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Unit 1

THE SCIENTIFIC ATTITUDE

What is the nature of the scientific attitude, the attitude of the man or woman who studies and applies physics, biology, chemistry, geology, engineering, medicine or any other science?

We all know that science plays an important role in the societies in which we live. Many people believe, however, that our progress depends on two different aspects of science. The first of these is the application of the machines, products and systems of applied knowledge that scientists and technologists develop. Through technology, science improves the structure of society and helps man to gain increasing control over his environment. New fibres and drugs, faster and safer means of transport, new systems of applied knowledge (psychiatry, operational research, etc.) are some examples of this aspect of science.¹

The second aspect is the application by all members of society, from the government official to the ordinary citizen, of the special methods of thought and action that scientists use in their work.²

What are these special methods of thinking and acting? First of all, it seems that a successful scientist is full of curiosity—he wants to find out how and why the universe works. He usually directs his attention towards problems which he

notices have no satisfactory explanation, and his curiosity makes him look for underlying relationships even if the data available seem to be unconnected.³ Moreover, he thinks he can improve the existing conditions, whether of pure or applied knowledge, and enjoys trying to solve the problems which this involves.

He is a good observer, accurate, patient and objective and applies persistent and logical thought to the observations he makes.⁴ He utilizes the facts he observes to the fullest extent. For example, trained observers obtain a very large amount of information about a star (e.g. distance, mass, velocity, size, etc.) mainly from the accurate analysis of the simple lines that appear in a spectrum.

He is sceptical—he does not accept statements which are not based on the most complete evidence available—and therefore rejects authority as the sole basis for truth. Scientists always check statements and make experiments carefully and objectively to verify them.⁵

Furthermore, he is not only critical of the work of others, but also of his own, since he knows that man is the least reliable of scientific instruments and that a number of factors tend to disturb impartial and objective investigation (see Unit 8).⁶

Lastly, he is highly imaginative since he often has to look for relationships in data which are not only complex but also frequently incomplete. Furthermore, he needs imagination if he wants to make hypotheses of how processes work and how events take place.

These seem to be some of the ways in which a successful scientist or technologist thinks and acts.

Glossary

1. **geology** [dʒi'ɒlədʒi] **n.** a science that deals with the origin and history of the earth and its life, esp. as recorded in rocks (地质学)
2. **technologist** [tek'nɒlədʒist] **n.** a person who devotes himself to applying practical sciences to engineering or industrial arts
3. **psych-** concerning the mind, as opposed to the body
psychiatry [sai'kaiətri] **n.** the branch of medicine concerned with the treatment of mental disorders (精神病学)
4. **operational research** [ɒpə'reɪʃənl ri'sə:tʃ] also **operations research** mathematical or scientific analysis of the systematic efficiency and performance of manpower, machinery, equipment, and policies used in a governmental, military or commercial operation (运筹学, 即对人力、机械设备、政策的运行或执行情况以及系统的效益, 进行数学分析, 常用于管理、军事、商业等方面。)
5. **persistent** [pə'sɪstənt] **adj.** refusing to give up or let go; pushing on, esp. against opposition
6. **spectrum** [s'pektrəm] **n.** the distribution of a characteristic of a physical system or phenomenon, esp. the distribution of energy emitted by a radiant source, arranged in order of wavelengths (谱, 指某一物理系统或现象, 其性能的分布范围, 尤指光谱, 即某一辐射源发出的能量, 根据其波长的大小依次排列的图案。)
7. **sceptical** ['skeptɪkəl] **adj.** also **skeptical** unwilling to believe or ready to question
8. **objective** [əb'dʒektɪv] 1) **n.** goal, purpose, something that

- one tries to achieve; 2) **adj.** not influenced by one's own personal feelings or opinions; based on observable phenomena
9. **impartial** [im'pɑ:fəl] **adj.** fair; just; giving equal attention to all concerned, not favoring one more than others
10. **imaginative** [i'mædʒineitiv] **adj.** having or showing a good ability to think creatively and inventively
11. **data** ['deɪtə] **pl. n.** (used with a singular or plural verb) information, esp. information organized for analysis or used as the basis for a decision
12. **hypothesis** [hai'pəθisis] **n.**
hypotheses [hai'pəθisi:z] **pl.** something not proved but taken to be true for the purpose of argument or further study or investigation

Notes

1. *new fibres and drugs*: newly made or man-made fibres and drugs. Until the 20th century drugs were obtained primarily from plants. Beginning about 1900 drugs from animal sources became available. The development of organic chemistry made it possible that many drugs could be synthesized more cheaply than those isolated from plants and animals. For more information refer to Speed Reading Passage 1. (此处的 new 系指“新合成的”或“人造的”。二十世纪之前,药物主要从植物中提取。1900年前后,动物也开始成为制作药物的来源。有机化学的发展使人们有可能用合成的方法获得许多新药。其成本要比从动植物中提取低得多)。

transport: transportation in U.S.A.

new systems of applied knowledge: new branches of applied science. The words in brackets (psychiatry, operational research)

suggest this. Also, science might be defined as a body of knowledge organized in a systematic manner. (这一短语系指应用科学的新分支。有两个佐证,一.括弧内列出的“精神病学”、“运筹学”便是;二.科学就是一知识体系。)

2. *the application by all members of society... of the special methods of thought and action:* the fact that all members of society apply the special methods of thought and action. This is called nominalization, which means using a noun phrase to replace a noun clause. Because it simplifies sentence structure by using less words, nominalization has become one of the characteristics of Scientific English. (这种结构叫做名词化,即用名词短语来替代名词从句。由于这种句子用词较少,结构简单,现已成为科技英语的特点之一。)

3. *...which he notices have no satisfactory explanation:* these problems, he notices, have no satisfactory explanation. In this attributive clause, “he notices” functions as a parenthesis, that is, an explanatory phrase or clause. Such verbs as *say, know, think, notice, consider, believe, etc.*, are often used this way. (在 *which* 引出的定语从句中, *he notices* 起插入语句的作用。) Some examples follow:

a. How many kinds of electric current *do you know* are there in common use? (你知道通常使用的电流有几种?)

b. Who *did you say* came today? (你说今天谁来了?)

c. We are here to fight for what *we believe* is right. (我们是为了对我们认为是正确的进行争辩而到这里来的。)

d. The author meant these questions to emphasize the very things which *he felt* were of great importance. (作者提出这些问题,其用意就是为了强调那些作者本人认为是十分重大的事情。)

4. In this unit several phrasal verbs are used. One type is *v. + n. + prep.*, in which the key element is the noun, while the verb has little or no meaning at all. Its only function is to show that this is a phrasal verb. In translating into Chinese, it is better to change this English noun into a Chinese verb. Likewise, if any adjective is used as a modifier in the phrase, it will be accordingly translated into a Chinese adverb. (英语中有一种短语动词的组成规律是：“动词+名词+介词”。其中的动词基本上不表示什么意义，只表示该短语是动词性的；其中的名词是该短语中的基本要素。译成汉语时，最好将这个名词译成动词，如英语中还用有形容词，则也可相应地译成副词。)

gain increasing control over: 愈来愈能控制

direct attention towards (to): 注意(重)

apply persistent and logical thought to: 对……反复不断地运用推理加以思考

play an important role in: 有(起)重大作用

5. Note that the two adverbs here “carefully” and “objectively” modify not only the verb “make”, but the verb “check” as well. This is known as multiple modification. That is, a modification is applicable to more than one head. The attributive clause in Para. II also illustrates the point: “that scientists and technologists develop” modifies all the three nouns preceding the clause, namely, “the machines”, “products”, and “systems of applied knowledge”. (此处的两个副词同时修饰 make 和 check 两个动词。这叫做复合修饰语，即同一个修饰语同时修饰一个以上的中心词。第二段中的定语从句也是这样，它修饰主句中的三个名词。)
6. Note several different uses of “of” in this unit. (请注意本单元中 of 的几个用法。)

- 1) used with **an** action noun to link it with a following noun that is either the subject or the object of that action, e.g., the discovery of Dr. Thomson; the discovery of an element, but the discovery of an element by Dr. Thomson. In addition, a noun clause can also be used after "of" to denote the object, e.g. to make hypotheses of how processes work... (与动作名词连用, 表示该动作的主体或客体; 后面还可接一从句表示动作的客体。)
- 2) used with certain adjectives to indicate the object of an action implied by the preceding adjective, e.g., full of curiosity; critical of the work (与某些形容词连用, 表示该形容词所示动作的客体。)
- 3) used after superlatives to indicate the sense of "from among" e.g., the eldest of the three; the least reliable of scientific instrument. (与形容词最高级连用, 表示选择。)

Exercises

Comprehension

1. Paragraph Summary: Which of the following best sums up the main idea of each paragraph?
 - 1) Para. 1
 - a. How to define science
 - b. How to define the scientific attitude
 - c. The essence of the scientific attitude
 - 2) Para. 2 and 3
 - a. Basic and applied science
 - b. The important role of science

- c. Two aspects of science: knowledge and the way of its being acquired and organized
- 3) Para. 4
- a. Asking why for everything—key to success
 - b. Eagerness to understand and control nature—an important qualification for a scientist
 - c. Scientist—a problem-solver
- 4) Para. 5
- a. How to obtain information about a star
 - b. The need for a scientist to cultivate powers of observation
 - c. The importance of spectrum analysis in getting information about a star
- 5) Para. 6 and 7
- a. Open-mindedness and everything being based on evidence—two other important qualities for a successful scientist
 - b. The need for a scientist to perform experiments carefully and objectively
 - c. Avoiding being influenced by subjective thinking—key to success
- 6) Para. 8
- a. Forming a hypothesis—the first step in research
 - b. Active and creative thinking—yet another characteristic of a scientist
 - c. Seeking for order in disorder—one goal of a scientist
2. Vocabulary Recognition or Substitute Reference: The meaning of a word or phrase is best understood from its context—the words around it. Decide which of the following fits the

word or phrase as it is used in the paragraph.

- 1) nature (1.1)
 - a. the external world
 - b. kind or order
 - c. substance or essence
- 2) scientific attitude (1.1)
 - a. an attitude which agrees with the principles of science
 - b. an attitude towards science
 - c. a systematic and exact attitude
- 3) that (1.8)
 - a. systems
 - b. knowledge
 - c. machines, products and systems
- 4) develop (1.9)
 - a. advance to a higher stage
 - b. bring into existence
 - c. improve the value of
- 5) action (1.17)
 - a. act
 - b. activity
 - c. doing things
- 6) curiosity (1.20)
 - a. desire for knowledge of something interesting or strange
 - b. the quality of being interested in things because of their oddness or novelty
 - c. eagerness to learn or inquisitiveness
- 7) works (1.21)
 - a. makes or performs something
 - b. operates or functions
 - c. proves practicable
- 8) underlying (1.24)
 - a. fundamental
 - b. lying beneath
 - c. present though not obvious
- 9) available (1.24)
 - a. to be had
 - b. able or ready to be used

- c. able to be seen
- 10) improve (1.25)
- a. make or become better
 - b. increase the value of
 - c. advance to a higher stage
- 11) conditions (1.26)
- a. requirements which must be met before something is done
 - b. environment
 - c. state in which things exist (the level where science developed)
- 12) this (1.27)
- a. pure or applied knowledge
 - b. improvement of the existing conditions
 - c. the seeking of underlying relationship
- 13) accurate (1.28)
- a. exact
 - b. free from error, especially as the result of care
 - c. agreeing with the exact truth
- 14) patient (1.28)
- a. suffering with calmness
 - b. capable of enduring unfavorable conditions without showing serious effects
 - c. persevering and untiring in long-continued work
- 15) statements (1.35)
- a. act of stating
 - b. that which is stated
 - c. facts, conclusions, etc.
- 16) if (1.46)
- a. on condition that
 - b. whether
 - c. even though
- 17) how (events take place) (1.47)

a. in what way b. for what reason c. to what extent

3. Discussion and criticism:

- 1) Do you think there are other special ways of thinking and acting, used by scientists? If so, comment and explain.
- 2) Do you think some of these ways are more important than others? If so, give reasons.
- 3) Do you know of any famous scientist whose work demonstrates some or all the qualities mentioned in the passage? Give details.
- 4) Do you agree that it is important to train the non-scientist to think in a scientific way (11.15-18). Give good evidence for your point of view.
- 5) Do you agree that "man is the least reliable of scientific instruments" (11.41-42)? Give examples.
- 6) Give a clear explanation of what you think the word "authority" (1.37) means.

Skills Development

1. Put in the missing words. If you have difficulty doing this, refer to the list given at the end of the exercise.
 - 1) Benjamin Franklin wondered about lightning. He combined his _____ with imagination and performed his famous kite experiment to show that lightning and an electric spark are the same thing.
 - 2) Science as a method of _____, as well as an accumulated and verified body of _____ about the natural environment, grows in importance in education. Science as a force in the modern world, and technology as science _____ to the daily affairs of man, has

gained a firm place in the elementary school curriculum.

- 3) Man, as the only living thing that is the product and at the same time master of environment, is gaining increasing _____ the environment.
- 4) A scientist has to use certain processes of investigation. These methods include reading what he _____ other scientists have done, making _____ observations. carefully designing _____ (including experiments), developing theories, and the like.
- 5) Sometimes evidence is _____. It may take time for new facts to become available. When they are _____, a person may have to change his mind. The mind cannot be made up once and for all. New knowledge may make a change in thinking necessary. So you see, what is _____ as true often is relatively, and not absolutely, true.
- 6) Creative thinking plays a central _____ in discovery. It helps people to understand the physical world and control _____.
- 7) Successful research workers usually are people who are highly _____ and are not afraid to speculate, but who are also _____ their investigations.
- 8) The _____ of new scientific discoveries to industrial production usually make jobs easier.

A list for reference:

accepted, accurate, application, applied, available, control over, critical of, curiosity, imaginative, incomplete, investigations, knowledge, knows, nature, role or part, thinking or thought

2. Translate the following passage into Chinese:

It is characteristic of scientific thinking to keep an open mind on a subject until there is enough evidence on which to base a statement, and even then the science is not dogmatic. Scientific thinking is sometimes described as impartial and objective, that is, the scientist should not allow his judgment to be influenced by personal tendency of one-sidedness. In practice the objectivity is only partly followed. It must be admitted that in contemplating problems and seeking a hypothesis, a scientist, the least reliable of scientific instruments, sometimes is required to permit subjective factors to enter into the event. Strict discipline is followed, however, in avoiding subjective influence in planning and executing experiments and observations. Instrumental measurements are employed wherever possible in preference to measurements involving human judgment. If it is necessary to use human judgment in assessing results, then objectivity can be achieved by some device, such as the assessment of the results by a person who does not know what results are expected. If there is a characteristic that distinguishes the scientist from the others, it is perhaps his independence of mind, which demands demonstrable evidence to enable him to form his own judgment, and his unwillingness to accept uncritically the views of authorities on matters within his speciality.

3. Translate the following sentences into English:

- 1) 随着科学技术的进步,人类越来越能控制自然界,并使它做一切人类想让它做的事。
- 2) 看来,如果一位科学家想有所成就的话,他不仅必须善于观察,而且对其观察所得,运用推理予以思考。
- 3) 我们应当采用一整套在我们看来为顺利完成这次任务所

必不可少的、专门的工作方法。(using a parenthesis)

4) 核物理学是研究物质的最小微粒如何变化的。
(using the pattern "n + prep + noun clause")

5) 美国的 J·亨利(Henry)和英国的 M·法拉第(Faraday) 两人在1832年前后发现了感应电动势(induced emf),结果使当时的技术有了巨大的发展。(nominalization)

4. Speed Reading: Select the answer which is most accurate according to the information given in each passage.

Passage 1

Fibres are all around us and within us. They have been used to make our clothes, the curtains at the window, and the blankets on the bed. The fibres that are within us form connective tissue—strong elastic tissue that holds the various parts of our bodies together.

Fibres fall into two categories: natural fibres and man-made or synthetic fibres. The former refer to threadlike materials obtained from plants and animals. The significant animal fibres are hair, wool and silk; the most important plant fibres are cotton, woodpulp and jute. The latter are in fact imitations of natural fibres.

Throughout the ages men have used vegetable and animal fibres to make cloth, paper, rope and many other articles. Natural fibres still form the bulk of the world's fibre production. But there are only a thousand or so plants and animals that produce fibres that can be useful to man, In order to satisfy the ever-increasing need it has been necessary to develop a greater variety of man-made fibres. Modern science has made this possible. The man-made fibre industry started when chemists learned how to use cellulose for fibre. They also developed fibre bases unlike any natural substance. The chemical processes for making fibre bases can be varied to create special properties

in fibres for various purposes. Chemistry can produce stretch-resistant fibers. It can produce fibres with high resistance to wear, to chemicals, and to heat. Some kinds are made transparent, and others excel in holding color despite exposure to sunshine and weather. Some synthetic fibres, though more expensive, have replaced natural fibers by giving better service. For example, man-made fibres make the best cords for automobile tyres. In the United States man-made fibres now are used more than any natural fibre, except cotton. Because of their special qualities countless new uses also have been developed.

Even cotton and wool, which are, basically natural fibres, are quite frequently chemically modified or treated in order to improve their properties. As a result the final products can be considered as partially synthetic.

- 1) Fibres can be found _____ .
 - a. everywhere around us
 - b. in human bodies
 - c. in vegetables and animals, men included
- 2) Fibres are of _____ .
 - a. various kinds, such as cotton, wool, silk, etc.
 - b. two categories—natural and man-made fibres
 - c. three kinds, namely natural, synthetic and blending fibres
- 3) Synthetic fibre is a _____ development, the list of applications ranging _____ .
 - a. relatively new; from clothing to industrial uses
 - b. new; from clothing to everyday articles
 - c. completely new; from industrial uses to most advanced branches of science

- 4) In "It can produce fibres with high resistance to wear..." (Para. 3), "to wear" is _____.
- an infinitive, meaning "to have or carry something on one's body"
 - an infinitive, meaning "to be reduced by use"
 - a prepositional phrase, in which the noun "wear" means "the quality of resisting the effects of constant use"
- 5) In "... and others excel in holding color despite exposure to sunshine and weather." (Para. 3), "holding color" here means _____.
- "not changing color"
 - "not fading, or being colorfast"
 - "possessing the usual appearance"

Passage 2

Operations research is a scientific study of organizations and other systems that usually involve interactions between men, their decision procedures, and equipment, for the purpose of improving or optimizing performance. As the definition suggests, operations research brings the power of the scientific method to bear on operational problems. With this approach, operational problems are broken down into several distinct stages: problem formulation, including establishment of the objectives of the study and measures of the effectiveness of possible solutions; gathering and classification of data; construction of a theoretical model of the problem, with related hypotheses; finding methods of solution; and, finally, testing solutions in real-world situations.

In times of war military commands are faced with such problems as increasing the effectiveness of existing weapons systems and allocating scarce resources to the various military operations. But