جامعة مولاي إسماعيل
UNIVERSITÉ MOULAY ISMAÏL

كلية العلوم
FACULTÉ DES SCIENCES

DEPARTEMENT DE MATHEMATIQUE

FILIERE
DE MASTER :

Mathématiques Pures

MODULE :

ANGLAIS SCIENTIFIQUE 2

TEXTES DE LECTURE
ET EXERCICES

PR. MOHAMMED DIOURI

A.U.: 2019-2020
Session de printemps
(S2)

PREFACE

Congratulations…

You have been admitted to undertake graduate studies, which need research and (or) lead to a research career. In this career, you will need, among other research tools, the English language, which is important for many reasons:

- English is the lingua franca par excellence. It is spoken or understood almost all over the world.
- Almost all the research papers are published in English or at least with an English abstract (« publish in English or perish »).
- Most web sites are partially or totally in English. You may not feel that because of the way the search engines display results.
- In 2019, 19 out of the 20 and 40 out of the 50 top universities of the world were exclusively English speaking (according to *Academic Ranking of World Universities*).
- An individual who is fluent in English earns an average of 30% more.
- A unique linguistic scenario is encountered in almost all developed and emerging countries. It consists, on the one hand, in using the national language (s) for teaching and all internal communication, thus targeting the knowledge society; and on the other hand, in opening up to the world through English, aiming at universality.

In your research work, you will need more reading than writing, listening, and speaking. That is why this course will consist mainly in understanding texts. Nevertheless, we will also try to practice the three other language skills.

Since you have already taken a course of basic English, and since I am not an English language specialist, I will not, and cannot, start from scratch to teach you English in this 48-h course. I will only help you improve your Scientific English abilities.

In order to hit two birds with one stone, we will be reading various documents pertaining to science and research. If you are interested in other texts, you are welcome to propose them. We may consider studying them, time permitting.

The enclosed reading texts may be enough to give you an idea about science and research. However, they are not enough to make you reach a good level of scientific English. Therefore, you need to read and listen as much, and as frequently, as you can. I will be at your service for any help or advice.

I will try to make myself understood by choosing words and pronouncing them as clearly as possible (usually with a simplified American accent). However, if you still cannot understand, feel free to ask for help.

Since you have learned communication, I would like to benefit from your experience. Therefore, every advice, remark or suggestion is more than welcome.

Good luck

Prof Mohammed Diouri

SCIENTIFIC ENGLISH
COURSE SYLLABUS

INSTRUCTOR:

- Name: Mohammed Diouri

- Degrees: MS (Ingénieur) in Animal Husbandry,

PhD in Animal Science (Fiber ruminant nutrition).

- Title: Professor (Biology department, College of science, Moulay Ismail University).

- Office: Biology department (in front of the department chairman's office, next to the secretary's),
- Cell phone # 0665999822
- E-mail address: m.diouri@umi.ac.ma (if the sender is not recognized, the message will be ignored)

COURSE OBJECTIVES
- To improve the English language command, mainly in reading and writing.
- To enlarge science and research vocabulary.
- To learn some methods and techniques in scientific research and communication.

PREREQUISITE
A minimum level of English ("Baccalauréat" level)

COURSE OUTLINE: (36-h lecture and 10-h lab):
Graduate studies and research
Thinking of a research topic
Looking for research funding
Looking for references
Reading about your subject
Conducting your research
Writing a scientific document
Publishing a research article
Communicating and collaborating with others
Listening to others
Writing assignments (CV, research proposal, manuscript submission, cover letter)
Oral presentation (research projects)
English usage exercises

GRADING:
It will be based on:
* Writing and (or) presentation assignments (considered as mid-term exam)
* A final exam

TEXT:

Reading material is attached hereto. More handouts may be given in class. Suggestions are welcome.

SCIENTIFIC ENGLISH
Rules and advices

Learning:

The best way to learn to speak a language is to live with its native speakers. Therefore, a one- or two-week vacation in UK, USA or even in Gibraltar may do more good than a one- or two-month course.

If you cannot live with native speakers, practice as much as you can (friends, movies, etc.).

Focus on phrases not individual words (he-does, so-do-I, quality-assurance and car-insurance).

Use an English-English dictionary (Webster, Oxford, Cambridge).

Pair a new word or expression with a story, a picture or a proverb (e.g., in the summer, I scream for ice cream; birds of a feather flock together).

Learn deeply the (2000) most common words and the (500) most common phrases, especially in your field.

Enrich your vocabulary (reading, signing up for courses and alerts).

Reading and comprehension:

Do not try to understand every single word, unless it is necessary.

Phrasal verbs (come up, look down, look forward) may be confusing. They may be separable (pull down), inseparable (put up with) or both (carry out).

The present perfect is used to talk about the past and the present at the same time. It describes an event that begins in the past and extends to the present. For example, "I have known this researcher since 1990", but "I met her in 1990".

Try to understand the sentence without translating it into another language; unless it is necessary.

Beware of false friends (large, culture, actual, hazard, resume).

Separate the syllables or examine the word in order to understand (breakfast, guideline, cowboy, heat-hot, strength-strong, etc.).

Remember that the decimal separator is a point (.) not a comma (,). 24,011 is twenty-four thousand (and) eleven.

The punctuation marks are important and may change the meaning (“end-of-study projects” is not “end of study projects”).

Try to understand from within the language cultural framework.

Pay attention to figurative meanings.

Writing:

Avoid spoken English (I will do instead of I’ll do).

Use neutral or formal (neither too formal nor slangy) styles and words (e.g. “good morning, ladies and gentlemen. May I welcome you to this conference” instead of “good morning, everyone. Thanks for coming”; “steal” instead of “rob”)

Use polite expressions (please, I am sorry it would be impossible, I am afraid I cannot, where can I wash my hands?).

Make your text clearly understandable (“metal tanks containing sulfur” versus “sulfur containing metal tanks”).

Prefer short and simple sentences and expressions (“in the example ~~which is~~ given above”, “I locked myself out”, the report is due out).

Do not let other languages influence your style (e.g. false friends, apply math to biology, depend on, the right moment).

When using a bilingual dictionary, choose the context appropriate synonym (régime= regime or diet).

If you use a translation software, review the translated text before submitting it, and make sure it is what you mean (“translator is a traitor”). Translation programs often consider the word usage frequency (rapport/report-ratio). This may lead to undesired or strange meanings, especially when the original text is not well written (e.g. “the results wind given”) or when you translate word-by-word (“this secretary you need”, “text treatment”).

Always use international units (m, kg, l, °C, etc.).

Choose either British or American English, not a combination of both (Spelling: center, program, behavior, license, labeled, realize, catalog, MS; Vocabulary: thesis-dissertation, period, elevator, 1st floor, pants). Check the spelling, after choosing the preferred form.

Beware of the mistakes the spellchecker will miss (compliment/complement, septic/skeptic (sceptic), causal/casual, pubic/public).

Avoid words having more than one meaning (if in doubt, don't) such as gallon, ton, 4/6/2008, faculty); or give more information (US gallon, metric ton, 6 April 2008, faculty of science).

English is widely spoken and written by non-natives. Therefore, beware of borrowing.

There are different education and evaluation systems around the world. Therefore, make sure your score and your degree are known or correctly understood by others.

Remember the other sex and use inclusive vocabulary (gender equity): Police officer (instead of policeman), he or she, dear Sir or Madam, Ms Jones, etc.

Address people by their names, degrees and/or titles (Dr so and so, dear director,).

Always mention the country (at least) for locations, even for Paris and London! (i.e. Meknes, Morocco; Paris, France; London, UK, etc.).

Write complete sentences, not just lists of words or phrases. Organize and link your ideas in paragraphs.

Use different time frames and tenses.

Add elaborations to your text: argumentation, academic and professional examples, etc.

Try to write from within the language cultural framework.

Speaking:

If you forget a word and cannot find a synonym, try to explain it.

Always utter the "s" at the end of the word. This is usually the only way to show the plural form, because the definite article is invariable (the book, the books).

French pronunciation rules are not always applicable: An "S" between two vowels is not necessarily pronounced "Z" (thesis, analysis). A double "S" may be pronounced "Z" (to possess [pəz'es]). A "G" before an "E" or an "I" is not necessarily pronounced like "j" (get [get]; gigabyte [g'igəbait]). Conversely, a "G" before an "M" may be pronounced like "j" (acknowledgment). A "C" before an "I" may be pronounced [k] (zincic [ziŋkik]).

The stress is very important (olive, parameter, perimeter) and may change the meaning of a word (desert [d'ezərt] and dessert [diz'ə:rt]; carrier [k'ariər] and career [kər'iər]). The stress position, or the pronunciation, changes when the word changes from a verb to a noun or an adjective (to conduct-a conduct, Japan-Japanese, history-historical, to estimate-an estimate, to separate-separate).

The pronunciation changes also with the meaning (lead (verb)-lead (noun), scarify (cut and remove debris)-scarify (frighten)).

Americans often avoid the “T” when it is in the middle of the word. They either almost omit uttering it (twenty, want to do) or transform it to a mixture of “D”, “R” and “T” (water). British omit pronouncing “R” after a vowel (sister [sistə], early [ə:li]). The same “a” may be pronounced differently (e.g. “can’t” [kænt] in Am.; [kant] in Br.). The letter “u” is often pronounced differently (“student” is [stu:dnt] in America but [stju:dnt] in UK). In general, the British pronunciation is closer to French than to the American one (route, zebra, privacy, vase).

When speaking English, think in English and do not translate from another language (“remember to do” instead of “do not forget to do”).

An Introduction to Science

Scientific Thinking and the Scientific Method

by

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Department of Geology
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January, 1997
http://www.muohio.edu/~schafesd/documents/intro-to-sci.htmlx

The Definition of Science

Science is not merely a collection of facts, concepts, and useful ideas about nature, or even the systematic investigation of nature, although both are common definitions of science. **Science is a method of investigating nature--a way of knowing about nature--that discovers reliable knowledge about it.** ***In other words, science is a method of discovering reliable knowledge about nature. There are other methods of discovering and learning knowledge about nature (these other knowledge methods or systems will be discussed below in contradistinction to science), but science is the*** **only** ***method that results in the acquisition of reliable knowledge.***

Reliable knowledge is knowledge that has a high probablility of being true because its veracity has been justified by a reliable method. ***Reliable knowledge is sometimes called justified true belief, to distinguish reliable knowledge from belief that is false and unjustified or even true but unjustified. (Please note that I do not, as some do, make a distinction between belief and knowledge; I think that what one believes is one's knowledge. The important distinction that should be made is whether one's knowledge or beliefs are true and, if true, are justifiably true.) Every person has knowledge or beliefs, but not all of each person's knowledge is reliably true and justified. In fact, most individuals believe in things that are untrue or unjustified or both: most people possess a lot of unreliable knowledge and, what's worse, they act on that knowledge! Other ways of knowing, and there are many in addition to science, are*** **not reliable** ***because their discovered knowledge is*** **not justified.** ***Science is a method that allows a person to possess, with the highest degree of certainty possible, reliable knowledge (justified true belief)***

about nature. The method used to justify scientific knowledge, and thus make it reliable, is called the scientific method. I will explain the formal procedures of the scientific method later in this essay, but first let's describe the more general practice of scientific or critical thinking.

Scientific and Critical Thinking

When one uses the scientific method to study or investigate nature or the universe, one is practicing scientific thinking. All scientists practice scientific thinking, of course, since they are actively studying nature and investigating the universe by using the scientific method. But scientific thinking is not reserved solely for scientists. Anyone can "think like a scientist" who learns the scientific method and, most importantly, applies its precepts, whether he or she is investigating nature or not. When one uses the methods and principles of scientific thinking in everyday life--such as when studying history or literature, investigating societies or governments, seeking solutions to problems of economics or philosophy, or just trying to answer personal questions about oneself or the meaning of existence--one is said to be practicing critical thinking. **Critical thinking is thinking correctly for oneself that successfully leads to the most reliable answers to questions and solutions to problems.** ***In other words, critical thinking gives you reliable knowledge about all aspects of your life and society, and is not restricted to the formal study of nature. Scientific thinking is identical in theory and practice, but the term would be used to describe the method that gives you reliable knowledge about the natural world. Clearly, scientific and critical thinking are the same thing, but where one (scientific thinking) is always practiced by scientists, the other (critical thinking) is sometimes used by humans and sometimes not. Scientific and critical thinking was not discovered and developed by scientists (that honor must go to ancient Hellenistic philosophers, such as Aristotle, who also are sometimes considered the first scientists), but scientists were the ones to bring the practice of critical thinking to the attention and use of modern society (in the 17th and 18th centuries), and they are the most explicit, rigorous, and successful practitioners of critical thinking today. Some professionals in the humanities, social sciences, jurisprudence, business, and journalism practice critical thinking as well as any scientist, but many, alas, do not. Scientists*** **must** ***practice critical thinking to be successful, but the qualifications for success in other professions do not necessarily require the use of critical thinking, a fact that is the source of much confusion, discord, and unhappiness in our sociey .***

The scientific method has proven to be the most reliable and successful method of thinking in human history, and it is quite possible to use scientific thinking in other human endeavors. For this reason, critical thinking--the application of scientific thinking to all areas of study and topics of investigation--is being taught in schools throughout the United States, and its teaching is being encouraged as a universal ideal. You may perhaps have been exposed to critical thinking skills and exercises earlier in your education. The important point is this: critical thinking is perhaps the most important skill a student can learn in school and college, since if you master its skills, you know how to think successfully and reach reliable conclusions, and such ability will prove valuable in any human endeavor, including the humanities, social sciences, commerce, law, journalism, and government, as well as in scholarly and scientific pursuits. Since critical thinking and scientific thinking are, as I claim, the same thing, only applied for different purposes, it is therefore reasonable to believe that if one learns scientific thinking in a science class, one learns, at the same time, the most important skill a student can possess--critical thinking. This, to my mind, is perhaps the foremost reason for college students to study science, no matter what one's eventual major, interest, or profession.

The Three Central Components of Scientific and Critical Thinking

What is scientific thinking? At this point, it is customary to discuss questions, observations, data, hypotheses, testing, and theories, which are the formal parts of the scientific method, but these are NOT the most important components of the scientific method. The scientific method is practiced within a context of scientific thinking, and scientific (and critical) thinking is based on three things: using empirical evidence (empiricism), practicing logical reasonsing (rationalism), and possessing a skeptical attitude (skepticism) about presumed knowledge that leads to self-questioning, holding tentative conclusions, and being undogmatic (willingness to change one's beliefs). These three ideas or principles are universal throughout science; without them, there would be no scientific or critical thinking. Let's examine each in turn.

1. Empiricism: The Use of Empirical Evidence

Empirical evidence is evidence that one can see, hear, touch, taste, or smell; *it is evidence that is susceptible to one's senses. Empirical evidence is important because it is evidence that others besides yourself can experience, and it is repeatable, so empirical evidence can be checked by yourself and others after knowledge claims are made by an individual. Empirical evidence* *is the* only *type of evidence that possesses these attributes and is therefore the only type used by scientists and critical thinkers to make vital decisions and reach sound conclusions.*

We can contrast empirical evidence with other types of evidence to understand its value. Hearsay evidence is what someone says they heard another say; it is not reliable because you cannot check its source. Better is testimonial evidence, which, unlike hearsay evidence, is allowed in courts of law. But even testimonial evidence is notoriously unreliable, as numerous studies have shown. Courts also allow circumstantial evidence (e.g., means, motive, and opportunity), but this is obviously not reliable. Revelatory evidence or revelation is what someone says was revealed to them by some deity or supernatural power; it is not reliable because it cannot be checked by others and is not repeatable. Spectral evidence is evidence supposedly manifested by ghosts, spirits, and other paranormal or supernatural entities; spectral evidence was once used, for example, to convict and hang a number of innocent women on charges of witchcraft in Salem, Massachusetts, in the seventeenth century, before the colonial governor banned the use of such evidence, and the witchcraft trials ended. Emotional evidence is evidence derived from one's subjective feelings; such evidence is often repeatable, but only for one person, so it is unreliable.

The most common alternative to empirical evidence, authoritarian evidence, is what authorities (people, books, billboards, television commercials, etc.) tell you to believe. Sometimes, if the authority is reliable, authoritarian evidence is reliable evidence, but many authorities are not reliable, so you must check the reliability of each authority before you accept its evidence. In the end, you must be your own authority and rely on your own powers of critical thinking to know if what you believe is reliably true. (Transmitting knowledge by authority is, however, the most common method among humans for three reasons: first, we are all conditioned from birth by our parents through the use of positive and negative reinforcement to listen to, believe, and obey authorities; second, it is believed that human societies that relied on a few experienced or trained authorities for decisions that affected all had a higher survival value than those that didn't, and thus the behaviorial trait of susceptibility to authority was strengthened and passed along to future generations by natural selection; third, authoritarian instruction is the quickest and most efficient method for transmitting information we know about. But remember: some authoritarian evidence and knowledge should be validated by empirical evidence, logical reasoning, and critical thinking *before you should consider it reliable, and, in most cases, only you can do this for yourself.*

It is, of course, impossible to receive an adequate education today without relying almost entirely upon authoritarian evidence. Teachers, instructors, and professors are generally considered to be reliable and trustworthy authorities, but even they should be questioned on occasion. The use of authoritarian evidence in education is so pervasive, that its use has been questioned as antithetical to the true spirit of scholarly and scientific inquiry, and attempts have been made in education at all levels in recent years to correct this bias by implementing discovery and inquiry methodologies and curricula in classrooms and laboratories. The recently revised geology laboratory course at Miami University, GLG 115.L, is one such attempt, as are the Natural Systems courses in the Western College Program at Miami. It is easier to utilize such programs in humanities and social sciences, in which different yet equally valid conclusions can be reached by critical thinking, rather than in the natural sciences, in which the objective reality of nature serves as a constant judge and corrective mechanism.

Another name for empirical evidence is natural evidence: the evidence found in nature. Naturalism is the philosophy that says that "Reality and existence (i.e. the universe, cosmos, or nature) can be described and explained solely in terms of natural evidence, natural processes, and natural laws." This is exactly what science tries to do. Another popular definition of naturalism is that "The universe exists as science says it does." This definition emphasizes the strong link between science and natural evidence and law, and it reveals that our best understanding of material reality and existence is ultimately based on philosophy. This is not bad, however, for, whether naturalism is ultimately true or not, science and naturalism reject the concept of ultimate or absolute truth in favor of a concept of proximate reliable truth that is far more successful and intellectually satisfying than the alternative, the philosophy of supernaturalism. The supernatural, if it exists, cannot be examined or tested by science, so it is irrelevant to science. It is impossible to possess reliable knowledge about the supernatural by the use of scientific and critical thinking. Individuals who claim to have knowledge about the supernatural do not possess this knowledge by the use of critical thinking, but by other methods of knowing.

Science has unquestionably been the most successful human endeavor in the history of civilization, because it is the only method that successfully discovers and formulates reliable knowledge. The evidence for this statement is so overwhelming that many individuals overlook exactly how modern *civilization came to be (our modern civilization is based, from top to bottom, on the discoveries of science and their application, known as technology, to human purposes.). Philosophies that claim to possess absolute or ultimate truth invariably find that they have to justify their beliefs by faith in dogma, authority, revelation, or philosophical speculation, since it is impossible to use finite human logic or natural evidence to demonstrate the existence of the absolute or ultimate in either the natural or supernatural worlds. Scientific and critical thinking require that one reject blind faith, authority, revelation, and subjective human feelings as a basis for reliable belief and knowledge. These human cognitive methods have their place in human life, but not as the foundation for reliable knowledge.*

2. Rationalism: The Practice of Logical Reasoning

Scientists and critical thinkers always use logical reasoning. Logic allows us to reason correctly, but it is a complex topic and not easily learned; many books are devoted to explaining how to reason correctly, and we can not go into the details here. However, I must point out that most individuals do not reason logically, because they have never learned how to do so. Logic is not an ability that humans are born with or one that will gradually develop and improve on its own, but is a skill or discipline that must be learned within a formal educational environment. Emotional thinking, hopeful thinking, and wishful thinking are much more common than logical thinking, because they are far easier and more congenial to human nature. Most individuals would rather believe something is true because they feel it is true, hope it is true, or wish it were true, rather than deny their emotions and accept that their beliefs are false.

Often the use of logical reasoning requires a struggle with the will, because logic sometimes forces one to deny one's emotions and face reality, and this is often painful. But remember this: emotions are not evidence, feelings are not facts, and subjective beliefs are not substantive beliefs. Every successful scientist and critical thinker spent years learning how to think logically, almost always in a formal educational context. Some people can learn logical thinking by trial and error, but this method wastes time, is inefficient, is sometimes unsuccessful, and is often painful.

The best way to learn to think logically is to study logic and reasoning in a philosophy class, take mathematics and science courses that force you to use logic, read great literature and study history, and write frequently. Reading, writing, and math are the traditional methods that young people learned to think logically (i.e. correctly), but today science is a fourth method. Perhaps *the best way is to do a lot of writing that is then reviewed by someone who has critical thinking skills. Most people never learn to think logically; many illogical arguments and statements are accepted and unchallenged in modern society--often leading to results that are counterproductive to the good of society or even tragic--because so many people don't recognize them for what they are.*

3. Skepticism: Possessing a Skeptical Attitude

The final key idea in science and critical thinking is skepticism, the constant questioning of your beliefs and conclusions. Good scientists and critical thinkers constantly examine the evidence, arguments, and reasons for their beliefs. Self-deception and deception of yourself by others are two of the most common human failings. Self-deception often goes unrecognized because most people deceive themselves. The only way to escape both deception by others and the far more common trait of self-deception is to repeatedly and rigorously examine your basis for holding your beliefs. You must question the truth and reliability of both the knowledge claims of others and the knowledge you already possess. One way to do this is to test your beliefs against objective reality by predicting the consequences or logical outcomes of your beliefs and the actions that follow from your beliefs. If the logical consequences of your beliefs match objective reality--as measured by empirical evidence--you can conclude that your beliefs are reliable knowledge (that is, your beliefs have a high probability of being true).

Many people believe that skeptics are closed-minded and, once possessing reliable knowledge, resist changing their minds--but just the opposite is true. A skeptic holds beliefs tentatively, and is open to new evidence and rational arguments about those beliefs. Skeptics are undogmatic, i.e., they are willing to change their minds, but only in the face of new reliable evidence or sound reasons that compel one to do so. Skeptics have open minds, but not so open that their brains fall out: they resist believing something in the first place without adequate evidence or reason, and this attribute is worthy of emulation. Science treats new ideas with the same skepticism: extraordinary claims require extraordinary evidence to justify one's credulity. We are faced every day with fantastic, bizarre, and outrageous claims about the natural world; if we don't wish to believe every pseudoscientific allegation or claim of the paranormal, we must have some method of deciding what to believe or not, and that method is the scientific method which uses critical thinking.

The Scientific Method in Practice

Now, we are ready to put the scientific method into action. Many books have been written about the scientific method, and it is a long and complex topic. Here I will only treat it briefly and superficially. The scientific method, as used in both scientific thinking and critical thinking, follows a number of steps.

1. *One must ask a meaningful question or identify a significant problem, and one should be able to state the problem or question in a way that it is conceivably possible to answer it. Any attempt to gain knowledge must start here. Here is where emotions and outside influences come in. For example, all scientists are very curious about nature, and they have to possess this emotional characteristic to sustain the motivation and energy necessary to perform the hard and often tedious work of science. Other emotions that can enter are excitement, ambition, anger, a sense of unfairness, happiness, and so forth. Note that scientists have emotions, some in high degree; however, they don't let their emotions give false validity to their conclusions, and, in fact, the scientific method prevents them from trying to do this even if they wished.*

   Many outside factors can come into play here. Scientists must choose which problems to work on, they decide how much time to devote to different problems, and they are often influenced by cultural, social, political, and economic factors. Scientists live and work within a culture that often shapes their approach to problems; they work within theories that often shape their current understanding of nature; they work within a society that often decides what scientific topics will be financially supported and which will not; and they work within a political system that often determines which topics are permitted and financially rewarded and which are not.

   Also, at this point, normally nonscientific emotional factors can lead to divergent pathways. Scientists could be angry at polluters and choose to investigate the effects of pollutants; other scientists could investigate the results of smoking cigarettes on humans because they can earn a living doing this by working for tobacco companies; intuition can be used to suggest different approaches to problems; even dreams can suggest creative solutions to problems. I wish to emphasize, however, that the existence of these frankly widespread nonscientific emotional and cultural influences does **not** *compromize the ultimate reliability and objectivity of scientific results, because subsequent steps in the scientific method serve to eliminate these outside factors and allow* *science to reach reliable and objective conclusions (admittedly it may take some time for subjective and unreliable scientific results to be eliminated). There exists a school of thought today in the humanities (philosophy, history, and sociology) called post-modernism or scientific constructivism, that claims that science is a social and cultural construct, that scientific knowledge inevitably changes as societies and cultures change, and that science has no inherently valid foundation on which to base its knowledge claims of objectivity and reliability. In brief, post-modernists believe that the modern, scientific world of Enlightenment rationality and objectivity must now give way to a post-modern world of relativism, social constructivism, and equality of belief. Almost all scientists who are aware of this school of thought reject it, as do I; post-modernism is considered irrelevant by scientists and has had no impact on the practice of science at all. We will have to leave this interesting topic for a later time, unfortunately, but you may be exposed to these ideas in a humanities class. If you are, remember to think critically!*

2. *One must next gather relevant information to attempt to answer the question or solve the problem by making observations. The first observations could be data obtained from the library or information from your own experience. Another souce of observations could be from trial experiments or past experiments. These observations, and all that follow, must be empirical in nature--that is, they must be sensible, measurable, and repeatable, so that others can make the same observations. Great ingenuity and hard work on the part of the scientist is often necessary to make scientific observations. Furthermore, a great deal of training is necessary in order to learn the methods and techniques of gathering scientific data.*
3. *Now one can propose a solution or answer to the problem or question. In science, this suggested solution or answer is called a scientific hypothesis, and this is one of the most important steps a scientist can perform, because the proposed hypothesis must be stated in such a way that it is testable.* **A scientific hypothesis is an informed,testable, and predictive solution to a scientific problem that explains a natural phenomenon, process, or event.** *In critical thinking, as in science, your proposed answer or solution must be testable, otherwise it is essentially useless for further investigation. Most individuals--noncritical thinkers all--stop here, and are satisfied with their first answer or solution, but this lack of skepticism is a major roadblock to gaining reliable knowledge. While some of these early proposed*

answers may be true, most will be false, and further investigation will almost always be necessary to determine their validity.

4. *Next, one must test the hypothesis before it is corroborated and given any real validity. There are* **two** *ways to do this. First, one can conduct an* **experiment.** *This is often presented in science textbooks as the only way to test hypotheses in science, but a little reflection will show that many natural problems are not amenable to experimentation, such as questions about stars, galaxies, mountain formation, the formation of the solar system, ancient evolutionary events, and so forth. The second way to test a hypothesis is to* **make further observations.** *Every hypothesis has consequences and makes certain predictions about the phenomenon or process under investigation. Using logic and empirical evidence, one can test the hypothesis by examining how successful the predictions are, that is, how well the predictions and consequences agree with new data, further insights, new patterns, and perhaps with models. The testability or predictiveness of a hypothesis is its most important characteristic. Only hypotheses involving natural processes, natural events, and natural laws can be tested; the supernatural cannot be tested, so it lies outside of science and its existence or nonexistence is irrelevant to science.*
5. *If the hypothesis fails the test, it must be rejected and either abandoned or modified. Most hypotheses are modified by scientists who don't like to simply throw out an idea they think is correct and in which they have already invested a great deal of time or effort. Nevertheless, a modified hypothesis must be tested again. If the hypothesis passes the further tests, it is considered to be a corroborated hypothesis, and can now be published.* **A corroborated hypothesis is one that has passed its tests, i.e., one whose predictions have been verified.** *Now other scientists test the hypothesis. If further corroborated by subsequent tests, it becomes highly corroborated and is now considered to be reliable knowledge. By the way, the technical name for this part of the scientific method is the "hypothetico-deductive method," so named because one deduces the results of the predictions of the hypothesis and tests these deductions. Inductive reasoning, the alternative to deductive reasoning, was used earlier to help formulate the hypothesis. Both of these types of reasoning are therefore used in science, and both must be used logically.*

Scientists never claim that a hypothesis is "proved" in a strict sense (but sometimes this is quite legitimately claimed when using popular language), because proof is something found only in mathematics and *logic, disciplines in which all logical parameters or constraints can be defined, and something that is not true in the natural world. Scientists prefer to use the word "corroborated" rather than "proved," but the meaning is essentially the same. A highly corroborated hypothesis becomes something else in addition to reliable knowledge--it becomes a scientific fact.* **A scientific fact is a highly corroborated hypothesis that has been so repeatedly tested and for which so much reliable evidence exists, that it would be perverse or irrational to deny it.** *This type of reliable knowledge is the closest that humans can come to the "truth" about the universe (I put the word "truth" in quotation marks because there are many different kinds of truth, such as logical truth, emotional truth, religious truth, legal truth, philosophical truth, etc.; it should be clear that this essay deals with scientific truth, which, while certainly not the sole truth, is nevertheless the best truth humans can possess about the natural world).*

There are many such scientific facts: the existence of gravity as a property of all matter, the past and present evolution of all living organisms, the presence of nucleic acids in all life, the motion of continents and giant tectonic plates on Earth, the expansion of the universe following a giant explosion, and so forth. Many scientific facts violate common sense and the beliefs of ancient philosophies and religions, so many people persist in denying them, but they thereby indulge in irrationality and perversity. Many other areas of human thought and philosophy, and many other knowledge systems (methods of gaining knowledge), exist that claim to have factual knowledge about the world. Some even claim that their facts are absolutely or ultimately true, something science would never claim. But their "facts" are not reliable knowledge, because--while they might fortuitously be true--they have not been justified by a reliable method. If such unreliable "facts" are true--and I certainly don't maintain that all such knowledge claims are false--we can never be **sure** *that they are true, as we can with scientific facts.*

6. ***The final step of the scientific method is to construct, support, or cast doubt on a scientific theory. A theory in science is not a guess, speculation, or suggestion, which is the popular definition of the word "theory."*** **A scientific theory is a unifying and self-consistent explanation of fundamental natural processes or phenomena that is totally constructed of corroborated hypotheses.** ***A theory, therefore, is built of reliable knowledge--built of scientific facts--and its purpose***

is to explain major natural processes or phenomena. Scientific theories explain nature by unifying many once-unrelated facts or corroborated hypotheses; they are the strongest and most truthful explanations of how the universe, nature, and life came to be, how they work, what they are made of, and what will become of them. Since humans are living organisms and are part of the universe, science explains all of these things about ourselves.

These scientific theories--such as the theories of relativity, quantum mechanics, thermodynamics, evolution, genetics, plate tectonics, and big bang cosmology--are the most reliable, most rigorous, and most comprehensive form of knowledge that humans possess. Thus, it is important for every educated person to understand where scientific knowledge comes from, and how to emulate this method of gaining knowledge. Scientific knowledge comes from the practice of scientific thinking--using the scientific method--and this mode of discovering and validating knowledge can be duplicated and achieved by anyone who practices critical thinking.

Six Rules of Critical Thinking in Science

1. Is it falsifiable?

For any explanation to be considered science, it must be falsifiable. It must be possible to obtain some evidence that would falsify the claim. This is what makes science science, and why most significantly evidence matters.

2. Is it logical?

All conclusions or predictions drawn from an explanation must logically follow. This is important because explanations are tested by evaluating such predictions.

3. Is it comprehensive?

Does the explanation account for all of the available evidence? If not, then how can it possibly be true? This means you cannot pick and choose among the available evidence and select only those items that support your explanation. To be a viable alternative explanation, all the available evidence must be explained.

4. Has everyone been honest?

Anybody offering an explanation has an obligation to weigh all the evidence and reach a rational conclusion. You always must be on guard of self-deception, and you must be willing to abandon any explanation if the evidence contradicts it. Science makes progress when falsified explanations are abandoned and replacing them with new explanations.

5. Is it replicable?

Any evidence offered in support of an explanation must be capable of being obtained independently and confirmed by someone else. If something repeatedly cannot be confirmed independently, then the original evidence becomes suspect, and so does the explanation it supported.

6. Is it sufficient?

Is the evidence offered sufficient to support the truth of the explanation? The belief we place in an explanation must remain proportionate to the amount of credible evidence that has been accumulated in its support. Remember the burden of proof rests on the person putting forth the explanation, and the more extraordinary the claim, the more solid the evidence required to support it. Further the absence of falsifying evidence is not the same as the presence of evidence that confirms a claim or explanation.

Conclusion

If an explanation or claim passes on all six rules, then you are justified in considering it to be true. Of course, this does not provide a guarantee of truth, but it means you have a good basis for supporting the explanation. If an explanation fails one of the six rules, then it should be rejected or at least treated with great skepticism. If you following these six rules you will be a skeptical thinker, supporting or accepting an explanation only when the evidence warrants it. These rules are one of the reasons reports in science are subjected to peer reviews prior to publication to guard against making exactly such mistakes.

After J. Lett. 1990. A field guide to critical thinking. Skeptical Inquirer *14(2): 153-160.*

List of academic databases and search engines

From Wikipedia, the free encyclopedia

This page contains a representative list of notable databases and search engines useful in an academic setting for finding and accessing articles in academic journals, institutional repositories, archives, or other collections of scientific and other articles. Databases and search engines differ substantially in terms of coverage and retrieval qualities. Users need to account for qualities and limitations of databases and search engines, especially those searching systematically for records such as in systematic reviews or meta-analyses.[1] As the distinction between a database and a search engine is unclear for these complex document retrieval systems, see:

- the general list of search engines for all-purpose search engines that can be used for academic purposes
- the article about bibliographic databases for information about databases giving bibliographic information about finding books and journal articles.

Note that "free" or "subscription" can refer both to the availability of the database or of the journal articles included. This has been indicated as precisely as possible in the lists below.

This is a dynamic list and may never be able to satisfy particular standards for completeness. You can help by expanding it with reliably sourced entries.

Name	Discipline(s)	Description	Access cost	Provider(s)
Academic Search	Multidisciplinary	Several versions: Complete, Elite, Premier, and Alumni Edition[2]	Subscription	EBSCO Publishing[3]
Aerospace & High Technology Database	Aerospace, Aeronautics, Astronautics		Subscription	ProQuest[4]

What is R?

Introduction to R

R is a language and environment for statistical computing and graphics. It is a GNU project which is similar to the S language and environment which was developed at Bell Laboratories (formerly AT&T, now Lucent Technologies) by John Chambers and colleagues. R can be considered as a different implementation of S. There are some important differences, but much code written for S runs unaltered under R.

R provides a wide variety of statistical (linear and nonlinear modelling, classical statistical tests, time-series analysis, classification, clustering, …) and graphical techniques, and is highly extensible. The S language is often the vehicle of choice for research in statistical methodology, and R provides an Open Source route to participation in that activity.

One of R's strengths is the ease with which well-designed publication-quality plots can be produced, including mathematical symbols and formulae where needed. Great care has been taken over the defaults for the minor design choices in graphics, but the user retains full control.

R is available as Free Software under the terms of the Free Software Foundation's GNU General Public License in source code form. It compiles and runs on a wide variety of UNIX platforms and similar systems (including FreeBSD and Linux), Windows and MacOS.

The R environment

R is an integrated suite of software facilities for data manipulation, calculation and graphical display. It includes

- *an effective data handling and storage facility,*
- *a suite of operators for calculations on arrays, in particular matrices,*
- *a large, coherent, integrated collection of intermediate tools for data analysis,*
- *graphical facilities for data analysis and display either on-screen or on hardcopy, and*
- *a well-developed, simple and effective programming language which includes conditionals, loops, user-defined recursive functions and input and output facilities.*

The term "environment" is intended to characterize it as a fully planned and coherent system, rather than an incremental accretion of very specific and inflexible tools, as is frequently the case with other data analysis software.

R, like S, is designed around a true computer language, and it allows users to add additional functionality by defining new functions. Much of the system is itself written in the R dialect of S, which makes it easy for users to follow the algorithmic choices made. For computationally-intensive tasks, C, C++ and Fortran code can be linked and called at run time. Advanced users can write C code to manipulate R objects directly.

Many users think of R as a statistics system. We prefer to think of it as an environment within which statistical techniques are implemented. R can be extended (easily) via *packages*. There are about eight packages supplied with the R distribution and many more are available through the CRAN family of Internet sites covering a very wide range of modern statistics.

R has its own LaTeX-like documentation format, which is used to supply comprehensive documentation, both on-line in a number of formats and in hardcopy.

اللجنة المغربية الأمريكية للتبادل التربوي والثقافي
THE MOROCCAN AMERICAN COMMISSION FOR EDUCATIONAL AND CULTURAL EXCHANGE

JOINT SUPERVISION MOROCCAN DOCTORATE GRANTS

What is the Joint Supervision Grant ?

The Joint Supervision Program sends Moroccan doctoral candidates to an American university to pursue a year of study and research with an American Ph.D. co-supervisor.

Candidates selected under this program spend up to one full year at an American university conducting research in labs, libraries, and auditing classes under the supervision of their American co-supervisor.

Ph.D. students interested in this program must first find an American professor willing to host them for one year. Applications must include a letter of invitation from an American professor that clearly states the professor's support for applicants to come and work with them at their university.

The American professor becomes an official co-supervisor along with the applicant's Moroccan supervisor. The American professor's letter must express a clear commitment to supervise and guide the applicant's doctoral work in the United States. The applicant's Moroccan *directeur de thèse* must also write a letter of support expressing their participation in this grant.

Many applications reflect a previously established relationship between Moroccan and the American professors. Equally frequent are applications with the U.S. professor identified through their significance in the applicant's field of research and the applicant having sent out emails to many such professors to find one who will write them a letter of support.

Joint Supervision grantees normally do not take courses for credit at their American host university. Requests for courses for credit must be approved by the Commission and AMIDEAST.

The Joint Supervision grant is preferably for one round-trip to the USA, but upon request, the grant can be divided into two trips. The minimum research time allowed under the grant is two months.

In the USA, administration of the Joint Supervision Program and Joint Supervision students is carried out by AMIDEAST in Washington, DC.

Consider the following :

- *Applications without commitments and authorization from both Moroccan and American professors will not be considered.*
- *Applications must include an evaluation of the applicant's dissertation proposal by both the Moroccan* directeur de thèse *and the American co-supervisor.*
- *Candidates must submit a minimum TOEFL score of 477 for the paper-based test or an internet-based test (IBT) minimum score of 53. Candidates in the humanities must have a minimum 500 / 61.* Applicants who hold a B.A. in English Studies are exempt from this requirement.
- *Applications must include a shortened thesis proposal specifically tailoredfor this application that covers the following points:*

1- the dissertation's hypothesis and overall purpose must be stated clearly in plain English in the first few paragraphs of the modified thesis proposal;

2- how the dissertation's thesis and research are situated in the context of current research in field, taking place in Morocco and in the world in general;

3- how the proposal relates to Morocco's national development needs is an important element in the Selection Committee's consideration of the proposal;

4- a brief review of the relevant literature, including an up-to-date bibliography.

The Joint Supervision Scholarship covers the following :

1) A monthly stipend for a total of 12 months while at the American university, divided into two periods if appropriate. The Joint Supervision grant covers one or two round-trips between Morocco and the American host university;

2) Reasonable charges at the American host university, subject to MACECE's and the U.S. co-supervisor's approval;

3) An allowance of up to $1000 for the purchase of books and materials;

4) An allowance of up to $1000 for the purchase or rental of necessary academic equipment;

5) Medical insurance covering the grantee's period(s) of stay in the U.S.

6) MACECE also provides a round-trip ticket and per diem for the American co-supervisor to attend the PhD thesis defense of the Moroccan student and to spend up to one week in Morocco connecting with Moroccan colleagues and universities.

The maximum period over which Joint Supervision is disbursed is three years.

Like all Fulbright programs, the Joint Supervision grantee must pledge to return to Morocco upon completion of the program.

Appendix 2

English-French

FALSE FRIENDS

English word	=	French false friend	=
Achieve (v.)	Réaliser	**Achever**	to complete
Actually	en fait	**Actuellement**	presently
Adjustment	réglage, correction	**Ajustement**	fitting
Agenda	ordre du jour	**Agenda**	diary
Agony	angoisse, souffrance	**Agonie**	death throes
Affect (v.)	toucher	**Affecter**	assign
Assist (v.)	aider	**Assister à**	to attend
Assurance	garantie	**Assurance**	insurance
Averse	réticent, hostile	**Averse**	downpour
Balance	équilibre, bilan	**Balance**	scale (weighing)
Benefit	avantage	**Bénéfice**	profit
Cart	charrette, chariot	**Carte**	map, card
Classical	classique (style)	**Classique**	standard
Command (v.)	ordonner	**Commander**	to order
Conception	idée	**Conception**	design
Conference	rencontre, congrès	**Conférence**	lecture
Control (v.)	maîtriser	**Contrôler**	inspect, monitor
Curb	frein, restriction	**Courbe**	curve
Deceive (v.)	tromper	**Décevoir**	disappoint
Delay	retard	**Délai**	waiting time
Demand (v.)	exiger, réclamer	**Demander**	to request, apply for
Dispose of (v.)	se débarrasser de	**Disposer de**	to absorb, to have
Dosage	posologie, injection	**Dosage**	assay, analysis
Eventual	final, ultime	**Eventuel**	possible
Evidence	preuve	**Evidence**	fact
Experience	expérience (vie)	**Expérience (labo)**	experiment
Facile	superficiel	**facile**	easy
Facilities	installations	**Facilité**	ease
Formation	élaboration, dispositif	**Formation**	training, development
Hazard	danger	**Hasard**	random
Journal	revue, périodique	**Journal**	newspaper
Large	grand	**Large**	wide, broad
Location	localisation	**Location**	rental
Margin	marge	**Margine**	amurca, lees
Material	matériau-matière	**Matériel**	equipment
Measure	mesure (action)	**Mesure**	measurement
Physician	médecin	**Physicien**	physicist
Realize (v.)	s'apercevoir	**Réaliser**	to achieve
Reclamation	remise en valeur	**Réclamation**	complaint

Report (v.)	signaler, rapporter	**Reporter**	postpone
Respect (v.)	respecter (honorer)	**Respecter (loi)**	to comply with
Response	réaction	**Réponse**	reply, answer
Rest (v.)	se reposer	**Rester**	to remain, to stay
Resume (v.)	reprendre	**Résumer**	to sum up
Resume	C.V.	**Résumé**	summary, abstract
Sensible	raisonnable	**Sensible**	sensitive
Society	association	**Société**	company
Stage	stade	**Stage**	training
Suppose (v.)	imaginer	**Supposer**	to assume
Survey (v.)	étudier, enquêter	**Surveiller**	to supervise, monitor
Table	tableau, table	**Table**	(work) table
Tentative	provisoire	**Tentative**	attempt
Vaccine	vaccin	**Vaccine**	cow pox

Appendix 3

LANGUAGE EXERCISES

1. You are answering an international phone call. Spell your name and provide your home phone number and e-mail address.

2. Put in the plural form.

Cell, language, method.
Address, bus, rash, march, fox.
Study, university.
Half, calf.
Child, ox.
Woman, goose.
CV, TV, DVD, UV.
+, I, p.
Analysis, axis, basis, thesis, hypothesis.
Appendix, matrix, index, vortex.
Maximum, medium, spectrum, datum, bacterium.
Phenomenon, criterion.
Motto, potato, tomato
Formula, vertebra, alga, lamella.
lemma, plasmodesma.
Fungus, nucleus, nucleolus, radius, stimulus, locus.
Series, species, means.
Information, research, equipment, evidence, damage, knowledge.

3. Be more polite.

No, I can't.
Leave a message.
Is it O.K. that I sit here?
Yes, I want.
No, I don't smoke.
No, it's not necessary.
Our prices do not include VAT.

Contact us for more information.
The following documents are enclosures.

4. You are answering a phone call. Complete the phrasal verb.

Hold …
I will call you … when he arrives.
I'm sorry, he's not …
I'm afraid she is …..
I'll put you …..
I'm looking ….. to meeting you soon.
I'm fed … … this repeated story.
I can't put … … this weather.
Could you add those bills …? They add … to 700 dirhams.

5. Transform into passive voice.

We can use two types of sensors to detect heat.
We have made several changes.
We equipped the piston with a transparent head.
We use a computer to process data.
We must design a specific set-up to analyze combustion.
It was thought that a woman could never match a man in politics.

6. Complete the sentence with the verb in parentheses.

Thank you for ….. (pick me up) at the airport.
I'll let you ….. (know) about the European funding.
I'd like you ….. (meet) our lab technician.
I'm looking forward to ….. (see) you at the conference.
Let me ….. (introduce) you to Professor Ait Benhaddou.
It made the arm ….. (move up).
Jones suggested ….. (use) a radio telescope.
The mixture … (not need) … (be) heated.
While she was … (wait) her husband, she was … (listen) Quran.

7. Transform the following sentences as in the example.

An engine with 4 cylinders => a 4-cylinder engine.
Data processing in real time.
A research center for cancer chemotherapy.
A radius of 100 meters.
A computer costing 1,000 dollars.
A robot controlled by a computer.
Research that is developing fast.
A method that already exists.
A vacation that lasts 6 weeks.
Three groups of students.
Groups of three students.
Stress of a drought that is induced by osmosis.
A paint that is light blue.
Only articles in the English language will be considered for publication.

8. Hyphenate the compound adjective if necessary.

An *up to date security system.*
A *well known researcher.*
This software is up to date.
This chimpanzee is well known.
She is one of the best twentieth century writers.
These paintings date from the seventeenth century.

9. Add the definite article ("the") if necessary.

… fibers have been proved to have a beneficial effect on … patient 4.
… electroencephalography is used in cognitive brain research.
… crystalline structure of … azurite has been examined thanks to … microscope.
This reduces the solution to … division by P.
By … transitivity, we obtain … following equation.
… condition of … normality is met.
Most of … people were bored.
He is from … Kingdom of Saudi Arabia and she is from … North Korea.

She graduated from … University of Arizona; and she is working at … Moulay Ismail University.
… Professor Rami will lecture at 11.00 am.
Khalid has a Master's degree in … Algebra.
… knowledge and … wisdom are two different things.

10. Choose at, by, of, on, to, or with.

Replace the wrong answer … the right one.
Choose four students … random.
You should comply … the law, abide … your principles, and stick … your values.
Please, dispose … this dirty paper.
The conclusion will depend … the experimental design.
In his research, my colleague has applied genetics … botany.

11. Complete with: up to, until, as far as, to, down to:

His fever remained high …… 10 pm.
Could you drive me …… the station?
The crater extends ……. the little island.
The pressure dropped …. 2 bars.
I accept to pay …. $1,000.

12. Choose "effect" or "affect".

The viral disease is not …. by diet, but may be … by it.

13. Choose "compose" or "comprise".

That class was … of 20 students. It … 12 boys and 8 girls.
Cellulose is not … by animal cell components; but, with other constituents, it … the plant cell wall.

14. Translate the French word "milieu".

Le milieu de l'intervalle.
Le milieu de culture.
Le milieu social.
Le milieu naturel.
Le milieu acide.
Le milieu d'avril.

15. Choose "essay" or "assay".

Yusra has just finished her … on commerce in Morocco.
Khalid is performing an … on the stone he brought from Tounfite to determine its components.

16. Choose "isolate" or "insulate".

That animal was … from the herd.
They wear warm clothes to … themselves from that freezing cold.

17. Choose the right tense for verbs within parentheses and put the sentences in a logical order.

A. The purpose of this study (to be) to design a system which would allow real-time outdoor detection of pollution gases.
B. It (to be) a well-known fact that weather conditions (to have) an influence on the diffusion process of pollution.
C. This paper first (to describe) the types of devices used and (to show) how the use of neural networks (to provide) an efficient solution for real-time detection of acute atmospheric pollution.
D. However, the equipment presently available (to prove) to be inappropriate for outdoor operation.
E. Chronic pollution for instance (to result) from four main factors: atmospheric pressure and temperature, wind direction, and the nature of pollution gases.
F. The effect of atmospheric conditions on pollution (to be) the subject of numerous investigations over the past 20 years.
G. Weistorm (1999) for instance (to use) traditional lab sensors to collect data.

18. Choose “which” or “that” to complete the following sentences.

They have been studying the magnetic fields ….. are produced by the human brain.
Dyslexia, ….. is known to come from inefficient processing of temporal stimuli, has been the focus of this research.
Alcoholism, ….. is a major problem in western countries, has become a continuing challenge to modern brain research.
Findings prove that only the changes ….. are neurodegenerative can be considered as irreversible.
All the information ….. has been collected so far indicates that this method is the best one ….. can be used in those clinical cases.

19. Replace “as a result” with “which”, “thus” or “thereby” in the following sentence.

An oxidizing agent was introduced. As a result, CO_2 was produced.

20. Complete with “whose”, “among which”, “in which”, “by which” (=whereby).

Mobile phones … use has been spreading considerably over the past 30 years are said to have some adverse effects on health, … headaches are the most frequent.
Base stations, which are the means … radio frequencies are transmitted, have much stronger power levels than regular handsets … RF transmitters have powers in the range of only 0.2 to 0.6 watts.
Therefore, much more attention should be paid to the base stations ... locations are not always carefully selected.

21. Fill in with “whereas”, “however”, “though”, “in contrast with” (= unlike), “in spite of”, “nevertheless”.

… the sun radiates great quantities of neutrinos, the latter cannot be collected and studied.

…, some neutrinos interact with an atom and therefore can be observed.
… other radiations, neutrinos are generated deep into the sun core and have no electric charge.
… American scientists try to detect the neutrinos with a tank of chlorine, the Canadians use heavy water.
…, … improvements in the theoretical calculations, the discrepancy with the experimental data counting the flow of neutrinos remains large.

22. Fill in with "might", "should", "could", "is likely", "seems", "appears".

It ... from the above experiments that the neutrino flux calculations are erroneous.
There … be a fundamental misconception in the theory.
It … also … that there is a flaw in the experiment design.
Another explanation … be that the sun is undergoing a temporary reduction of its activity.
Researchers … revise the standard solar model predicting that the behavior of the sun does not change.

23. Choose "if" or "whether" for the blank.

… the temperature rises, this means the reaction is exothermic.
We need to determine … CO_2 levels have an influence.
It is not known … this theory can be applied in such cases.
It will cause damage ….. the wall of the piston is not protected.

24. choose : "detection of obstacles" or "detecting obstacles".

… is vital for robotics.
… in a complex environment requires special cameras.
… was difficult in this case.

25. Choose "to measure" or "for measuring".

This device is used … the pressure.

We used this device … the pressure.

26. fill in the blanks with “need”, “require”, “request”, “is indispensable” (= is a necessity), or “demand”.

The immigration authorities … an entry visa.
I would … a receipt of payment to be reimbursed.
Authors are … to send their submissions by e-mail.
It … to register accompanying persons prior to the beginning of the conference.
This participant was not happy. He … a discount since he was not given a copy of the proceedings.
You are kindly … to send a deposit to confirm your hotel reservation.

27. Choose “consist in” or “consist of”.

Her duties consist ... welcoming visitors.
The exhibition consists ... 180 drawings.

28. Choose “few” or “a few”, “quite a few” (a good few), “little”, “a little” or “quite a little”.

I will give you … examples.
It is easy. … people can do it.
He was lonely. He had … friends.
Fatima speaks … English (some English).
I was… afraid of that exam (very afraid).
She was … known in this new neighborhood.

29. put “a” or “an”.

… error is … mistake.
In 2003, … university in China started ranking world universities.
There exists … M satisfying condition 3.
… herb is … seed-bearing plant that does not have … woody stem.

30. Choose less, fewer or lesser

The street now has ... trees.
Some plants do better with ... sun.
He served ... than six years in prison.
they nest mostly in Alaska and to a ... extent in Siberia.
... trade means ... jobs.
I have had ... problems lately.
They have to choose the ... of two evils, war or dictatorship.

31. Choose bored or boring.

The students were ... because the lecturer was ...
Ironning is ...

32. Choose to or too.

.
I'll do anything you want me …
The weather changed from hot … cold.
Temperatures fell … freezing.
The shark was … close for comfort.
Is Jenny going …?
… many people, that sounds stupid.
… many people were there.