SECTION T

TOUS - UNDERSTANDING THE NATURE OF SCIENCE

UNDERSTANDING THE NATURE OF SCIENCE

1. Modern scientists can solve more complicated problems than the scientists of the past because they

   A. know that many of the ideas of earlier scientists were wrong.
   B. have more imagination than earlier scientists.
   C. can build on the ideas and discoveries of earlier scientists.
   D. are more intelligent than earlier scientists.
   E. receive a better education than earlier scientists.

2. Betty is planning an experiment on the conditions required for seeds to germinate. She knows that they need water and air and thinks that warmth and light may also be necessary. She plans to set up one experiment in which seeds of various kinds are given water and air in a warm light place.
   What other experiments should she set up?

   A. One other in which the seeds are without water and air and are kept in a cold, dark place.
   B. One other in which the seeds are without water and air and are kept in a cold, light place.
   C. One other in which the seeds have water and air and are kept in a cold, dark place.
   D. Two others; one in which the seeds have water and air and are kept in a cold, light place, and one in which the seeds have water and air and are kept in a warm, dark place.
   E. Two others, one in which the seeds have water and air and are kept in a cold, dark place and one in which the seeds are without water and air and are kept in a warm, light place.

3. All the following play some part in scientific discovery, but one of them is more characteristic of scientific investigation than the others. Which one is it?

   A. Measurement and calculation.
   B. Using complicated apparatus.
   C. Making experimental measurements more accurate.
   D. Checking through the work of earlier scientists.
   E. Testing ideas by observation and experiment.

4. Scientific discoveries have come from
   A. many countries of the world.
   B. only countries with big industries.
   C. only countries with large populations.
   D. almost all the countries with free education for all.
   E. only countries where the governments finance research.

5. In the past, important scientific discoveries were made by clergymen, statesmen, businessmen, and others who worked on science as amateurs. Why is this less true today?

A. Men in other professions are less interested in science today than they used to be.
B. Scientific research today requires many years of specialised preparation and training.
C. Important discoveries cannot be made today without expensive equipment, which only scientists possess.
D. Only professional scientists have the abilities needed to make important discoveries.
E. Everyone now has to work so hard at his own job that there is not time to work on science as an amateur.

6. We do experiments when we are learning science because

A. experiments are used to test ideas by experience.
B. experiments enable us to learn better.
C. experiments make learning more interesting.
D. we can show that we all get the same results.
E. it is important to learn to handle apparatus skilfully.

7. Why should one make a written note of all the observations made when carrying out a scientific investigation?

A. One might forget them, and they may turn out to be important later.
B. It is a good way to train powers of observation.
C. It trains one to think clearly and write accurately.
D. Good scientists always do it.
E. One is supposed to have a complete record of what one has done.

8. Which of the following is the most complete statement of what scientists <u>study?</u>

A. Atoms, radiations, life.
B. Substances, energy, living things.
C. Matter, space, waves.
D. Plants, animals, micro-organisms.
E. Molecules, earth, stars.

9. Which one of the following is the best description of a scientific experiment?

A. Measurements made to find the value of a physical constant to a greater degree of accuracy.
B. Observations made to learn more about natural phenomena.
C. Observations made under controlled conditions to test a given hypothesis.
D. Studies made with scientific equipment to verify natural laws.
E. Measurements made under specified conditions to support crude, unaided observations.

10. A scientist predicted that an experiment would come out in a certain way. When he did the experiment, the result was different from what he expected. As a scientist, which of the following would be his most likely reaction?

A. "I should not have made a prediction before trying out the experiment."
B. "I will improve the experiment and made it come out in the way I predicted."
C. "If I had better equipment for the experiment, I would get the right results."
D. "If I practise long enough, it will come out in the way I want it to."
E. "Something was wrong either with my prediction, the experiment, or my observations."

11. When new evidence that does not fit into a well-established scientific theory appears, which one of the following do scientists usually do?

A. Discard the theory and produce a new one.
B. Modify the evidence in such a way that it does fit the theory.
C. Keep the theory because it has proved useful and ignore the new evidence.
D. Change the theory in such a way that the evidence can fit it.
E. Design experiments to refute the new evidence.

12. The test of the validity of a scientific theory is that the theory

A. makes it easy to understand the world we live in.
B. stimulates further scientific investigation.
C. gives a simple picture of a complicated pattern of natural events.
D. makes a clear distinction between what are facts and what are beliefs.
E. explains all the known facts related to certain phenomena.

13. An astronomer in Australia reports that he has seen evidence of plant growth on the planet Venus. Scientists will accept this report as important evidence if

A. other independent observations confirm the report.
B. the species of plants have been identified.
C. the Australian government certifies the observation as correct.
D. other astronomers agree that there is oxygen on Venus.
E. the astronomer in Australia is a biologist as well as an astronomer.

14. Which of the following is the principal aim of scientific investigation?

A. To verify what has already been discovered about the physical universe.
B. To describe and explain natural phenomena in terms of principles and theories.
C. To discover, collect and classify as many facts as possible about inanimate and animate nature.
D. To provide the people of the world with the means for leading happier lives.
E. To make the world more technologically advanced and so do without hard physical labour.

15. John Smith is a very imaginative young person. If he does not become a scientist, what is the most likely explanation?

A. He might not want to give up his freedom of thought.
B. Imaginative people usually become artists or writers.
C. He might like some other field of work better than science.
D. Science is too factual and gives no scope for the imagination.
E. A scientist has to be objective which is impossible if one is imaginative.

UNDERSTANDING THE NATURE OF SCIENCE

1. Which of the following is the most complete statement of what scientists study?

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   E. Molecules, earth, stars.

2. Which of the following is the best description of a scientific law?

   A. A good guess about how things happen in nature.
   B. A rule that a scientist follows when he is working.
   C. A statement that summarises similar events in nature.
   D. A concise summary of the results of an experiment in mathematical terms.
   E. A description of natural events by the use of theoretical ideas.

3. Gay-Lussac carried out many experiments with gases and observed that when gases are heated, their volumes always increase in the same way provided that the pressure remains the same. Gay-Lussac expressed this by saying, "at constant pressure, the volume of a given mass of gas varies directly with the temperature." His statement is an example of

   A. the formulation of a scientific theory.
   B. the testing of a scientific hypothesis.
   C. the statement of a scientific law.
   D. a deduction from kinetic theory.
   E. stating the result of a scientific experiment.

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5. If a botanist wants to determine the factors that contribute to the growth of a certain plant, which of the following things would be <u>least</u> likely to help him?

   A. To formulate an hypothesis based on what he thinks the factors are.
   B. To find the mathematical equation that fits the plant's growth curve
   C. To think about the factors that contribute to the growth of other plants.
   D. To look the subject up in the library.
   E. To talk his problem over with other botanists.

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E. Design experiments to refute the new evidence.

8. Which one of the following best describes the purpose of a scientific theory?

A. It provides the final answer to a scientific question.
B. It gives directions for making use of scientific discoveries.
C. It relates facts and explains different natural events.
D. It suggests good methods for carrying out scientific experiments.
E. It implies the questions that lead to further important experiments.

9. In the 17th century, Newton formulated his laws of motion and the theory of universal gravitation, which were eventually accepted by all physicists. In the 20th century, Einstein proposed the much broader theory of relativity, which physicists have now generally accepted. Physicists today consider Newton's ideas as

A. mistaken because of Newton's limited experience.
B. concepts that can be contained within Einstein' theory.
C. applicable only to physical events in the solar system.
D. superior to Einstein's because they can be used to solve many physical problems.
E. historically interesting but no longer of much value.

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E. To make the world more technologically advanced and so do without hard physical labour.

12. If we ask an astronomer to explain why some stars vary in their apparent brightness, he will most likely give his explanation in terms of

A. the logical necessity for some stars at least to vary in brightness.
B. accepted scientific laws and principles.
C. precise mathematical formulae and equations.
D. verified astronomical data.
E. the theory of the expanding universe.

13. John Smith is a very imaginative young person. If he does not become a scientist, what is the most likely explanation?

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14. Today, physicists of several countries are working on experiments to determine whether or not one of Einstein's theories correctly predicts the effect of gravity on light. This work best illustrates the fact that

A. an important function of a theory is to stimulate research.
B. it is important to have an accurate value for the velocity of light.
C. space travel has uncovered new facts that need explanation.
D. it takes a long time before a theory is found to be generally acceptable.
E. some people will always doubt the value of any theory.

15. The word model has a special meaning in science and models play an important part in scientific thinking. An example of a scientific model is "the atom is like a miniature solar system composed of electrons in orbits round a nucleus containing protons and neutrons". Which of the following statements about scientific models is NOT correct?

A. Models are mental images and may not represent reality.
B. Models contain as few assumptions as possible.
C. Models represent what scientists could see with very powerful instruments.
D. Models are only tentative and may be modified or discarded.
E. Models are useful because they express the unknown in terms of the known.

POPULATION IV CHEMISTRY PRACTICAL (National Option)

Item	Correct Response	Behaviour Category	Source	Marks
1	A.I.K.U.	II	1.24	
	A.J.R.T.	II		8
2	N.R.S.V.	II	2.26	4
3X	E.H.	II	2.27	
Y	D.G.	II		
Z	D.H.	II		6
			Total	18

Summary of Behaviour Categories

I		0	0
II	18	0	18
III		12	12
	18	12	30
	Practical	Pen and Paper	Total

POPULATION IV PHYSICS PRACTICAL (National Option)

Item	Correct Response	Behaviour Category	Source	Marks	
1	A	I	1.25	1	
2	C	I	1.26	1	
3	E	III	1.27	1	
4	B	III	1.28	1	
5	II = I + III	III	2.31	1	If II = I + III within 20%
	II = IV or I + III = IV			1	If II = IV or I + III = IV (not both) within 20%
	V = VI + VII			1	If V = VI + VII within 20%
6	A	III	2.32	1	
7	1.48 to 1.52	II	2.33	1	
			Total	9 x 2 to bring close to the biology and chemistry scores	

Summary of Behaviour Categories

	Practical	Pen and Paper	Total
I	2	0	2
II	1	0	1
III	6	12	18
	9	12	21

SECTION 2 (FOR POPULATION II)

UNDERSTANDING THE NATURE OF SCIENCE

ANSWER CODE

	1.	C	* 9.	C
	2.	D	* 10.	E
	3.	E	* 11.	D
	4.	A	12.	E
	5.	B	* 13.	A
	6.	A	* 14.	B
	7.	A	* 15.	C
*	8.	B		

* Anchor item with Population IV

SECTION 2 (FOR POPULATION IV)

UNDERSTANDING THE NATURE OF SCIENCE

ANSWER CODE

*	1.	B		9.	C
	2.	C	*	10.	A
	3.	C	*	11.	B
*	4.	C		12.	B
	5.	B	*	13.	C
*	6.	E		14.	A
*	7.	D		15.	C
	8.	C			

* Anchor items with Population II