



QUESTIONS FROM TEXTBOOK SOLVED

Question 1. 1. Some of the most profound statements on the nature of science have come from Albert Einstein, one of the greatest scientists of all time. What do you think did Einstein mean when he said: "The most incomprehensible thing about the world is that it is comprehensible"?

Answer: The whole of physical world is complex in nature. The biological world has its own complexities. Moreover, vastly different orders of magnitudes are involved in space, time and mass. In spite of all this, almost all the physical phenomena can be expressed in terms of few basic laws. When viewed in this context, Einstein's statement becomes very clear.

Question 1. 2. "Every great physical theory starts as a hearsay and ends as a dogma". Give some examples from the history of science of the validity of this incisive remark.

Answer: A common observation in our daily life is that light travels in straight line. When Huygens propounded his wave theory, it was against the accepted belief. However, soon it became a dogma as reflection, refraction etc., could be successfully explained on the basis of wave theory. When photoelectric effect was discovered then it was found that wave theory of light cannot explain the phenomena and we came to a conclusion that light truly has dual characteristic. It may behave both as wave and a particle. We may consider other similar examples from the history of science.

Question 1. 3. "Politics is the art of the possible". Similarly, "Science is the art of the soluble". Explain this beautiful aphorism on the nature and practice of science.

Answer: Science is a systematised study of observations. A scientist patiently analyses these observations and comes out with certain laws. As an illustration, Tycho Brahe worked for twenty long years to make observations on planetary motions. It is from this huge reservoir of observations that Kepler formulated his three famous laws of planetary motion. Thus, science is the art of the soluble just as politics is the art of the possible.

Question 1. 4. Though India now has a large base in science and technology, which is fast expanding, it is still a long way from realising its potential of becoming a world leader in science. Name some important factors, which in your view have hindered the advancement of science in India.

Answer: Some of the important factors which have hindered the growth of science in India are given below:

- Lack of infrastructure and funds for quality research work in science.
- Science education is neither properly oriented nor directed. It needs specific directions depending on our requirements.
- The rural based science education is nearly non-existent so that majority of population is deprived of the benefits of advancements in science and technology.
- Poor pay scales and other facilities to scientists as compared to administrators.
- Indian society is full of superstitions and is highly traditional.

Therefore, they are slow in adopting the new scientific trends.

- There is practically no co-ordination between the researchers and the industrialists. The industrialists are the actual consumers of new research and technology. The industrialists of this country have little confidence in the ability of the Indian scientists.

Question 1. 5. No physicist has ever "seen" an electron. Yet, all physicists believe in the existence of electrons. An intelligent but superstitious man advances this analogy to argue that 'ghosts' exist even though no one has 'seen' one. How will you refute his argument?

Answer: Many phenomena which depend upon the existence of electrons have been predicted and actually observed in everyday life. There is no phenomenon which can be explained on the basis that ghosts exist though they are not seen. So, obviously, the comparison between two situations does not make any sense.

Question 1. 6. The shells of crabs found around a particular coastal location in Japan seem mostly to resemble the legendary face of a Samurai. Given below are two explanations of this observed fact. Which of these strikes you as a scientific explanation?

(a) A tragic sea accident several centuries ago drowned a young Samurai. As a tribute to his bravery, nature through its inscrutable ways immortalised his face by imprinting it on the crab shells in that area.

(b) After the sea tragedy, fishermen in that area, in a gesture of honour to their dead hero, let free any crab shell caught by them which accidentally had a shape resembling the face of a Samurai. Consequently, the particular shape of the crab shell survived longer and therefore in course of time the shape was genetically propagated. This is an example of evolution by artificial selection. [Note: This interesting illustration taken from Carl Sagan's 'The Cosmos' highlights the fact that often strange and inexplicable facts which on the first sight appear 'supernatural' actually turn out to have simple scientific explanations. Try to think out other examples of this kind],

Answer:

- (a) The explanation given in option
(b) strikes as a scientific explanation.

Question 1. 7. The industrial revolution in England and Western Europe more than two centuries ago was triggered by some key scientific and technological advances. What were these advances?

Answer: Some of the key advances during that period in science and technology include the application of heat and thermodynamics to form the steam engine. Discovery of electricity helped in designing dynamos and motors. Study of gravitation led to the study of motion and making guns and cannons. This gave power in the hands of western countries and they ruled over rest of the world. The discovery of explosives not only helped army but also mineral exploration. These are some examples of scientific and technological advances which helped England and Europe to have their prominent positions in the world. In fact, the progress in chemistry, physics and natural sciences brought the industrial revolution in England and western Europe.

Question 1. 8. It is often said that the world is witnessing now a second industrial revolution, which will transform the society as radically as did the first. List some key contemporary areas of science and technology, which are responsible for this revolution.

Answer: Some key contemporary areas of science and technology, which are chiefly responsible for a new industrial revolution taking place now and likely to take place in near future are: (i) Design of super-fast computers.

- Biotechnology.
- Developments in the field of space sciences.
- Development of super-conducting materials at room temperature.
- Advancements in the field of electronics, information technology and nanotechnology.

Question 1.9. Write in about 100 words a fiction piece based on your speculation on the science and technology of the twenty-second century.

Answer:

1. The development on the front of genetic engineering and biotechnology will include:
 - (a) Production of man, animals and plants with specific characteristics.
 - (b) High yielding variety of plants and specific crops would be sown.
2. Multiple use of laser in various fields or even more developed device which will transform the world. Man would treat himself as the king of universe.
3. Man may travel in space with unthinkable speeds and transportation would be totally revolutionised.
4. Man would travel deeper into the space and may settle on other planets, befriend strange creatures from other worlds or may wage a war with them.
5. In the field of communication, 22nd century has many surprises in store. Two persons sitting on the globe or on moon would talk on phone face to face.
6. Man may partially conquer diseases and slow down ageing.

Question 1.10. Attempt to formulate your 'moral' views on the practice of science. Imagine yourself stumbling upon a discovery, which has great academic interest but is certain to have nothing but dangerous consequences for the human society. How, if at all, will you resolve your dilemma?

Answer: A scientist aims at truth. A scientific discovery reveals a truth of nature. So, any discovery, good or bad for mankind, must be made public. A discovery which appears dangerous today may become useful to the mankind some time later. In order to prevent misuse of scientific technology, we must build up a strong public opinion. Scientists should in fact take up two roles - to discover truth and to prevent its misuse.

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