was the sensitivity of the assay (пробы)?
a) 0.02 b) 2.0 c) 0.2
3. What is the output impedance (амплитуда) at the 5V end?
a) 0.02 b) 0.20 c) 0.92
4. What amperage of flex is used?
a) 0.6 b) 6 c) 6.8
5. What is the temperature below which the superconductor conducts electricity with no resistance?
a) 91 b) 19 c) 90
6. What is the enthalpy (физическая величина) change when 2 moles of water are formed at a pressure of one atmosphere and a temperature of 298 kelvin?
a) - 517.6 b) -5716 c) -571.6
7. What is the lowest frequency at which young mice squeak (make a noise) when isolated from their mother?
a) 450 b) 45 c) 405
8. What speed laser pulses were used?
a) 15 b) 50 c) - 50

5. In pairs answer the following questions.
1. How do we say these values?
a) % b) 5/a c) 10% d) 107 e)10-9
2. How do we say these symbols?
a) 28 % b) x (in e.g. 5 x 109) c) -
3. What is the difference between 1.356 and 1,356? How do we say them?

6. Read the information. Translate it.
The International System of Units (SI) is the most common measurement system around the world, particularly in the fields of science, commerce and trade. It is a modern form of the metric system and as such is devised around the number 10. The system consists of 7 base units and a set of prefixes. There are a number of other common SI-derived units.

7. In pairs discuss the following questions. Express your agreement or disagreement with the partner's opinion. Give reasons.
1 What units of measurement do you commonly use in your everyday life?
2 What units do you use in your work/study?
3 Which SI prefixes (metric prefixes) do you know? How do they change the quantity?

8. Discuss the following questions in pairs. Express your agreement or disagreement with the partner's opinion. Give reasons.

1. How is the information in the results section of a paper different from the discussion section?
2. Why do researchers usually keep the results and discussion sections separate?
3. Why might some researchers present the results and discussion together as one section?
4. Some papers include a conclusion section. What is the difference between a discussion and a conclusion?

9. Read three extracts from a research paper. Then match an extract (A-C) with the part of the paper it comes from:
the materials and methods section, the results section or the discussion section
A. The majority of the activated carbons examined have surface ranging between 900 a n d 2000 mK/g, and the ratio of micropore volume to total pore volume ranges between 0.26 and 0.65.
B. The highest storage factor attained is 89 for compacted grain-based activated carbons from rain sorghum. Therefore, sorghum-based activated carbons will be effective for natural gas storage in the fuel tanks of moto vehicles.
C. Carbonisation and activation were performed in an electrical-resistance furnace under a steady flow of gaseous Ns. The samples were contained in cylindrical baskets made from 60 mesh stainless steel gauze.

10. Below are two extracts from the final draft of your friend's materials and methods section, based on the lab notes for the next experiment. Complete each extract using the words given below.

A

Actual, aid, and, approximately, average, due, estimated, evaporated, length, placed, ranged, suspended, to

The experiment investigated filling carbon nanotubes with a suspension containing fluorescent beads. The tubes (1) _____in (2) _____ from 20 (3) _____ 5 Ohm and had an (4)_____diameter of (5) _____ 500 nm and a wall thickness of 15 nm. The tube diameters were (6) _____ 300 (7) _____ from electron microscope images and ranged between. 700 nm. The (8) _____tube diameters may have been smaller (9) _____ to tube deformation. The CNTs were then (10) _____ solution and (11) _____ on glass cover slips with the (12) _____ of dielectrophoresis. The 2-propanol then (13) _____.

Unit 8. SOCIALIZING AT A CONFERENCE

Reading skills

Text

1. **Scientific networking**

Attending a scientific conference is a great opportunity to meet new people and do some networking. A large network will come in handy to land new projects, collaborations or jobs to progress in your scientific career. You cannot change anything from past conferences. Luckily, there's a new one in a few months and you are going to get your stuff together and make the most of it. But do you know how? Do you know how to network at a conference? If you follow these tips you will be a master of socializing at scientific conference dinners.

2. Socializing Before a Scientific Conference

You need to do some homework. Your social success should not depend just on your personal skills. Planning ahead is a key. What we want to do is to know who will attend the conference and decide if we want to meet them. Additionally, we want to let others know that we will also be there.

3. Create or Join the LinkedIn Event of the Conference

One problem with registering to a conference is that you only know the speakers, but not the list of attendees. LinkedIn allows you to join or create an Event. You will not only see relevant information of the event, but also those that like you are attending. As an extra incentive for stalkers, you can check the LinkedIn profile of the attendees to decide beforehand if they are worth having a chat with.

4. Find or Create A Twitter Hash tag For The Conference

Twitter is a not only a great way to get visibility as a PhD student. It also helps to find people who tweet about conferences and even announce they will join them. To recognize which tweets belong with which event, people include in their tweets an unique hashtag. Somebody has to decide which one is the official hashtag of the event. So if the organizers haven't done yet, be proactive and propose them with one. Encourage them to promote the hashtag in the event website and in their mailing list. Once people start using the hashtag, you just need to do a Twitter search based on the hashtag and find who is interested in the event and what's being said about it. Extra tip: if you are not attending the conference, checking tagged tweets a hashtag is a good way to follow in real-time the discussion about the event via Twitter.

5. Contact Some of the Attendees

At this stage you know who the speakers are as well as some of the attendees. Now you have an idea of some of the people you would like to talk to and socialize at the conference dinner. It's time for cold emailing. Use for your email a self-explanatory title (don't just say "Hello"). Use something like "Meeting at conference XXX dinner to discuss the problem?" The first paragraph of your email is your elevator pitch, short and to the point. After reading the first paragraph, the scientist you are hitting on should already know if he wants to meet or not. Leave the details for the rest of the email. Elevator pitch: "I am a PhD student at Prof. John Doe's group interested in parallel DNA sequence alignment. Would like to meet at the conference dinner to discuss a possible collaboration to implement your alignment algorithms in a massive parallel study?" The rest of the email could contain some of your achievements. Describe also what's in for the other person to meet with you.

6. Socializing During a Scientific Conference Dinner

The conference dinner arrived. It's time to seduce everybody with your Pierce Brosnan's charms.You might have arranged some meetings already. Attend those first and say "thanks for making time for me". But leave room for meeting strangers. You don't know where a pleasant surprise might be waiting for you.

7. What To Wear: Good Clothes and The Badge

There is a lot of advice on what and what not to wear in academia. This is of great importance when giving a talk, attending a conference or having a job interview. The best dressing advice you can get: "dress a bit better than those around you". During the day you should check how the speakers and other attendees dress. You need to up-dress them, but just a bit. Is it a conference for hardcore nerds that wear shorts and Metallica t-shirts? Then cool sneakers, jeans and a polo t-shirt will do. Most people dress neat with quality trousers, shirt, blazer and no tie? You wear the same plus a tie. You should also have your badge visible. It encourages people to read it, pronounce your name, your university and then ask what you do. And hey, they might even remember your name after two glasses of wine.

8. Sit with People You Don't Know

Meeting new people is a key to expanding your network. This time you are not going to sit with your boss and the rest of the colleagues from your group. Always start with a "May I join you?" Unless they are busy or the seats are taken they will always say yes.

9. Sit with "Young" Scientists

It's easy to feel infatuated by the charisma of that big professor in your field. Approaching a hot-shot is and getting something out of him would pay off being at the conference. Unfortunately, reputed scientists have a busy agenda and they tend to talk to peers of the same academic rank. If they talk to lower ranking people is with lack of interest or just to reinforce the impression that they know it all. Then you have the young scientists. They are of your same age, more open-minded, with smaller egos and with fewer people to talk to. If this is not enough I give you two more reasons: young scientists are the ones doing the most innovative research and the ones more interested in collaborating with you.

10. **Ask More, Listen More, Talk Less about Yourself**

The goal of networking is getting people to like you. And the key to get people to like you is to shut up and listen to what they have to say. Don't you find annoying that guy that can't stop talking about himself and the things he does? Guess what? People won't like you if you keep talking about yourself. Doesn't it feel good when people ask you things and want to know more about you? Doesn't it make you feel a bit important? That you are worth listening? Guess what? People would like the same from you. The key is to be genuinely interested in the other person. This means letting the other person do the talking and when he stops, you should keep him talking by asking questions like:

- What is your research about?
- Do you have some exciting results so far?
- How is it to do research in your group? Pros, cons?
- How is it to live in your city?
- What were the toughest moments in your PhD? How did you get out of the problems?
- What are your scientific plans?

11. Have 2 Elevator Pitches Ready

Most people will reciprocate and ask things about you. One first thing they will ask is what you do, what your research is about. Here it is convenient to have not one, but two elevator pitches of your research. Use each one depending on who's asking. (An elevator pitch is a 30 to 60 second description of your research; it should include what you do, why and how you do it)

First elevator pitch: your grandma should understand it easily. This one you will use for non-experts in your field.

Second elevator pitch: include all sorts of complicated jargon and be so scientifically correct that your PI couldn't find a single flaw in your speech. This is for experts in your field.

12. Don't Only Talk About Work

After a long day of presentations, poster sessions and work chit-chat at the dinner, it might be time to skip work and have some fun. Try to shift conversations towards non-work related topics like hobbies and anecdotes. You can listen to others and start asking more personal things.

Adapted from: https://thesiswhisperer.com/2013/01/23/crash-course-on-socializing-at-a-scientific-conference-dinner/
Accessed: 11.08.2020

After text tasks

1. **Look through the following words from the text and try to find some other meanings of them. Which meaning of these words matches the translation of this text?**

1. scientific conference [saɪənˈtɪfɪk] [ˈkɒnf(ə)r(ə)ns] научная конференция
2. beforehand [bɪˈfɔːhand] заблаговременно
3. encourage [ɪnˈkʌrɪdʒ] поддерживать
4. discussion [dɪˈskʌʃ(ə)n] дискуссия
5. sequence [ˈsiːkw(ə)ns] последовательность
6. alignment [əˈlaɪnm(ə)nt] выравнивание
7. achievements [əˈtʃiːvmənts] достижения
8. job interview [dʒɒb] [ˈɪntəvjuː] собеседование
9. quality [ˈkwɒlɪti] качество
10. pronounce [prəˈnaʊns] произносить
11. reinforce [riːɪnˈfɔːs] усиливать
12. impression [ɪmˈprɛʃ(ə)n] впечатление
13. collaboration [kəˈlæbəreɪʃn] сотрудничество
14. genuinely [ˈdʒɛnjʊɪnli] искренне
15. reciprocate [rɪˈsɪprəkeɪt] отвечать взаимностью
16. convenient [kənˈviːnɪənt] удобный
17. depending [dɪˈpendɪŋ] в зависимости
18. scientifically correct [ˌsaɪənˈtɪfɪkəli] [kəˈrɛkt] научно правильный
19. conversation [kɒnvəˈseɪʃ(ə)n] разговор, беседа
20. fun discussions [fʌn] [dɪˈskʌʃ(ə)nz] веселые дискуссии

2. Translate the following word combinations into Russian.

1. scientific career
2. personal skills
3. extra incentive
4. find people
5. extra tip
6. meeting at conference
7. alignment algorithms
8. great importance
9. academic rank

3. Read the text and answer the following questions:
1. What opportunities does participation in a scientific conference give you?
2. What kind of web site does the author of the text suggest people going to the same scientific conference?
3. What kind of clothes should you wear for the conference? List them.
4. What are the basic rules for communication in a conference hall with well-known scientists?
5. How many seconds should your brief speech last, and what should you talk about?

4. Find the English equivalents to the following word combinations in the text. Make up your own sentences with these phrases.
1. инновационные исследования
2. заинтересованы в сотрудничестве
3. захватывающие результаты
4. сложный жаргон
5. стендовые сессии

5. What is the main idea of the text? Choose the correct answer. Offer your own version of the main idea of the text.

a) The importance of attending a scientific conference.
b) Some special tips will help you become a master of scientific conferences.
c) It is better to communicate with famous scientists at a scientific conference.

6. Mark true (T) or false (F) sentences.
a) At the scientific conference it is desirable to wear an official suit with a tie and with a badge.
b) When you talk to people at a scientific conference, you need to talk as much as possible about yourself.
c) At a scientific conference, you need to communicate with people you know.
d) When writing a letter to a scientific conference participant, you can use the explanatory name "Hello" for your email.
e) After a long day of presentations, poster sessions and working in the chat at dinner, on a rest, try to shift conversations towards non-work related topics.

7. In what paragraph is it written that goal of networking is getting people to like you?
a) 1; b) 2; c) 3.

8. Choose the correct answer to the given question. Make your own question to the text with the question word “Why”. Ask your partner this question. Express your agreement or disagreement with the partner's opinion. Give reasons.

What should a man wear at a scientific conference?
a) T-shirt, shorts, sneakers.
b) Official suit.
c) It does not matter.

9. Translate the sentence.
Would you like to meet at the conference dinner to discuss a possible collaboration to implement your alignment algorithms in a massive parallel study?

10. Match column A and B.

A	B
1. research	a) описание
2. genuinely	b) результаты
3. results	c) стимул
4. description	d) исследование
5. incentive	e) искренне

11. Complete the sentence.
Unfortunately, reputed scientists have a busy agenda and they tend … .

12. Choose the sentence with the correct word order.
a) Approaching a hot-shot is would pay off being and getting something out of him at the conference.
b) Approaching a hot-shot at the conference is and getting something out of him would pay off being.
c) Approaching a hot-shot is and getting something out of him would pay off being at the conference.

Communication skills

(Adopted from: Armer T. Cambridge English for scientists. Cambridge University Press. https://portal.tpu.ru/SHARED/m/MALORISS/studentam/SelfStudy/Tab2/Posobie5cours.pdf)

1. In pairs, discuss the following questions. Express your attitude to the partner's response. Give reasons.
1. Have you ever been to a conference? Tell your partner about your experience.
2. Do you plan to attend any conferences in the near future?
3. What might be difficult (apart from giving a presentation) about attending a conference where the main (or only) language is English?

2. In pairs, look at the list of typical conference activities (a-h) below and then discuss the following questions.

Typical conference activities

a) making arrangements for coffee, lunch or an evening out
b) asking someone which talks they have been to
c) asking someone for their opinion on a talk
d) finding out about where someone works and what research they are doing
e) asking someone if they are giving a talk
f) asking someone how successful their presentation was
g) introducing yourself or someone else for the first time
h) networking (making useful contacts)

Questions

1. Which of these activities have you done (or might you expect to do) at conferences?
2. Which activities are easier / more difficult for you? Why?
3. Do you know any words or phrases which are appropriate for these activities?

3. In pairs, role play some of the conference activities (a-h) in Exercise 2.

4. Find out some online poster advertising a conference and answer the following questions.

1. Who might be interested in attending this conference?
2. If a researcher applies on 7 May, could he/she give a paper at this conference?
3. If you were interested in this conference, how could you find out more?

5. Think about an experiment you have been working on or that you are familiar with. Use the topic sentences to write at least one paragraph for the results section of a paper.

6. You are asked for advice on writing up the discussion section of someone's paper. Look at some of the questions. Can you answer any of them? Role play the dialogue with your partner.

1. Should I work through my discussion in the same order I used for the results?
2. Can I mention any new results?
3. Do I need to mention the results again?
4. Can I refer to other work that's been done in the area?
5. In terms of language, is there anything in particular I should be careful with?

7. Complete the following sentences from three more research papers. In each space, write the noun form of the word in brackets or use *of, on* or *to*.

1. The_____ (able)_____ a gecko_____ walls walk_____ demonstrates that. (activate)_____the adhesive system improves the gecko's movement over smooth surfaces.
2. The_____ (form)_____ a CaP layer_____ the surface allowed further crystal growth.
3.Although the species M. fortunate has a lower_____ (expose) to vent fluids it seems to have a higher_____ (accumulate)_____metals in its tissues.

8. In pairs, read another extract from your group mate`s paper. Then combine the second and third sentences of the extract into one sentence in two different ways using:

a) a relative pronoun (which, that, who, etc.)
b) a verb
The F4-TCNQ layer is stable in air, but appears to be temperature sensitive. At temperatures above 75 °C the energy difference increases. This increase indicates that molecular desorption occurs.

Unit 9. CAREER DEVELOPMENT

Reading skills

Text

1. **Research and development (R&D)** is rapidly becoming an essential department in many profit and nonprofit organizations. This means the need for engineers and scientists with great research skills and an aptitude to innovate is increasing. If you are looking to develop a career in R&D – be it to discover an HIV vaccine, design efficient manufacturing processes, develop new consumer products, or simply gather more information on a particular subject – one thing remains constant: you must be a well-educated professional with the right occupational skills.

2. Develop a Love for Science

Without a love for science, your efforts to pursue a career in R&D may end in futility. Right from high school, science subjects should be your favorite. If you find yourself querying basic observations like why the sky is blue or why people age, then you are ready for this profession. Reading science journals and watching documentaries is a good way to increase your scientific curiosity. Oh, don’t forget math is equally important! In addition to letting a love for science grow in you, familiarize yourself with the skills that make competent R&D professionals. You will need teamwork skills to productively collaborate with

other scientists or engineers, analytical skills to assess the accuracy of your scientific findings, and outdoor skills, just in case the profession takes you to the forests!

3. Choose a Specialty

R&D is an expansive academic field. It is wise to choose an area of specialism as early as possible, so that you can embark on pursuing college education that focuses on your chosen area. Do you, for instance, want to know more about planet Earth and other celestial bodies so you can design space vehicles? Then pursuing a bachelor's degree in space studies or rocket science will give you the best foundation. Are you always keen to learn about the features of an upcoming iPhone and other telecommunication products? Why not pursue a bachelor's in telecommunication engineering? In short, undergraduate school should not be about pursuing a general B.Sc. degree.

4. Pursue Graduate-level Education

In R&D, undergraduate training is not sufficient. It can only get you hired as a lab technician. As such, you have to follow up your bachelor's with a master's degree. Although you can proceed to pursue a PhD as soon you are finished with grad school, it is advisable to take a pause and find employment as a research associate or assistant. This is crucial as you will get the opportunity to put your innovative skills to test, develop report-writing skills, and gain research experience. Thereafter, go for your PhD.

5. Join Professional Associations

Joining a relevant professional association enables you to network with other R&D professionals in your field and access their published works. Examples of research associations you could join include:

- British Science Association (BSA)
- American Association for the Advancement of Science (AAAS)
- Association of Clinical Research Professionals (ACRP)
- National Society of Professional Engineers (NSPE)

Some of these associations, like ACRP, offer research certifications that you can pursue to improve your competence and employability. Also, be sure to keep up with The Research and Development Society website.

With advanced qualifications and vast experience in R&D, no one will stand in your way to becoming an R&D manager.

Adapted from: https://www.careeraddict.com/develop-a-career-in-research-and-development
Accessed: 25.02.18

After text tasks

1. **Look through the following words from the text and try to find some other meanings of them. Which meaning of these words matches the translation of this text?**

1. essential department [ɪˈsɛnʃ(ə)l] [dɪˈpɑːtm(ə)nt] необходимый отдел
2. aptitude [ˈaptɪtjuːd] способность
3. consumer [kənˈsjuːmə] потребитель
4. occupational [ɒkjʊˈpeɪʃ(ə)n(ə)l] профессиональный
5. futility [fjuːˈtɪlɪti] бесполезность
6. curiosity [kjʊərɪˈɒsɪti] любопытство
7. familiarize [fəˈmɪlɪərʌɪz] ознакомиться
8. embark [ɪmˈbɑːk] начинать
9. for instance [fɔː] [ˈɪnst(ə)ns] например
10. pursuing [pəˈsjuːɪŋ] преследуя
11. proceed [prəˈsiːd] продолжить
12. advisable [ədˈvʌɪzəb(ə)l] целесообразный
13. crucial [ˈkruːʃ(ə)l] ключевой
14. report-writing skills [rɪˈpɔːt- ˈrʌɪtɪŋ] [skɪlz] навыки написания отчётов
15. thereafter [ðɛːrˈɑːftə] после этого
16. gain experience [geɪn] [ɪkˈspɪərɪəns] приобретать опыт
17. enable [ɪˈneɪbəl] позволять
18. advancement [ədˈvɑːnsm(ə)nt] продвижение
19. employability [ɪmˈplɔɪəˈbɪlɪti] трудоспособность
20. vast experience [vɑːst] [ɪkˈspɪərɪəns] огромный опыт

2. Translate the following word combinations into Russian

1. occupational skills
2. basic observations
3. scientific curiosity
4. space vehicles
5. research experience
6. productively collaborate
7. proceed to pursue
8. develop skills
9. nonprofit organizations
10. advancement of science

3. Read the text and answer the following questions:

1. What is a good way to increase student’s scientific curiosity?
2. What skills are important for success?
3. How to get a PhD?
4. What are basic principles of research and development?
5. Why do researchers need to join an association?

4. Find the English equivalents to the following word combinations in the text. Make up your own sentences with these phrases.

1. склонность к инновациям

2. потребительские товары
3. обширная научная область
4. как можно раньше
5. целесообразно принять

5. What is the main idea of the text? Choose the correct answer. Offer your own version of the main idea of the text.

a) For career development you should improve your skills and pursue Graduate-level education.
b) Without a love for science, your efforts to pursue a career in R&D may end in futility.
c) Reading science journals and watching documentaries is a good way to increase your scientific curiosity.

6. Mark true (T) or false (F) sentences.
a) It is wise to choose an area of specialism as later as possible, so that you can embark on pursuing college education that focuses on your chosen area.
b) After ending high school, science subjects should be your favorite.
c) In R&D, undergraduate training is sufficient.
d) Research and development (R&D) is rapidly becoming an essential department in many profit organizations.
e) R&D is an expansive academic field.

7. In what paragraph is it written that it is wise to choose an area of specialism as early as possible?
a) 2; b) 3; c) 1.

8. Put the names of the paragraphs 1, 2 and 3 in the correct order.

Title	Number
a) Choose a Specialty	
b) The need for engineers and scientists	
c) Develop a Love for Science	

9. Answer the question. Make your own question to the text with the question word "Why". Ask your partner this question. Express your agreement or disagreement with the partner's opinion. Give reasons.

What is research and development (R&D)?

10. Translate the sentence.
Although you can proceed to pursue a PhD as soon you are finished with grad school, it is advisable to take a pause and find employment as a research associate or assistant.

11. Match column A and B.

A	B
1. Upcoming 2. Efforts 3. To assess 4. To improve 5. To develop	a) Оценивать b) Улучшить c) Усилия d) Предстоящий e) Развивать

12. Complete the sentence.
Reading science journals and watching documentaries is a good way… .

13. Choose the sentence with the correct word order.
a) This is crucial as you will get the opportunity to put your innovative skills to test, develop report-writing skills, and gain research experience.
b) This is the crucial opportunity as you will put your innovative skills to get to gain, report-writing develop skills, and research experience test.
c) As you will get the opportunity to put your crucial to test, innovative skills this is develop report-writing skills, and gain research experience.

Communication skills

(Adopted from: Armer T. Cambridge English for scientists. Cambridge University Press. https://portal.tpu.ru/SHARED/m/MALORISS/studentam/SelfStudy/Tab2/Posobie5cours.pdf)

1. Discuss the questions in groups. Express your agreement or disagreement with the partner's opinion. Give reasons.

1. What can you tell about your career in science?
2. How do you prepare for your future profession?
3. How does university education help you to become a qualified specialist?
4. What does your scientific research include?
5. Who are the most famous scientists in physics?
6. What do you know about scientific and business ethics?
7. What are the rules of scientific communication?
8. What scientific works help you in your scientific research?
9. How to think as a scientist?
10. What are peculiarities of a scientific style of writing?

2. Discuss with the partner the following:

a) a laboratory experiment you took part in
b) scientific resources you use in your research
c) goals and objectives of your scientific research
d) scientific research methods you use in your research

3. Physics is a developing branch of science, isn`t it? Prove it.

4. Make up a short project summary on your scientific area of about 150 words using the following words or phrases.

aims to – however – the initial phase – the proposed research – the study will indicate- practical application

5. Some phrases given below are appropriate when giving a formal talk on your research. Some are not. Define them.

Phrases

1. Good afternoon, everybody. / Welcome, ladies and gentlemen ...
2. To start, thank you / I'd like to start by thanking you all for coming to my talk today.
3. I'm Mike Downi and at present / My name is Mike Down and I'm a PhD candidate at Northumbria University.
4. I'm going to talk today / My talk today is about my recent research investigating ...
5. I'll begin with explaining / To start with, I'll explain briefly how T-cell responses …
6. After that, I'll / I'll go on to describe the alternative method I have been investigating ...
7. Finally, I will discuss / I'll conclude by discussing why this method could be useful as a way ...
8. I plan to talk for about 40 minutes, leaving plenty of time for … / I will talk for about 40 minutes and then I'll answer any questions at the end of my talk.

5. Match each pair of phrases (1 -8) to their correct function (a-f) below. Note that one of the functions may be expressed with three different pairs of phrases.

Correct function

a) Give instructions for asking questions._____
b) Greet the audience._____

c) Introduce the topic of the presentation._____
d) Introduce yourself._____
e) Outline the structure of the presentation._____
f) Thank the audience for coming._____

6. In pairs, discuss the following questions. Express your agreement or disagreement with the partner's opinion. Give reasons.

1. Have you ever applied for a job in science? If not, what kind of job would you like to apply for in the future?
2. Which of the following documents are job applicants usually asked for in your country?
• application form
• biodata
• cover letter (covering letter)
• resume or CV (curriculum vitae)
3. Have you ever written one of these documents in English?
4. Do you think that the information you include and the way you organize a resume or CV in English will be the same as a resume or CV in your own language?

7. The application form asks applicants to include a copy of their CV. In pairs, look at the list of possible headings for a CV (a-l) and then answer the following questions.

Possible headings for a CV

a) computer skills
b) dissertations
c) education
d) grants and awards
e) personal information
f) presentations
h) research experience
i) study abroad
j) teaching experience
k) technical skills
1) travel

Questions

1. Would you use all the headings (a-l) on your CV? Why / why not?
2. How would you organize the information in your CV? Put the list of headings (a-l) in the best order.
3. What kind of information would you include under each heading? Make suggestions for each heading.

8. Rewrite the following sentences as bullet points in your scientific area for your report at the conference.

1. My main research focus was to generate specific carbohydrate oligomers by using pure cloned enzymes.
2. During my project, I focused on the creation of a new CD4 positive HeLa cell clone.
3. As part of the Cell Wall Genomics team, I have developed sensitive methods to determine the fine structure of pectin in maize.

9. In pairs, answer the following questions. Express your agreement or disagreement with the partner's opinion. Give reasons.

1. What is the correct order of information in a citation?
2. If the paper has not yet been published, what do you write instead of the volume and page?
3. If the paper has been submitted (given) to a journal but not yet accepted, what do you write instead of the journal name, volume and page?

11. Rewrite the following extracts from three different papers using either a relative pronoun (which, that, who, etc.) or a verb with -ing.

1. The adhesive apparatus is only activated on sloped surfaces, not on flat surfaces even when slippage occurs. This results in greatly reduced sprinting velocity on smooth, flat surfaces.
2. Consumption of dark chocolate resulted in the decrease in the stress hormone cortisol in the urine. This suggests potential benefits of dark chocolate consumption.
3. On exposure to metals, Bazoricus demonstrates considerable antioxidant enzymatic activity. This reflects a physiological adaptation to continuous metal exposure.

12. Write a paragraph for a discussion section. The discussion section of a paper often describes limitations of the current research and what experiments could be done in future. Read the following statements about someone`s research and decide whether they describe a limitation (L) or an idea for future research (F).

1. The process of charge transfer has not been investigated. _____
2. Desorption might occur because of the temperature used or because of the vacuum. _____
3. Try using higher temperatures at atmospheric pressure to see what happens._____
4. Try doping with other TCNQ-related molecules. ____
5. The graphene sample thickness is not consistent. _____
6. F4-TCNG might be useful in silicon-based as well as graphene-based

electronics. _____
7. Investigate different ways of applying the F4-TCNQ layer. _____

13. Look at the phrases below. Which can be used to express limitations and which suggestions for future research?
1. The scope of this study did not permit us to examine ...
2. Given this limitation, we do not know if/whether...
3. It is hoped that this research can serve as a basis for future studies into ...
4. This is a clear limitation of the study and raises further questions related to ...
5. These results are preliminary findings and suggest that further research on ...

14. The paragraph below describes the limitations and suggestions for future direction of a study looking at the production of grapheme layers. Complete the paragraph using the words and phrases given below.

clear – given – hoped – indicates – permit – raises –scope – serve – as

The study (1)_____ that it is possible to produce large-area graphene films using a solid-phase-based method. It is (2)_____that this research can (3)_____a basis for further studies into grapheme synthesis. One limitation of the present research is that the (4)_____ of the study did not (5)_____ us to investigate the differences between using 6H-SiC and 3C-SiC/Si substrates. (6)_____ this limitation, we do not know if this method is selective for the type of SiC substrate. In addition, the current study did not investigate a range of heating rates. It is possible that lower temperatures could be used if the process were lengthened. This is a (7)_____limitation of the study and (8) _____ further research questions related to the possibility of optimising processing conditions to better control graphene production.

Unit 10. THE ROLE OF SCIENCE AND TECHNOLOGY IN THE 21ST CENTURY

Reading skills

Text

1. Developments in science and technology are fundamentally altering the way people live, connect, communicate and transact, with profound effects on economic development. To promote tech advance, developing countries should invest in quality education for youth, and continuous skills training for workers and managers. Science and technology are key drivers to development, because technological and scientific revolutions underpin economic advances, improvements in health systems, education and infrastructure. The technological

revolutions of the 21st century are emerging from entirely new sectors, based on micro-processors, tele-communications, bio-technology and nano-technology. Products are transforming business practices across the economy, as well as the lives of all who have access to their effects. The most remarkable breakthroughs will come from the interaction of insights and applications arising when these technologies converge. Through breakthroughs in health services and education, these technologies have the power to better the lives of poor people in developing countries. Eradicating malaria, a scourge of the African continent for centuries, is now possible. Cures for other diseases which are endemic in developing countries are also now possible, allowing people with debilitating conditions to live healthy and productive lives.

2. Access and application are critical. Service and technology are the differentiators between countries that are able to tackle poverty effectively by growing and developing their economies, and those that are not. The extent to which developing economies emerge as economic powerhouses depends on their ability to grasp and apply insights from science and technology and use them creatively. Innovation is the primary driver of technological growth and drives higher living standards. As an engine of growth, the potential of technology is endless, and still largely untapped in Africa and other developing world regions across the globe. Less developed countries not only lack skilled labour and capital, but also use these less efficiently. Inputs account for less than half of the differences in per capita income across nations. The rest is due to the inability to adopt and adapt technologies to raise productivity. Computing for example, through unlocking infrastructure backlogs and managing integrated supply chains, can transform economic performance by enabling affordable and accessible services in education and healthcare. The combination of computers and the Internet, and mobile devices and the "cloud", has transformed human experience, empowering individuals through access to knowledge and markets, changing the relationship between citizens and those in authority, as well as allowing new communities to emerge in virtual worlds that span the globe.

3. According to the United Nations International Telecommunications Union (UN-ITU), by the end of 2010 there were an estimated 5.3 billion mobile cellular subscriptions worldwide, including 940 million subscriptions to 3g services. About 90 percent of the world's population can access mobile networks, with three-quarters of mobile subscribers living in developing economies. Cellular technology has allowed Africa to leapfrog the age of fixed line telephony, bringing affordable access to millions of people. However, the continued and equitable expansion of Information Communication Technology (ICT) depends on electricity. The real divide over the next 20 years will be between those who have access to reliable electricity to power these devices and those who do not. Other technologies under development are interventions for cognitive enhancement, proton cancer therapy and genetic engineering. Revolutionary inventions include small underground nuclear power units called nuclear batteries that will be ultra-safe and maintenance-free; new types of

photovoltaics that will make electricity from sunlight cheaper than that from coal; and myriad nano-technologies, some of which lower the cost and increase the reliability of many products – even in the poorest areas of the developing world.

4. Managing technological revolutions poses challenges. Certain innovations and discoveries will raise fraught bio-ethical issues, as genetic modification of food crops and cloning of human embryos has already done. There is a risk that their cost, particularly in the early stages of development, will worsen the present inequality by limiting access to wealthy individuals. This already happens in health care in certain G7 countries, where the demand for very high-cost diagnostic equipment and surgical interventions enabling longevity and better quality of life for older wealthy people overstretches public health care budgets, and lowers service quality in poor neighborhoods. Finally, resource-intensive technologies, focused on satisfying high consumption demand, like holidays abroad in costal resorts, wilderness areas, or iconic cities, increase carbon emissions and environmental damage. To promote technological advances, developing countries should invest in quality education for youth, continuous skills training for workers and managers, and should ensure that knowledge is shared as widely as possible across society.

5. In a world in which the Internet makes information ubiquitous, what counts is the ability to use knowledge intelligently. Knowledge is the systemically integrated information that allows a citizen, a worker, a manager, or a finance minister to act purposefully and intelligently in a complex and demanding world. The only form of investment that allows for increasing returns is in building the stocks and flows of knowledge that a country or organization needs, and in encouraging new insights and techniques. Adopting appropriate technologies leads directly to higher productivity, which is the key to growth. In societies that have large stock and flows of knowledge, virtuous circles that encourage widespread creativity and technological innovation emerge naturally, and allow sustained growth over long periods. In societies with limited stocks of knowledge, bright and creative people feel stifled and emigrate as soon as they can; creating a vicious circle that traps those who remain in a more impoverished space. Such societies stay mired in poverty and dependency. The investment climate is crucial, as are the right incentive structures, to guide the allocation of resources, and to encourage research and development. Successful countries have grown their ability to innovate and learn by doing, by investing public funding to help finance research and development in critical areas. Everyone is involved, i.e. big and small, public and private, rich and poor. The benefits that are certain to flow from technological revolution in an increasingly connected world and knowledge-intensive world will be seized by those countries and companies that are alive to the rapidly changing environment, and nimble enough to take advantage of the opportunities. Those that succeed will make substantial advances in reducing poverty and inequality.

Adapted from: https://ieet.org/index.php/IEET2/more/chetty20121003

After text tasks

1. **Look through the following words from the text and try to find some other meanings of them. Which meaning of these words matches the translation of this text?**

1. advance [ədˈvɑːns] прогресс, достижения
2. access [ˈækses] доступ
3. breakthrough [ˈbreɪkˈθruː] прорыв
4. application [ˌæplɪˈkeɪʃən] применение
5. condition [kənˈdɪʃən] условие
6. poverty [ˈpɔvətɪ] бедность
7. emerge [ɪˈməːdʒ] появляться
8. powerhouse [ˈpauəhaus] электростанция
9. grasp [grɑːsp] схватывание, восприятие
10. primary [ˈpraɪmərɪ] основное
11. labour [ˈleɪbə] труд, рабочая сила
12. adopt [əˈdɔpt] принимать, внедрять
13. enable [ɪˈneɪbl] позволять, включать
14. healthcare [ˈhelθkɛə] здравоохранение
15. subscription [səbˈskrɪpʃn] абонент
16. leapfrog [ˈliːpfrɒg] обогнать, опередить
17. nuclear [ˈnjuːklɪə] атомная энергия
18. pose [pəʊz] представлять, ставить
19. issue [ˈɪʃuː] проблема
20. inequality [ˌɪniːˈkwɔlɪtɪ] неравенство

2. Translate the following word combinations into Russian. Make up your own sentences with these phrases.

1. integrated supply chains
2. drivers to development
3. human experience
4. mobile networks
5. revolutionary inventions
6. increase the reliability
7. certain innovations
8. surgical interventions
9. poor neighborhoods
10. consumption demand

3. Read the text and answer the following questions:
1. In what areas do we have technological revolution in the 21st century?
2. What technologies could improve the quality of life in developing countries?
3. Why the potential of the technology is of limited use in developing countries?
4. What are the challenges posed by technological revolutions?
5. How does the introduction of technology ensure economic growth?

4. Find the English equivalents to the following word combinations in the text:
1. прорывы в области здравоохранения
2. изнурительные условия
3. драйвер технологического роста
4. уровень жизни
5. генная инженерия

5. What is the main idea of the text? Choose the correct answer. Offer your own version of the main idea of the text.

a) Scientific impact on developing countries slows down the development of society.
b) Innovative technology is a key driver to development.
c) Successful countries have increased their capacity to innovate and train by investing public funds in the fight against corruption.

6. Mark true (T) or false (F) sentences.
a) To promote technological advances, developing countries should not invest in quality education for youth.
b) Successful countries have grown their ability to innovate and learn by doing, by investing public funding to help finance research and development in critical areas.
c) The potential of technology is endless, and still largely untapped in Africa.
d) In a world in which the Internet makes information ubiquitous, what counts is the ability to collect knowledge.
e) Less developed countries not only have a large pool of skilled labour and capital, but also use them more effectively.

7. In what paragraph is it written that adopting appropriate technologies leads directly to higher productivity, which is the key to growth?
a) 1; b) 2; c) 3.

8. Put the names of the paragraphs in the correct order. Title the other paragraphs.

Title	Number

a) Scientific impact on developing countries	
b) Technological revolution of the 21st century	
c) Investing in future development	

9. Choose the correct answer to the given question. Make your own question to the text with the question word "Why". Ask your partner this question. Express your agreement or disagreement with the partner's opinion. Give reasons.

What bio-ethical issues will certain innovations and discoveries raise?
a) Pollution of the environment
b) Genetic modification of food crops and cloning of human embryos
c) Overcrowding of cities

10. Translate the sentence.
To promote technological advances, developing countries should invest in quality education for youth, continuous skills training for workers and managers, and should ensure that knowledge is shared as widely as possible across society.

11. Match column A and B.

A	B
1. advance	a) достижения
2. poverty	b) здравоохранение
3. grasp	c) бедность
4. healthcare	d) восприятие
5. labour	e) труд

12. Complete the sentence.
Revolutionary inventions include … .

13. Choose the sentence with the correct word order.
a) The ability makes information ubiquitous in a world in which the Internet, what counts is to use knowledge intelligently.
b) In a world in which the Internet makes information ubiquitous, what counts is the ability to use knowledge intelligently.
c) What counts in a world to use knowledge intelligently in which the Internet makes information ubiquitous, is the ability.

Communication skills

(Adopted from: Armer T. Cambridge English for scientists. Cambridge University Press. https://portal.tpu.ru/SHARED/m/MALORISS/studentam/SelfStudy/Tab2/Posobie5cours.pdf)

1. In pairs, discuss the following questions.

1. What kind of texts do you need to write in English about your work or studies?
2. Why is it important to write your texts in an appropriate style?
3. What can you do to take note of the different styles of language used in English texts?

2. You have some questions about writing a critical review. Discuss the questions given below. Express your agreement or disagreement with the partner's opinion. Give reasons.

1. How long should my review be?
2. Can I write a critical review if I've only read the abstract?
3. How should I approach the reading? What should I read first?
4. Is it a good idea to think of questions I want to answer?
5. Do I need to take notes or can I just highlight the relevant bits of the text?

3. Read three recent posts from an online forum (A-C) below. Imagine you belong to the forum where these questions are asked. Which questions could you answer? Which answers could you guess? Read the posts again. For each post, say which sentence or sentences (1-3) in each one the writer uses to:

a) ask the question
b) say what the problem is
c) thank the reader

A. Subject: Filovirus Host Range?

(1) Does anybody know what the host range is for filoviruses (i.e. Ebola and Marburg)? (2) I know that they can infect most (all?) types of mammals and several species of birds, but I can't find the actual host range anywhere. (3) Any help here would be appreciated.

B. Subject: materials which x-rays can't pass through?

(1) I've been looking for a while now, but I can't find anything telling me what the radiopaque materials are. (2) In other words, which materials can't x-rays pass through? (3) Thanks in advance.

C. Subject: Quality of scientific writing considered in peer review?

(1) I was wondering how important the quality of the writing of a submitted paper is in the peer review process. (2) I don't mean the quality of the data, but the actual writing. (3) In other words, will a nicely written paper with the same data be more likely to be accepted?

4. How are the questions in the Subject field of each post different from normal questions? Think of a question related to your own research. Then

write a three-sentence post for an online forum in an appropriate style using the phrases below to help you.

• Does anybody know what ... is ... ?
• I know that.., but I can't find / don't know ...
• I was wondering how / what / why **...**
• I don't mean ... , but **...**
• In other words, ...
• Any help here would be appreciated.
• Thanks in advance.

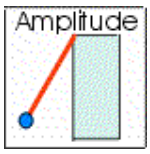
5. Read the beginning of the email sent to members of a laboratory. Then in pairs, answer the questions below.

Dear all,
Sooner or later, issues of Technology Transfer (sharing and using discoveries, inventions, materials, data etc.) will become important in your research career. Protecting your work from competitors and, where appropriate, making it attractive to the commercial sector will be important during your career as a professional scientist. What are the key issues that you must think about?

1. What is the purpose of the email?
2. What kind of discoveries, inventions, materials and data might you share with other scientists in your field?
3. What do you think are the key issues of technology transfer?

Glossary of Physics Terms

Absolute humidity (or Saturation value) The maximum amount of water vapor, which could be present in 1 m^3 of the air at any given temperature, is called absolute humidity.
Absolute magnitude A classification scheme, which compensates for the distance, differences to stars. It calculates the brightness that stars would appear to have if they were all at a defined, standard distance of 10 parsec
Absolute scale Temperature scale set so that zero is at the theoretical lowest temperature possible. This would occur when all random motion of molecules has ceased
Absolute zero The theoretical lowest temperature possible, which occurs when all random motion of molecules has ceased
Acceleration due to gravity The acceleration produced in a body due to the earth's attraction is called acceleration due to gravity. It is denoted by the letter g. Its SI unit is m/s^2. On the surface of the earth, its average value is $9.8 m/s^2$. The value of g on the surface of the earth increases in going towards the poles from the equator. The acceleration due to gravity of the earth decreases with altitude and with depth inside the earth. The value of g at the center of the earth is zero.
Acceleration The rate of change of velocity of a moving object is called its acceleration. The SI units of acceleration are m / s^2. By definition, this change in velocity can result from a change in speed, a change in direction, or a combination of changes in speed and direction
Adiabatic cooling The decrease in temperature of an expanding gas that involves no additional heat flowing out of the gas. It is the cooling from the energy lost by expansion
Adiabatic heating The increase in temperature of compressed gas that involves no additional heat flowing into the gas. It is heating from the energy gained by compression
Air mass A large, more or less uniform body of air with nearly the same temperature and moisture conditions throughout
Allotropic forms Elements that can have several different structures with different physical properties-for example, graphite and diamond are two allotropic forms of carbon
Alpha particle The nucleus of a helium atom (two protons and two neutrons) emitted as radiation from a decaying heavy nucleus; also known as an alpha ray
Alternating current An electric current that first moves one direction, then the opposite direction with a regular frequency
Amp Unit of electric current. It is equivalent to coulomb/sec.
Ampere Full name of the unit Amp
Amplitude (of waves) The maximum displacement of particles of the medium from their mean positions during the propagation of a wave is called the amplitude of the wave.
Amplitude (of an oscillation) The maximum displacement of a body from its mean position during an oscillatory motion is called the amplitude of oscillation.



Angle of incidence Angle of an incident (arriving) ray or particle to a surface; measured from a line perpendicular to the surface (the normal)

Angle of reflection Angle of a reflected ray or particle from a surface; measured from a line perpendicular to the surface (the normal)

Angular Acceleration The rate of change of angular velocity of a body moving along a circular path is called its angular acceleration. Angular acceleration is denoted by a.

Angular Displacement The angle described at the center of the circle by a moving body along a circular path is called angular displacement. It is measured in radians.

Angular Momentum Quantum Number From quantum mechanics model of the atom, one of four descriptions of the energy state of an electron wave. The quantum number describes the energy sublevels of electrons within the main energy levels of an atom.

Angular Velocity The rate of change of angular displacement is called angular velocity.

Astronomical unit The radius of the earth's orbit is defined as one astronomical unit (A.U.)

Atom The smallest unit of an element that can exist alone or in combination with other elements.

Atomic mass unit Relative mass unit (u) of an isotope based on the standard of the carbon-12 isotope, which is defined as a mass of exactly 12.00 u; one atomic mass unit (I u) is 1/12 the mass of a carbon-12 atom.

Atomic number The number of protons in the nucleus of an atom

Atomic Weight Weighted average of the masses of stable isotopes of an element as they occur in nature, based on the abundance of each isotope of the element and the atomic mass of the isotope compared to carbon-12

Avogadro's Number The number of carbon-12 atoms in exactly 12.00 g of C that is 6.02 x 10^23 atoms or other chemical units. It is the number of chemical units in one mole of a substance

Axis The imaginary line about which a planet or other object rotates

Background Radiation Ionizing radiation (alpha, beta, gamma, etc.) from natural sources

Balanced Forces When a number of forces act on a body, and the resultant force is zero, then the forces are said to be resultant forces.

Balmer series A set of four line spectra, narrow lines of color emitted by hydrogen atom electrons as they drop from excited states to the ground state

Barometer An instrument that measures atmospheric pressure, used in weather forecasting and in determining elevation above sea level

Beat Rhythmic increases and decreases of volume from constructive and destructive interference between two sound waves of slightly different frequencies
Beta particle High-energy electron emitted as ionizing radiation from a decaying nucleus; also known as a beta ray
Big bang theory Current model of galactic evolution in which the universe was created from an intense and brilliant explosion from a primeval fireball
Binding energy The energy required to break a nucleus into its constituent protons and neutrons; also the energy equivalent released when a nucleus is formed
Black hole The theoretical remaining core of a supernova that is so dense that even light cannot escape
Blackbody radiation Electromagnetic radiation emitted by an ideal material (the blackbody) that perfectly absorbs and perfectly emits radiation
Bohr model Model of the structure of the atom that attempted to correct the deficiencies of the solar system model and account for the Balmer series
Boiling point The temperature at which a phase change of liquid to gas takes place through boiling. It is the same temperature as the condensation point
Boundary The division between two regions of differing physical properties
British thermal unit The amount of energy or heat needed to increase the temperature of one pound of water one degree Fahrenheit (abbreviated Btu)
Cathode rays Negatively charged particles (electrons) that are emitted from a negative terminal in an evacuated glass tube
Celsius scale of temperature In the celsius scale of temperature, the ice-point is taken as taken as the lower fixed point (0 deg C) and the steam-point is taken as the upper fixed point (100 deg C). The interval between the ice point and steam point is divided into 100 equal divisions. Thus, the unit division on this scale is 1degC. This scale was earlier called the centigrade scale. 1 deg C = 9/5 deg F.
Centigrade Alternate name for the Celsius scale
Centrifugal force An apparent outward force on an object following a circular path that. This force is a consequence of the third law of motion
Centripetal force The force required to pull an object out of its natural straight-line path and into a circular path; centripetal means
Chain reaction A self-sustaining reaction where some of the products are able to produce more reactions of the same kind; in a nuclear chain reaction neutrons are the products that produce more nuclear reactions in a self-sustaining series
Circular Motion The motion of a body along a circular path is called circular motion.
Coefficient of cubical expansion The increase in volume of a substance per unit original volume per degree rise in temperature is called its coefficient of cubical xpansion. The SI unit of coefficient of cubical expansion is K-1.
Coefficient of linear expansion The increase in length per unit original length per degree rise in temperature is called the coefficient of linear expansion. The SI unit of the coefficient of linear expansion is K-1.

Compression A part of a longitudinal wave in which the density of the particles of the medium is higher than the normal density is called a compression.
Compressive stress A force that tends to compress the surface as the earth's plates move into each other
Condensation (sound) A compression of gas molecules; a pulse of increased density and pressure that moves through the air at the speed of sound
Condensation (water vapor) Where more vapor or gas molecules are returning to the liquid state than are evaporating
Condensation nuclei Tiny particles such as tiny dust, smoke, soot, and salt crystals that are suspended in the air on which water condenses condensation point the temperature at which a gas or vapor changes back to a liquid
Condensation point the temperature at which a gas or vapor changes back to a liquid
Conduction The transfer of heat from a region of higher temperature to a region of lower temperature by increased kinetic energy moving from molecule to molecule
Constructive interference The condition in which two waves arriving at the same place, at the same time and in phase, add amplitudes to create a new wave
Control rods Rods inserted between fuel rods in a nuclear reactor to absorb neutrons and thus control the rate of the nuclear chain reaction
Convection Transfer of heat from a region of higher temperature to a region of lower temperature by the displacement of high-energy molecules, for example, the displacement of warmer, less dense air (higher kinetic energy) by cooler, denser air (lower kinetic energy)
Conventional current Opposite to electron current-that is, considers an electric current to consist of a drift of positive charges that flow from the positive terminal to the negative terminal of a battery
Coulomb Unit used to measure quantity of electric charge; equivalent to the charge resulting from the transfer of 6.24 billion particles such as the electron
Coulomb's law Relationship between charge, distance, and magnitude of the electrical force between two bodies
Covalent bond A chemical bond formed by the sharing of a pair of electrons
Covalent compound Chemical compound held together by a covalent bond or bonds
Crest The point of maximum positive displacement on a transverse wave is called a crest.
Critical angle Limit to the angle of incidence when all light rays are reflected internally
Critical mass Mass of fissionable material needed to sustain a chain reaction
Curvilinear Motion The motion of a body along a curved path is called curvilinear motion.
Cycle A complete vibration
De-acceleration See retardation

Decibel scale A nonlinear scale of loudness based on the ratio of the intensity level of a sound to the intensity at the threshold of hearing
Destructive interference The condition in which two waves arriving at the same point at the same time out of phase add amplitudes to create zero total disturbance. (also see constructive interference
Dew point temperature The temperature at which condensation begins
Dew Condensation of water vapor into droplets of liquid on surfaces
Diffraction The bending of light around the edge of an opaque object
Diffuse reflection Light rays reflected in many random directions, as opposed to the parallel rays reflected from a perfectly smooth surface such as a mirror
Direct current An electrical current that always moves in one direction
Direct proportion When two variables increase or decrease together in the same ratio (at the same rate)
Dispersion The effect of spreading colors of light into a spectrum with a material that has an index of refraction that varies with wavelength
Displacement The change in the position of an object in a particular direction is called displacement. Displacement may also be defined as the shortest distance between the initial and final position of a moving body. It is a vector quantity.
Distance The actual length of the path traveled by a body irrespective of the direction is called the distance traveled. It is a scalar quantity.
Doppler effect An apparent shift in the frequency of sound or light due to relative motion between the source of the sound or light and the observer
Echo A reflected sound that can be distinguished from the original sound, which usually arrives 0.1 sec or more after the original sound
Elastic strain An adjustment to stress in which materials recover their original shape after a stress is released
Electric circuit Consists of a voltage source that maintains an electrical potential, a continuous conducting path for a current to follow, and a device where work is done by the electrical potential; a switch in the circuit is used to complete or interrupt the conducting path
Electric current The flow of electric charge electric field force field produced by an electrical charge
Electric field lines A map of an electric field representing the direction of the force that a test charge would experience; the direction of an electric field shown by lines of force
Electric generator A mechanical device that uses wire loops rotating in a magnetic field to produce electromagnetic induction in order to generate electricity
Electric potential energy Potential energy due to the position of a charge near other charges
Electrical conductors Materials that have electrons that are free to move throughout the material; for example, metals
Electrical energy A form of energy from electromagnetic interactions; one of five forms of energy-mechanical, chemical, radiant, electrical, and nuclear

Electrical force A fundamental force that results from the interaction of electrical charge and is billions and billions of times stronger than the gravitational force; sometimes called the
Electrical insulators Electrical nonconductors, or materials that obstruct the flow of electric current
Electrical nonconductors Materials that have electrons that are not moved easily within the material, for example, rubber; electrical nonconductors are also called electrical insulators
Electrical resistance The property of opposing or reducing electric current
Electrolyte Water solution of ionic substances that conducts an electric current
Electromagnet A magnet formed by a solenoid that can be turned on and off by turning the current on and off
Electromagnetic force One of four fundamental forces; the force of attraction or repulsion between two charged particles
Electromagnetic induction Process in which current is induced by moving a loop of wire in a magnetic field or by changing the magnetic field
Electromagnetic waves The waves which are due to oscillating electrical and magnetic fields and do not need any material medium for their propagation are called electromagnetic waves. These waves can, however, travel through material medium also. Light waves, radio waves are examples of electromagnetic waves. All electromagnetic waves travel in vacuum with a speed of 3×10 8 m/s.
Electron configuration The arrangement of electrons in orbits and sub-orbits about the nucleus of an atom
Electron current Opposite to conventional current; that is, considers electric current to consist of a drift of negative charges that flows from the negative terminal to the positive terminal of a battery
Electron pair A pair of electrons with different spin quantum numbers that may occupy an orbital
Electron volt The energy gained by an electron moving across a potential difference of one volt; equivalent to 1.60 x 10^-19 Joules
Electron Subatomic particle that has the smallest negative charge possible and usually found in an orbital of an atom, but gained or lost when atoms become ions
Electronegativity The comparative ability of atoms of an element to attract bonding electrons
Electrostatic charge An accumulated electric charge on an object from a surplus or deficiency of electrons; also called
Element A pure chemical substance that cannot be broken down into anything simpler by chemical or physical means; there are over 100 known elements, the fundamental materials of which all matter is made
Energy The capacity of a body to do work is called its energy. Energy is a scalar quantity. The SI unit of energy is Joule.

Escape Velocity The minimum velocity with which an object must be thrown upwards so as to overcome the gravitational pull and escape into space, is called escape velocity (V esc). The escape velocity depends upon the mass and radius of the planet/star. It does not depend upon the mass of the body thrown up. The escape velocity of earth is given by.

Evaporation Process of more molecules leaving a liquid for the gaseous state than returning from the gas to the liquid. It can occur at any given temperature from the surface of a liquid. Evaporation takes place only from the surface of the liquid. Evaporation causes cooling. Evaporation is faster if the surface of the liquid is large, the temperature is higher and the surrounding atmosphere does not contain a large amount of vapor of the liquid.

Fahrenheit scale of temperature On the Fahrenheit scale, the ice point, the ice point (lower fixed point) is taken as 32? F and the steam point (upper fixed point) is taken as 212 deg F. The interval between these two points is divided into 180 equal divisions. Thus, unit division on the Fahrenheit scale is 1deg F. The temperatures on the Celsius scale and the Fahrenheit scale are related by the relationship, C/100 = (F - 32) / 180. The temperature of a normal healthy person is 37 deg C or 98.6 deg F.

First law of motion Every object remains at rest or in a state of uniform straight-line motion unless acted on by an unbalanced force

Fluids Matter that has the ability to flow or be poured; the individual molecules of a fluid are able to move, rolling over or by one another

Force Force is a push or pull which tends to change the state of rest or of uniform motion , the direction of motion, or the shape and size of a body. Force is a vector quantity. The SI unit of force is Newton, denoted by N. One N is the force which when acts on a body of mass 1 kg produces an acceleration of 1 m/s^2.

Force of gravitation The force with which two objects attract each other by virtue of their masses is called the force of gravitation. The force of attraction acts even if the two objects are not connected to each other. It is an action-at-a-distance force.

Fracture strain An adjustment to stress in which materials crack or break as a result of the stress

Free fall The motion of a body towards the earth when no other force except the force of gravity acts on it is called free fall. All freely falling bodies are weightless.

Freezing point The temperature at which a phase change of liquid to solid takes place; the same temperature as the melting point for a given substance

Frequency (of waves) The number of waves produced per second is called its frequency.

Frequency (of oscillations) The number of oscillations made by an oscillating body per second is called the frequency.

Friction The force that resists the motion of one surface relative to another with which it is in contact. The cause of friction is that surfaces, however smooth

they may look to the eye, on the microscopic scale have many humps and crests. Thus the actual area of contact is very small indeed, and the consequent very high pressure leads to local pressure welding of the surface. In motion the welds are broken and remade continually.
Fuel rod Long zirconium alloy tubes containing fissionable material for use in a nuclear reactor
Fundamental charge Smallest common charge known; the magnitude of the charge of an electron and a proton, which is 1.60 x 10^-19 coulomb
Fundamental frequency The lowest frequency (longest wavelength) that can set up standing waves in an air column or on a string
Fundamental properties A property that cannot be defined in simpler terms other than to describe how it is measured; the fundamental properties are length, mass, time, and charge
g Symbol representing the acceleration of an object in free fall due to the force of gravity; its magnitude is 9.80 m/sec^2 (32.0 ft/sec^2)
Gamma ray Very short wavelength electromagnetic radiation emitted by decaying nuclei
Gases A phase of matter composed of molecules that are relatively far apart moving freely in a constant, random motion and have weak cohesive forces acting between them, resulting in the characteristic indefinite shape and indefinite volume of a gas
Gram-atomic weight The mass in grams of one mole of an element that is numerically equal to its atomic weight
Gram-formula weight The mass in grams of one mole of a compound that is numerically equal to its formula weight
Gram-molecular weight The gram-formula weight of a molecular compound
Gravitational constant G The constant G which appears in the equation for Newton's law of gravitation is called the universal constant of gravitation or the gravitational constant. Numerically it is equal to the force of gravitation, which acts between two bodies of mass 1kg each separated by a distance of 1m. The value of G is 6.67×10-11 Nm²/kg².
Gravitational potential energy = mgh
Greenhouse effect The process of increasing the temperature of the lower parts of the atmosphere through redirecting energy back toward the surface; the absorption and reemission of infrared radiation by carbon dioxide, water vapor, and a few other gases in the atmosphere
Ground state Energy state of an atom with electrons at the lowest energy state possible for that atom
Half-life The time required for one-half of the unstable nuclei in a radioactive substance to decay into a new element
Heat Heat is a form of energy, which makes a body hot or cold. Heat is measured by the temperature-effect it produces in any material body. The SI unit of heat is Joule(J).

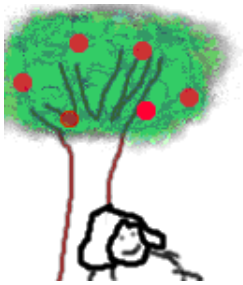
Heisenberg uncertainty principle You cannot measure both the exact momentum and the exact position of a subatomic particle at the same time-when the more exact of the two is known, the less certain you are of the value of the other
Hertz Unit of frequency; equivalent to one cycle per second
Horsepower Measurement of power defined as a power rating of 550 ft-lb/sec
Hypothesis A tentative explanation of a phenomenon that is compatible with the data and provides a framework for understanding and describing that phenomenon
Impulse The impulse acting on a body is equal to the product of the force acting on the body and the time for which it acts. If the force is variable, the impulse is the integral of Fdt from t0 to t1. The impulse of a force acting for a given time interval is equal to change in momentum produced over that interval. J=m(v-u), assuming that the mass m remains constant while the velocity changes from v to u. The SI units of impulse are kg m/s.
Impulsive force The force which acts on a body for a very short time but produces a large change in the momentum of the body is called an impulsive force.
Incandescent Matter emitting visible light as a result of high temperature for example, a light bulb, a flame from any burning source, and the sun are all incandescent sources because of high temperature
Incident ray Line representing the direction of motion of incoming light approaching a boundary
Index of refraction The ratio of the speed of light in a vacuum to the speed of light in a material
Inertia The property of matter that causes it to resist any change in its state of rest or of uniform motion. There are three kinds of inertia- inertia of rest, inertia of motion and inertia of direction. The mass of a body is a measure of its inertia.
Infrasonic Sound waves having too low a frequency to be heard by the human ear; sound having a frequency of less than 20 Hz
Insulators Materials that are poor conductors of heat-for example, heat flows slowly through materials with air pockets because the molecules making up air are far apart; also, materials that are poor conductors of electricity, for example, glass or wood
Intensity A measure of the energy carried by a wave
Interference Phenomenon of light where the relative phase difference between two light waves produces light or dark spots, a result of light's wavelike nature
Intermolecular forces Forces of interaction between molecules
Internal energy Sum of all the potential energy and all the kinetic energy of all the molecules of an object
Inverse proportion The relationship in which the value of one variable increases while the value of the second variable decreases at the same rate (in the same ratio)
Ionization Process of forming ions from molecules

Ionized An atom or a particle that has a net charge because it has gained or lost electrons
Isostasy A balance or equilibrium between adjacent blocks of crust
Isotope Atoms of an element with identical chemical properties but with different masses; isotopes are atoms of the same element with different numbers of neutrons
Joule Metric unit used to measure work and energy; can also be used to measure heat; equivalent to newton-meter
Kelvin scale of temperature On this scale, the ice-point (the lower fixed point) is taken as 273.15K and the (the upper fixed point) is taken as 373.15K. The interval between these two points is divided into 100 equal parts. Each division is equal to 1K.
Kepler's first law Relationship in planetary motion that each planet moves in an elliptical orbit, with the sun located at one focus
Kepler's laws of planetary motion The three laws describing the motion of the planets
Kepler's second law Relationship in planetary motion that an imaginary line between the sun and a planet moves over equal areas of the ellipse during equal time intervals
Kepler's third law Relationship in planetary motion that the square of the period of an orbit is directly proportional to the cube of the radius of the major axis of the orbit
Kilocalorie The amount of energy required to increase the temperature of one kilogram of water one degree Celsius: equivalent to 1,000 calories
Kilogram The fundamental unit of mass in the metric system of measurement
Kinetic Energy Energy possessed by a body by the virtue of its motion is called kinetic energy. Kinetic energy = $1/2\ m\ v^2$
Latent heat of evaporization The heat absorbed when one gram of a substance changes from the liquid phase to the gaseous phase, or the heat released when one gram of gas changes from the gaseous phase to the liquid phase
Latent heat of fusion The quantity of heat required to convert one unit mass of a substance from solid to the liquid state at its melting point (without any change in its temperature) is called its latent heat of fusion (L). The SI unit of latent heat of fusion is J kg-1.
Latent heat Refers to the heat hidden in phase changes
Law of Conservation of Energy The change of one form of energy into another is called transformation of energy. For example, when a body falls its potential energy is converted to kinetic energy.
Law of conservation of mass Same as law of conservation of matter; mass, including single atoms, is neither created nor destroyed in a chemical reaction
Law of conservation of matter Matter is neither created nor destroyed in a chemical reaction
Law of conservation of momentum The total momentum of a group of interacting objects remains constant in the absence of external forces

Light-year The distance that light travels through empty space in one year, approximately 9.5 x 10^11 km
Line spectrum Narrow lines of color in an otherwise dark spectrum; these lines can be used as
Lines of force Lines drawn to make an electric field strength map, with each line originating on a positive charge and ending on a negative charge; each line represents a path on which a charge would experience a constant force and lines closer together mean a stronger electric field
Liquids A phase of matter composed of molecules that have interactions stronger than those found in a gas but not strong enough to keep the molecules near the equilibrium positions of a solid, resulting in the characteristic definite volume but indefinite shape of a liquid
Liter A metric system unit of volume, usually used for liquids
Longitudinal waves The wave in which the particles of the medium oscillate along the direction along the direction of propagation of wave is called the longitudinal wave. Sound waves are longitudinal waves.
Loudness A subjective interpretation of a sound that is related to the energy of the vibrating source, related to the condition of the transmitting medium, and related to the distance involved
Luminosity The total amount of energy radiated into space each second from the surface of a star
Luminous An object or objects that produce visible light; for example, the sun, stars, light bulbs, and burning materials are all luminous
Magnetic domain Tiny physical regions in permanent magnets, approximately 0.01 to 1 mm, that have magnetically aligned atoms, giving the domain an overall polarity
Magnetic field Model used to describe how magnetic forces on moving charges act at a distance
Magnetic poles The ends, or sides, of a magnet about which the force of magnetic attraction seems to be concentrated
Magnetic quantum number From quantum mechanics model of the atom, one of four descriptions of the energy state of an electron wave; this quantum number describes the energy of an electron orbital as the orbital is oriented in space by an external magnetic field, a kind of energy sub-sublevel
Magnetic reversal The flipping of polarity of the earth's magnetic field as the north magnetic pole and the south magnetic pole exchange positions
Magnitude The size of a measurement of a vector; scalar quantities that consist of a number and unit only, no direction, for example
Mass defect The difference between the sum of the masses of the individual nucleons forming a nucleus and the actual mass of that nucleus
Mass number The sum of the number of protons and neutrons in a nucleus defines the mass number of an atom; used to identify isotopes; for example, Uranium 238

Mass The quantity of matter contained in a body is called its mass. The SI unit of mass is kg. The mass of a body remains the same everywhere. It is a measure of inertia, which means a resistance to a change of motion
Matter Anything that occupies space and has mass
Mechanical energy The form of energy associated with machines, objects in motion, and objects having potential energy that results from gravity
Mechanical wave The waves, which need a material medium for their propagation, are called mechanical waves. Mechanical waves are also called elastic waves. Sound waves, water waves are examples of mechanical waves.
Melting point The temperature at which a phase change of solid to liquid takes place; the same temperature as the freezing point for a given substance
Metal Matter having the physical properties of conductivity, malleability, ductility, and luster
Meter The fundamental metric unit of length
Millibar A measure of atmospheric pressure equivalent to 1.000 dynes per cm ^2
Miscible fluids Fluids that can mix in any proportion
Mixture Matter made of unlike parts that have a variable composition and can be separated into their component parts by physical means
Model A mental or physical representation of something that cannot be observed directly that is usually used as an aid to understanding
Mole An amount of a substance that contains Avogadro's number of atoms, ions, molecules, or any other chemical unit; a mole is thus 6.02 x 10^23 atoms, ions, or other chemical units
Momentum Momentum is considered to be a measure of the quantity of motion in a body. The momentum of a body is defined as the product of its mass and velocity. Its SI units are kg m /s.
Natural frequency The frequency of vibration of an elastic object that depends on the size, composition, and shape of the object
Negative electric charge One of the two types of electric charge; repels other negative charges and attracts positive charges
Negative ion Atom or particle that has a surplus, or imbalance, of electrons and, thus, a negative charge
Net force The resulting force after all vector forces have been added; if a net force is zero, all the forces have canceled each other and there is not an unbalanced force
Newton A unit of force defined as kg.m/sec^2; that is, a 1 Newton force is needed to accelerate a 1 kg mass 1 m/sec^2
Newton's first law of motion A body continues in a state of rest or of uniform motion in a straight line unless it is acted upon by an external (unbalanced) force.
Newton's law of gravitation The gravitational force of attraction acting between any two particles is directly proportional to the product of their masses, and inversely proportional to the square of the distance between them. The force of attraction acts along the line joining the two particles. Real bodies having

spherical symmetry act as point masses with their mass assumed to be concentrated at their center of mass.



Newton's second law of motion The rate of change of momentum is equal to the force applied OR the force acting on a body is directly proportional to the product of its mass and acceleration produced by the force in the body.
Newton's third law of motion To every action there is an equal and opposite reaction. The action and reaction act on two different bodies simultaneously.
Noise Sounds made up of groups of waves of random frequency and intensity
Non Uniform Acceleration When the velocity of a body increases by unequal amounts in equal intervals of time, it is said to have non-uniform acceleration.
Non Uniform Speed When a body travels unequal distances in equal intervals of time then it is said to have non-uniform speed.
Non Uniform Velocity When a body covers unequal distances in equal intervals of time in a particular direction, or when it covers equal distances in equal intervals but changes it's direction it is said to have non uniform velocity.
Normal A line perpendicular to the surface of a boundary
Nuclear energy The form of energy from reactions involving the nucleus, the innermost part of an atom
Nuclear fission Nuclear reaction of splitting a massive nucleus into more stable, less massive nuclei with an accompanying release of energy
Nuclear force One of four fundamental forces, a strong force of attraction that operates over very short distances between subatomic particles; this force overcomes the electric repulsion of protons in a nucleus and binds the nucleus together
Nuclear fusion Nuclear reaction of low mass nuclei fusing together to form more stable and more massive nuclei with an accompanying release of energy
Nuclear reactor Steel vessel in which a controlled chain reaction of fissionable materials releases energy
Nucleons Name used to refer to both the protons and neutrons in the nucleus of an atom
Nucleus Tiny, relatively massive and positively charged center of an atom containing protons and neutrons; the small, dense center of an atom numerical constant a constant without units; a number
Ohm Unit of resistance; equivalent to volts/amps
Ohm's law The electric potential difference is directly proportional to the product of the current times the resistance
Orbital The region of space around the nucleus of an atom where an electron is likely to be found

Origin The only point on a graph where both the x and y variables have a value of zero at the same time
Oscillatory motion The to and fro motion of a body about its mean position is called oscillatory motion. Oscillatory motion is also called vibratory motion. Oscillatory motion is periodic in nature.
Pauli exclusion principle No two electrons in an atom can have the same four quantum numbers; thus, a maximum of two electrons can occupy a given orbital
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Period (wave) The time required for one complete cycle of a wave
Periodic wave A wave in which the particles of the medium oscillate continuously about their mean positions regularly at fixed intervals of time is called a periodic wave.
Permeability The ability to transmit fluids through openings, small passageways, or gaps
Phase change The action of a substance changing from one state of matter to another; a phase change always absorbs or releases internal potential energy that is not associated with a temperature change
Phase The particles in a wave, which are in the same state of vibration, i.e. the same position and the same direction of motion are said to be in the same phase.
Phases of matter The different physical forms that matter can take as a result of different molecular arrangements, resulting in characteristics of the common phases of a solid, liquid, or gas
Photoelectric effect The movement of electrons in some materials as a result of energy acquired from absorbed light
Photons A quanta of energy in light wave; the particle associated with light
Physical change A change of the state of a substance but not the identity of the substance pitch the frequency of a sound wave
Planck's constant Proportionality constant in the relationship between the energy of vibrating molecules and their frequency of vibration; a value of 6.63 x 10^-34 joule-sec
Plasma A phase of matter; a very hot gas consisting of electrons and atoms that have been stripped of their electrons because of high kinetic energies
Plastic strain An adjustment to stress in which materials become molded or bent out of shape under stress and do not return to their original shape after the stress is released
Polaroid A film that transmits only polarized light

Positive electric charge One of the two types of electric charge; repels other positive charges and attracts negative charges
Positive ion Atom or particle that has a net positive charge due to an electron or electrons being torn away
Potential Energy Energy possessed by a body by the virtue of its position or configuration is called potential energy. There are two types of potential energies, gravitational and elastic. The potential energy of a body by virtue of its height from the ground is called its gravitational potential energy. The potential energy of a body by virtue of its configuration (shape) is called its elastic potential energy.
Power The rate of doing work is called power. Power is a scalar quantity. The SI unit of power is Watt (1 W = 1 J/sec)
Pressure Defined as force per unit area; for example, pounds per square inch (lb/in^2)
Primary coil Part of a transformer; a coil of wire that is connected to a source of alternating current
Principle of calorimetry If no heat is lost to the surroundings and there is no change of state also, then,
Principle quantum number From quantum mechanics model of the atom, one of four descriptions of the energy state of an electron wave; this quantum number describes the main energy level of an electron in terms of its most probable distance from the nucleus
Projectile An object thrown into space either horizontally or at an acute angle and under the action of gravity is called a projectile. The path followed by a projectile is called its trajectory. The horizontal distance traveled by a projectile is called its range. The time taken by a projectile from the moment it is thrown until it touches the ground is called its time of flight.
Proof A measure of ethanol concentration of an alcoholic beverage; proof is double the concentration by volume; for example, 50 percent by volume is 100 proof.
Properties Qualities or attributes that, taken together, are usually unique to an object; for example, color, texture, and size
Proportionality constant A constant applied to a proportionality statement that transforms the statement into an equation
Pulse A wave of short duration confined to a small portion of the medium at any given time is called a pulse. A pulse is also called a wave pulse.
Quanta Fixed amounts; usually referring to fixed amounts of energy absorbed or emitted by matter
Quantum mechanics Model of the atom based on the wave nature of subatomic particles, the mechanics of electron waves; also called wave mechanics
Quantum numbers Numbers that describe energy states of an electron; in the Bohr model of the atom, the orbit quantum numbers could be any whole number 1, 2, 3, and so on out from the nucleus; in the quantum mechanics model of the

atom, four quantum numbers are used to describe the energy state of an electron wave
Rad A measure of radiation received by a material (radiation absorbed dose)
Radiant energy The form of energy that can travel through space; for example, visible light and other parts of the electromagnetic spectrum
Radiation The transfer of heat from a region of higher temperature to a region of lower temperature by greater emission of radiant energy from the region of higher temperature
Radioactive decay constant A specific constant for a particular isotope that is the ratio of the rate of nuclear disintegration per unit of time to the total number of radioactive nuclei
Radioactive decay series Series of decay reactions that begins with one radioactive nucleus that decays to a second nucleus that decays to a third nucleus and so on until a stable nucleus is reached
Radioactive decay The natural spontaneous disintegration or decomposition of a nucleus
Radioactivity Spontaneous emission of particles or energy from an atomic nucleus as it disintegrates
Rarefaction A part of a longitudinal wave in which the density of the particles of the medium is less than the normal density is called a rarefaction.
Real image An image generated by a lens or mirror that can be projected onto a screen
Rectilinear Motion The motion of a body in a straight line is called rectilinear motion.
Reflected ray A line representing direction of motion of light reflected from a boundary
Reflection The change when light, sound, or other waves bounce backwards off a boundary
Refraction A change in the direction of travel of light, sound, or other waves crossing a boundary
Relative humidity = (m/ms) x 100 where m is the actual mass of water vapor present in certain volume of the air and ms is the mass of water vapor required to saturate the same volume of the air at the same temperature.
Relative humidity The percentage of the amount of water vapor actually present in a certain volume of the air to the amount of water vapor needed to saturate it is called the relative humidity of the air.
Resonance When the frequency of an external force matches the natural frequency and standing waves are set up
Restoring force The force which tends to bring an oscillating body towards its mean position whenever it is displaced from the mean position is called the restoring force.
Resultant Force A single force, which acts on a body to produce the same effect in it as, done by all other forces collectively, is called the resultant force.

Retardation Negative acceleration is called retardation. In retardation the velocity of a body decreases with time.
Reverberation Apparent increase in volume caused by reflections, usually arriving within 0.1 second after the original sound
Saturated air Air in which equilibrium exists between evaporation and condensation; the relative humidity is 100 percent
Saturated solution The apparent limit to dissolving a given solid in a specified amount of water at a given temperature; a state of equilibrium that exists between dissolving solute and solute coming out of solution
Scalar Quantity A physical quantity, which is described completely by its magnitude, is called a scalar quantity.
Scientific law A relationship between quantities, usually described by an equation in the physical sciences; is more important and describes a wider range of phenomena than a scientific principle
Scientific principle A relationship between quantities concerned with a specific, or narrow range of observations and behavior
Second law of motion The acceleration of an object is directly proportional to the net force acting on that object and inversely proportional to the mass of the object
Second The standard unit of time in both the metric and English systems of measurement
Secondary coil Part of a transformer, a coil of wire in which the voltage of the original alternating current in the primary coil is stepped up or down by way of electromagnetic induction
Second's Pendulum A simple pendulum whose time period on the surface of earth is 2 seconds is called the second's pendulum.
Semiconductors Elements that have properties between those of a metal and those of a nonmetal sometimes conducting an electric current and sometimes acting like an electrical insulator depending on the conditions and their purity; also called metalloids
Shear stress Produced when two plates slide past one another or by one plate sliding past another plate that is not moving
Simple harmonic motion The vibratory motion that occurs when there is a restoring force opposite to and proportional to a displacement
Simple Pendulum A heavy point mass (actually a small metallic ball), suspended by a light inextensible string from a frictionless rigid support is called a simple pendulum. A simple pendulum is a simple machine based on the effect of gravity.
Solenoid A cylindrical coil of wire that becomes electromagnetic when a current runs through it
Solids A phase of matter with molecules that remain close to fixed equilibrium positions due to strong interactions between the molecules, resulting in the characteristic definite shape and definite volume of a solid

Sonic boom Sound waves that pile up into a shock wave when a source is traveling at or faster than the speed of sound
Specific heat Each substance has its own specific heat, which is defined as the amount of energy (or heat) needed to increase the temperature of one gram of a substance one degree Celsius
Speed The distance traveled by a body in one unit of time is called its speed. If a body covers distance s in time t then it's speed is given by s / t. It is a scalar quantity and it's SI unit's are m/s.
Spin quantum number From quantum mechanics model of the atom, one of four descriptions of the energy state of an electron wave; this quantum number describes the spin orientation of an electron relative to an external magnetic field
Standing waves Condition where two waves of equal frequency traveling in opposite directions meet and form stationary regions of maximum displacement due to constructive interference and stationary regions of zero displacement due to destructive interference
State of Motion When a body changes its position with respect to a fixed point in its surroundings then it is said to be in a state of motion. The states of rest and motion are relative to the frame of reference.
State of Rest When a body does not change its position with respect to a fixed point in its surrounding, then it is said to be in a state of rest. The states of rest and motion are relative to the frame of reference.
Steam-point It is the temperature of steam over pure boiling water under 1 atm pressure. The steam point is taken as the upper fixed point (100 deg C or 212 deg F) for temperature scales.
Superconductors Some materials in which, under certain conditions, the electrical resistance approaches zero
Super-cooled Water in the liquid phase when the temperature is below the freezing point
Supersaturated Containing more than the normal saturation amount of a solute at a given temperature
Temperature It is a numerical measure of hotness or coldness of a body. According to the molecular model, it is a measure of the average kinetic energy of the molecules of the body. Heat flows from a body at higher temperature to a body at lower temperature.
Tensional stress The opposite of compressional stress; occurs when one part of a plate moves away from another part that does not move
Thermal Capacity The quantity of heat required to raise the temperature of the whole body by one degree (1K or 1deg C) is called its thermal capacity.
Thermal Equilibrium When the two bodies in contact are at the same temperature and there is no flow of heat between them, these are said to be in thermal equilibrium. The common temperature of the bodies in thermal equilibrium is called the equilibrium temperature.
Thermal Expansion The increase in the size of an object on heating is called thermal expansion.

Thermometer It is a device used for numerical measurement of temperature. The commonly used thermometer is mercury thermometer.
Third law of motion Whenever two objects interact, the force exerted on one object is equal in size and opposite in direction to the force exerted on the other object; forces always occur in matched pairs that are equal and opposite
Time Period (of a wave) The time taken by a wave to travel through a distance equal to its wavelength is called its time period. It is denoted by T. Time period of a wave=1/frequency of the wave.
Time Period (of an oscillation) The time taken to complete one oscillation is called the time period of an oscillation. The time period of a pendulum does not depend upon the mass of the bob and amplitude of oscillation. The time period of a pendulum is directly proportional to the square root of the length and inversely proportional to the square root of the acceleration due to gravity.
Total internal reflection Condition where all light is reflected back from a boundary between materials; occurs when light arrives at a boundary at the critical angle or beyond
Transverse waves A wave in which the particles of the medium oscillate in a direction perpendicular of the direction of propagation of wave is called the transverse wave. Water waves, light waves and radio waves are examples of transverse waves.
Trough The point of maximum negative displacement on a transverse wave is called a trough.
Ultrasonic Sound waves too high in frequency to be heard by the human ear; frequencies above 20,000Hz
Unbalanced forces When a number of forces act on a body and the resultant force is not zero, then the forces are said to be unbalanced.
Uniform Acceleration When the velocity of a body increases by equal amounts in equal intervals of time it is said to have uniform acceleration.
Uniform Circular Motion The motion of an object in a circular path with uniform speed is called uniform circular motion. Uniform circular motion is accelerated motion.
Uniform Speed When a body travels equal distances in equal intervals of time then it is said to have uniform speed.
Uniform Velocity When a body travels along a straight line in particular direction and covers equal distances in equal intervals of time it is said to have uniform velocity.
Universal law of gravitation Every object in the universe is attracted to every other object with a force directly proportional to the product of their masses and inversely proportional to the square of the distance between the centers of the two masses
Unpolarized light Light consisting of transverse waves vibrating in all conceivable random directions
Van der Wall's force General term for weak attractive intermolecular forces
Vapor The gaseous state of a substance that is normally in the liquid state

Vector Quantity A quantity, which needs both magnitude and direction to describe it, is called a vector quantity. Such a physical quantity should also follow the vector law of addition.
Velocity Distance traveled by a body in a particular direction per unit time is called its velocity. It can also be defined as the displacement of the body per unit time. It is a vector quantity. The SI units of velocity are m / s.
Vibration A back and forth motion that repeats itself
Virtual image An image where light rays appear to originate from a mirror or lens; this image cannot be projected on a screen
Volt Unit of potential difference equivalent to joules/coulomb
Voltage drop The electric potential difference across a resistor or other part of a circuit that consumes power
Watt Metric unit for power; equivalent to joule/sec
Wave mechanics Alternate name for quantum mechanics derived from the wavelike properties of subatomic particles
Wave motion The movement of a disturbance produced in one part of a medium to another involving the transfer of energy but not the transfer of matter is called wave motion.
Wave period The time required for two successive crests or other successive parts of the wave to pass a given point
Wave velocity The distance traveled by a wave in one second is called the wave velocity. The wave velocity of a wave depends upon the nature of the medium through which it passes.
Wave (mechanical) A periodic disturbance produced in a material medium due to the vibratory motion of the particles of the medium is called a wave.
Wave A disturbance or oscillation that moves through a medium
Wavelength The distance between the two nearest points on a wave, which are in the same phase, is called the wavelength of the wave. The distance between two adjacent crests or two adjacent troughs is called its wavelength.
Weight The force with which a body is attracted towards the center of the earth is called its weight. The SI unit of weight is N. The gravitational units of weight are kg-wt and g-wt. The weight of a body of mass m is given by mg. Its value will depend upon the value of g at that place. The weight of a body is measured with a spring balance.
Weightlessness The state when the apparent weight of a body becomes zero is called the state of weightlessness. All objects while falling freely under the action of gravity appear weightless.
Work = Force x Displacement in the direction of the force
Work Work is done when a force acting on a body displaces it. Work is a scalar quantity. The SI unit for work is Joule.

Adapted from: http://www.tutor4physics.com/glossary.htm
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Academic English Glossary

Academic Advisor	A counselor or instructional faculty member who helps you select your classes and helps you identify your career and/or transfer interests
Academic Calendar	A list of important dates. Included are vacation breaks, registration periods, and deadlines for certain forms.
Academic Honors	Term general used to denote distinction in coursework, usually with students receiving an A grade in most or all of their courses. Every school is different, but many schools distinguish Honors Lists, Deans Lists, or Presidents Lists depending on the GPA for any one term/semester. Academic Honors may also refer to Latin Honors.
Academic Misconduct	Generally, any prohibited or dishonest means to receive credit or a higher grade, such as cheating or plagiarism.
Academic Probation	A student whose GPA falls below a designated number can be placed on academic probation. If the GPA does not improve, then the student may be prohibited from registering for classes for a designated number of semesters.
Academic Year	Annual period during which a student attends and receives formal instruction at a college or university, typically from August or September to May or June. The academic year may be divided into semesters, trimesters, quarters, or other calendars.
Accelerated Program	Completion of a college program of study in fewer than the usual number of years, most often by attending summer sessions and carrying extra courses during the regular academic term.
Accreditation	A process by which an institution or program is determined to have met an acceptable level of quality.
Accuplacer	The testing tool used to assess new students' reading, English and math skills. Results of the Accuplacer test help counselors and academic advisors recommend appropriate course placements.
Add	To register for a course. A college or university typically has a period of time at the beginning of a term during which students

	can add or drop courses.
Adjunct Faculty	An instructor who is not employed full-time with the college. An adjunct instructors usually teach one or two courses at the college.
Admission	The process of becoming officially recognized as a student. Once admitted to a particular institution, you do not have to go through this process again unless you stop out from this institution for an extended period of time.
Advising	Shorthand for "academic advising" — assistance with the process of planning what courses need to be taken in what sequence in order to reach your academic goal. In the early stages of your college career, while still formulating your goals, some advising might be provided by counselors. Once you have selected a curriculum, advising will become a part of your interaction with the full-time faculty in the related department.
Alumni / Alumnae	Persons who have graduated from the institution.
Articulation Agreement	An agreement between institutions that provides assurance of smooth transfer of credit from one to the other, at least in selected programs of study. Cape Fear Community College has formal articulation agreements with University of North Carolina system institutions.
Assistantship	A financial aid award granted to a graduate student to help pay for tuition that is offered in return for certain services, such as serving as a teaching assistant or research assistant.
Associate's Degree	An award that is generally earned after completing at least two years but less than four years of full time equivalent, required college coursework.
Audit	A way to register (and pay) for a "credit" course without receiving a letter grade on your transcript. Used for several reasons: among the most common being to review material for which you already have a passing grade on your record, or for courses taken purely out of personal interest which are not required in your chosen curriculum.
B	
Baccalaureate	May refer to the Bachelor's Degree, or students pursuing their

	Bachelor's degree. May also refer to a farewell service preceding a graduation or commencement.
Bachelor's Degree	An award (baccalaureate or equivalent degree, as determined by the Secretary of the US Department of Education) that normally requires at least four years but not more than five years of full-time equivalent college-level coursework.
Blackboard	An online web-based tool used to deliver courses, course materials, and interact with other students.
Board of Trustees	A governing board over the college. (Other Common Names include Board of Regents, Board of Directors, Board of Governors, Board of Visitors)

C

Campus	The grounds and buildings where a college or university is located.
Career Program	A curriculum designed primarily for direct entry into the workplace upon completion, although some do also provide alternatives for extension into a 4-year degree. Examples: Advertising Art, Landscape Technology.
Catalog	A book containing academic information about the college or university, including degree requirements, curriculum outlines, and college policies. Students are typically held accountable to the catalog published in the year they were admitted to the school.
Certificate	A record of successful completion of a shorter program of study (generally 12-38 credits), typically with application to skills needed for immediate entry into the workplace.
Chancellor	A leader of a college or university, usually either the executive or ceremonial head of the university or of a university campus. In most US schools, the chief executive officer is called the President, while the second in command is the Provost. Some multi-campus schools, such as a University system will be headed by a Chancellor who has authority over the whole system.
Closed Class / Closed Section	A course for which the maximum number of students is already enrolled. A student cannot enroll in such a class unless someone drops and a seat becomes available.

Co-ed	Open to both men and women (often used to describe a school that admits both sexes and a dormitory that houses both genders).
College	A postsecondary institution that typically provides only an undergraduate education, but in some cases, also graduate degrees. “College” is often used interchangeably with “university” and “school.” Separately, “college” can refer to an academic division of a university, such as College of Business.
Commencement	A graduation ceremony where students officially receive their degrees, typically held in May or June at the end of the academic year, though some colleges and universities also hold August and December ceremonies.
Common Application	A standard application form that is accepted by more than 450 member colleges and universities for admissions. Students can complete the form online or in print and submit copies to any of the participating colleges, rather than filling out individual forms for each school.
Community College	A public, two-year postsecondary institution that offers the associate degree. Also known as a “junior college.” Community colleges typically provide a transfer program, allowing students to transfer to a four-year school to complete their bachelor’s degree, and a career program, which provides students with a vocational degree.
Concurrent Enrollment	May refer to students who are registered in more than one academic program at a time. Sometimes the term is applied to students who are enrolled in both high school and college, or two different colleges or programs within the same institution. The term is distinguished from corequisite, where students must be enrolled in two separate courses at the same time.
Continuing Education / ConEd	Typically, continuing education courses help prepare individuals for employment, or upgrade workers already employed, although some programs and courses focus on personal enrichment. Some classes help to improve the adult’s social and cultural standing in the community. Continuing education courses may or may not be for credit, and usually do not lead to a degree. Some programs may lead to certificates or to help students prepare to take standard licensure exams.

Corequisite	A course that must be taken at the same time as another course.
Counseling	Many institutions offer students a counseling services to help students with both their academic and personal lives. Counseling services are typically free of charge to current students are strictly confidential. Counseling services may vary but often conferences can be arranged if students are experiencing social or personal difficulties. Counselors will discuss concerns, provide needed guidance and make community referrals when appropriate.
Course Load	The number of courses or credits a student takes during a specific term.
Course Objective	A goal that the instructor has identified for the student to meet once the course is completed. For example, a course objective could be to use MLA documentation properly.
Cover Letter	A letter accompanying a resume or application that describes how a person's qualifications match the advertised requirements or institution.
Credit	Units that a school uses to indicate that a student has completed and passed courses that are required for a degree. Each school defines the total number and types of credits necessary for degree completion, with every course being assigned a value in terms of "credits," "credit hours," or "units."
Critical Thinking	The ability to use specific criteria to evaluate reasoning and make a decision.
Curriculum	A program of study made up of a set of courses offered by a school.

D

Dean	The head of a division of a college or university.
Deferral	A school's act of postponing a student's application for early decision or early action, so that it will be considered along with the rest of the regular applicant group. A "deferral" can also refer to a student's act of postponing enrollment for one year, if the school agrees or temporarily postponing financial aid payments.

Degree	Official confirmation by the institution that you have successfully completed an extended program of study. Traditional 4-year undergraduate programs lead to the Bachelor's Degree.
Developmental Course	A course that prepares students for success in subsequent college-level courses. In some cases, credits earned in a developmental course will NOT count toward satisfying any degree or certificate program requirement.
Discipline	Generally the name given to that set of courses which are identified by a particular two-letter prefix in the College catalog — Biology, English, or Nursing, for example. Means about the same thing as "subject" in secondary school.
Discussion Board	An electronic method of interacting with other people by posting messages and reading postings from other people.
Dissertation	An in-depth, formal writing requirement on an original topic of research that is typically submitted in the final stages before earning a doctorate (Ph.D.).
Distance Learning	See Online Learning
Doctorate (Ph.D.)	The highest academic degree awarded by a university upon successful completion of an advanced program of study, typically requiring at least three years of graduate study beyond the master's degree (which may have been earned at a different university). Ph.D. candidates must demonstrate their mastery of a subject through oral and written exams and original, scholarly research presented in a dissertation.
Drop	To withdraw from a course. A college or university typically has a period of time at the beginning of a term during which students can add or drop courses.
Dual Degree	Program of study that allows a student to receive two degrees from the same college or university.
E	
Elective	A course in which the student has some choice or selection — as distinct from a course that is absolutely required in a particular curriculum. In many cases, "electives" may be limited within categories — as for example to satisfy General

	Education requirements where some elective credits must be taken from Humanities, others from Arts, others from Science, etc.
F	
Faculty	A school's teaching and administrative staff who is responsible for designing programs of study.
FAFSA	The Free Application for Federal Student Aid (FAFSA) is the application for education loans and grants from the federal government.
Fees	An amount of money charged by colleges and universities, in addition to their tuition, to cover costs of services such as libraries and computer technology.
Fellowship	An amount of money awarded by a college or university, usually to graduate students and generally based on academic achievement.
FERPA	A set of regulations that guarantees a student the right to inspect and review his/her educational records, the right to amend those educational records, and the right to some control over the disclosure of the records.
Financial Aid	All types of money offered to a student to help pay tuition, fees, and other educational expenses. This can include loans, grants, scholarships, assistantships, fellowships, and work-study jobs.
Freshman	Traditional name for first-year students in four-year degree programs.
Full-Time Student	A student enrolled in 12 or more credit hours in a semester.
G	
Goal	A statement describing something you wish to achieve. Goals may be short-term (something you wish to achieve quickly or in the near future) or long-term (something to be completed in the distant future or over a lifetime). Examples of common academic goals include graduating from college, earning an A in a course, etc.
Good Academic	A student with a cumulative GPA of 2.0 or better.

Grade Point Average / GPA	A student's overall academic performance, which is calculated as a numerical average of grades earned in all courses. The GPA is determined after each term, typically on a 4.0 scale, and upon graduation, students receive an overall GPA for their studies.
Graduate Student	A student who already holds an undergraduate degree and is pursuing advanced studies at a graduate school, leading to a master's, doctorate, or graduate certificate. A "graduate" can also refer to any student who has successfully completed a program of study and earned a degree.
Grant	A type of financial aid that consists of an amount of free money given to a student, often by the federal or a state government, a company, a school, or a charity. A grant does not have to be repaid. "Grant" is often used interchangeably with "scholarship."
Graduate Record Examination / GRE	A standardized graduate school entrance exam administered by the nonprofit Educational Testing Service (ETS), which measures verbal, quantitative, and analytical writing skills. The exam is generally required by graduate schools, which use it to assess applicants of master's and Ph.D. programs. Some business schools accept either the GMAT or GRE; law schools generally require the LSAT; and medical schools typically require the MCAT.
H	
HelpDesk	Term used to refer to a specific location or set of individuals who provide technical and basic computer support for the institutions technology solutions such as email, logging into computers, etc.
Honors Program	One of any special programs for high achieving students offering the opportunity for educational enrichment, independent study, acceleration or some combination of these.
Humanities	Academic courses focused on human life and ideas, including history, philosophy, foreign languages, religion, art, music, and literature.
Hybrid Classes	See Online Learning.
I	
Independent	Academic work chosen or designed by the student with the

Study	approval of the department concerned, under an instructor's supervision, and usually undertaken outside the regular classroom structure.
Information Literacy	A set of abilities requiring individuals to "recognize where information is needed and have the ability to locate, evaluate, and use effectively the needed information."
International Study	See Study Aboard.
Internship	An experience that allows students to work in a professional environment to gain training and skills. Internships may be paid or unpaid and can be of varying lengths during or after the academic year.
Internet Courses	See Online Learning
Ivy League	An association of eight private universities located in the northeastern United States, originally formed as an athletic conference. Today, the term is associated with universities that are considered highly competitive and prestigious. The Ivy League consists of the highly ranked Brown University, Columbia University, Cornell University, Dartmouth College, Harvard University, Princeton University, University of Pennsylvania, and Yale University.
J	
Judicial Board	To insure the right of appeal to all students. The Judicial Board will hear appeals concerning academic suspension, conduct suspension, and charges of discrimination and/or denial of service on the basis of race, color, national origin, age, religion, handicap, or sex. The Judicial Board's subcommittees (Academic, Financial Aid, Residency Status) will act on other categories of student appeals.
Junior	A student in the third year of high school or college / university.
Junior College	A two-year postsecondary institution that offers the associate degree. (See also, Community College.)
L	
Learning Lab	CFCC's Learning Lab aims to assist students in understanding course material and available educational technologies by

	providing instructional facilitators, computer facilitators, student tutors, and study skills tutors that are prepared to meet the needs of individual learning styles, and through computer-assisted instruction.
Learning Resource Center / LRC (Library)	The Learning Resource Center (LRC) is CFCC's academic library.
Liberal Arts	Academic studies of subjects in the humanities, social sciences, and the sciences, with a focus on general knowledge, in contrast to a professional or technical emphasis. "Liberal arts" is often used interchangeably with "liberal arts and sciences" or "arts and sciences."
Liberal Arts College	A postsecondary institution that emphasizes an undergraduate education in liberal arts. The majority of liberal arts colleges have small student bodies, do not offer graduate studies, and focus on faculty teaching rather than research.
M	
Major	The academic subject area that a student chooses to focus on during his or her undergraduate studies. Students typically must officially choose their major by the end of their sophomore year, allowing them to take a number of courses in the chosen area during their junior and senior years.
Matriculate	To be formally accepted as a degree or certificate candidate in a specific curriculum or major. i.e. "I think I'll be a Communications major" would translate more formally as "I plan to matriculate in the Communications curriculum".
Master's Degree	A graduate degree awarded by a college or university upon successful completion of an advanced program of study, typically requiring one or two years of full-time study beyond the bachelor's degree. Common degree types include master of arts (M.A.), which refers to the liberal arts; master of science (M.S.); and master of business administration (M.B.A.).
Minor	A second are of study that a student can emphasize in his or her degree. A minor usually requires fewer classes and is not as intensive as a major. For example, a student may major in Business with a minor in marketing.

MyCFCC	MyCFCC is the CFCC Student Portal allowing you to access many of CFCC's resources through the web, including Blackboard, CFCC Email, WebAdvisor, and more.
O	
Online Learning / Online Classes	Use of an electronic tool or online program to deliver all or part of a course to students who do not meet in the same physical location. Courses may be all or partially online (where some face-to-face meetings are required. Other common names are Distance Learning, E-Learning, or Internet Courses. Courses that have no face-to-face meeting are often called fully-online courses, whereas courses with some required face-to-face meetings may be called Hybrid, Blended, or Web Enhanced. This may also refer to the department that oversees electronic course delivery.
Orientation	A program of activities for new students designed to introduce them to some of the essential knowledge and skills for a successful College experience. May include topics ranging from selection of courses to child care and parking.
P	
Part-Time Student	A student enrolled in fewer than 12 credit hours in a semester.
Pass-Fail	A grading system in which students receive either a "pass" or "fail" grade, rather than a specific score or letter grade. Certain college or university courses can be taken pass-fail, but these typically don't include ones taken to fulfill major or minor requirements.
Plagiarism	The use of another person's words or ideas as your own, without acknowledging that person. Schools have different policies and punishments for students caught plagiarizing, which tends to occur with research papers and other written After text tasks.
Post doctorate	Academic studies or research for those who have completed a doctorate. A "postdoc" can refer both to a person who is pursuing a post doctorate and to the post doctorate itself.
Pre-requisite	A requirement that certain courses must be successfully completed before others may be attempted. Sometimes requires a grade of C or better in the earlier course – if so this will be stated explicitly in the course description for the later course.

President	See Chancellor
Private School	A postsecondary institution controlled by a private individual(s) or a nongovernmental agency. A private institution is usually not supported primarily by public funds and its programs are not operated by publicly elected or appointed officials. Stanford University, for example, is a private school.
Professional School	A higher education institution for students who have already received their undergraduate degree to gain training in specific professions, such as law, medicine, and pharmacy.
Professor	Instructor of a college-level course.
Program of Study	See Curriculum.
Provost	The senior academic officer of a college or university who typically oversees all academic policies and curriculum-related matters.
Public School	A postsecondary institution that is supported mainly by public funds and whose programs are operated by publicly elected or appointed officials. The University of California—Berkeley, for example, is a public school.
Q	
Quality Points	The number that is assigned each grade on a transcript. For example, an A is worth four quality points and a B is worth three points. Quality Points are typically used in the calculation of a GPA.
R	
Registrar	The college or university official who is responsible for registering students and keeping their academic records, such as transcripts.
Registration	The process in which students choose and enroll in courses to be taken during the academic year or in summer sessions. This may also refer to the department that oversees course enrollments.
Remedial Classes	See Developmental Course.

Resume	A page or two that provides a person's educational and work experiences, career objective, and contact information.
Rolling Admissions	An admissions process used by some colleges and universities in which each application is considered as soon as all the required materials have been received, rather than by a specific deadline. Colleges and universities with this policy will make decisions as applications are received until all spaces are filled.
Room and Board	Housing and meals. "Room and board" is typically one of the costs that colleges and universities will list in their annual estimated cost of attendance, in addition to tuition, fees, and textbooks and supplies. If students choose to live in dormitories, they may be required to buy into a meal plan to use on-campus dining facilities.
S	
School	Any educational institution, including those that provide elementary, secondary, and postsecondary education (typically beyond high school). In the postsecondary, "school" is often used interchangeably with "college" and "university."
Semester	Periods of study that divide the academic year into two equal segments of approximately 15 to 18 weeks each. Some schools also offer a shorter summer semester, beyond the traditional academic year.
Seminar	A course offered to a small group of students who are typically more advanced and who meet with a professor to discuss specialized topics.
Senior	A student in the fourth year of high school or college / university.
Service Learning	Classes that provide students the opportunity to volunteer at a Community Service Organization (CSO) as part of a class project. May also refer to the department that oversees volunteer opportunities at the institution.
Sophomore	Traditional name for second-year students in four-year degree programs.
Student Handbook	A publication of the college that outlines what the college expects of the student.

Student Services	Typically a group of connected departments that aim to make students' lives easier and more productive both inside the classroom and in their personal lives.
Study Abroad	The act of pursing educational opportunities in a country other than one's own. Studying aboard can range from a couple of weeks to an entire semester or academic year. Most schools offer some type of study aboard opportunities. Some schools now require students to have a study aboard experience.
Syllabus	A summary document prepared by the instructor that states basic information about plans for a particular course in a particular semester. Can include such things as textbook lists, office hours, test dates, required After text tasks, chapters to be covered, learning objectives, etc.
T	
To Be-Announced / TBA	To Be Announced – Seen in the schedule of classes when exact instructor, or sometimes exact classroom, was not yet known at the time the schedule was sent to the printer.
Teaching Assistant (TA)	A graduate student who assists a professor with teaching an undergraduate course, usually within his or her field, as part of an assistantship.
Tenure	A status offered to high-level faculty members at a college or university that allows them to stay permanently in their positions, after demonstrating a strong record of teaching and published research.
Term	Periods of study, which can include semesters, quarters, trimesters, or summer sessions.
Thesis	A formal piece of writing on a specific subject, which may be required to earn a bachelor's or master's degree.
Transcript	A formal record of grades received in all courses you have taken, and whether any degrees or certificates have been successfully completed. Must generally be sent directly from one College to the other when planning to transfer, or when applying to begin a higher degree program.
Transfer Credit	Credit granted toward a degree on the basis of studies completed at another college or university. For instance, students who transfer from a community college to a four-year

	college may earn some transfer credit.
Transfer Program	A specific set of criteria or courses that helps prepare students to transfer to a new school. These are especially common in community colleges to help students prepare to transfer to a four-year school.
U	
Undergraduate	A student enrolled in a two-year or four-year study program at a college or university after graduation from high school, leading to an associate or bachelor's degree.
University	A postsecondary institution that typically offers both undergraduate and graduate degree programs. "University" is often used interchangeably with "college" and "school."
W	
Wait List	A list of qualified applicants to a school who may be offered admission if there is space available after all admitted students have made their decisions. Being on a wait list does not guarantee eventual admission, so some students may choose not to remain on the list, particularly if the school is not their first choice.
WebAdvisor	The CFCC Registration system used to register for courses, find final grades, and view program plans.
Withdraw	The act of filing paperwork to remove yourself from the official class roster, either for a single course or for an entire semester.
Work-Study Student	A student employee receiving financial aid. Sometimes referred to as Federal Work Study or FWS.

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