

## READING COMPREHENSION

Read the text below and answer the questions that follow.

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### What Brings about Changes in Science?

(1) Einstein published three major scientific papers. One of these put forward a new way of calculating the size of molecules. Another explained Brownian motion — the random dance performed by specks of dust trapped in a fluid. Einstein suggested that the tiny particles making up the fluid — its atoms or molecules — were bouncing against the specks of dust and causing the motion. These papers helped to establish the reality of atoms and molecules. Another of Einstein's 1905 papers explained the photoelectric effect — the way that metals could emit electrons (tiny charged particles) from their surface when light was shone on them. Most scientists believed that light travelled in waves — like sound or water waves. But Einstein suggested that the photoelectric effect could be explained if light could also behave as a stream of tiny packets of energy.

(2) Einstein's paper on the photoelectric effect helped give birth to quantum theory, and it was for this paper that Einstein received the Nobel Prize in 1922. Quantum theory led, in the 1920s and 1930s, to another revolution in physics. Physicists showed that, as well as light waves behaving like particles, particles could sometimes act as waves. This theory established "objective probability" in physics. This was the idea that completely unpredictable chance events can take place at the subatomic level. Einstein never fully accepted the prevalent interpretation of quantum theory. But, while many of these interpretations involve wild metaphysical flights of fancy, the physical results are, like those of relativity, very well established.

(3) Marrying together the two pillars of 20th century physics — relativity and quantum theory — is a central problem for physics even today. Successfully doing this may require a revolution in science similar to those begun by Newton and Einstein. There are three main interconnected driving forces for such changes in science. The first is the development of technology. Changes in technology can make new experiments possible and they also influence the problems that scientists develop an interest in. Newton was fascinated by the new machines of the 17th century. Similarly, Einstein was fascinated by electricity and magnetism. This influence also works in a negative way. The governments and multinationals that control technology are often able to dictate what is researched.

(4) The second factor driving scientific progress is the way that the dominant ideas in society change. Ideas from the broader culture can impinge upon science. Newton's ideas were part of a revolutionary new attempt at a rational explanation of both nature and society. On the other hand, the dominant ideas in society can also limit the development of science. This is most obvious in the social sciences, where delving too deeply into how society is organized might raise difficult questions for our rulers. Less is at stake in the natural sciences. Indeed, improvements in natural sciences are vital to our rulers if they want to compete effectively with each other. But the distorted worldview of capitalism still impacts on science. Extremely narrow and specialized bodies of knowledge develop—creating problems for scientists trying to bring about the kind of sweeping revolution heralded by Einstein.

(5) Finally, science moves forward because scientists seek to develop logically consistent theories. This can push them beyond the dominant or common sense ideas of their time. Einstein's breakthrough cannot be reduced simply to changes in technology or wider cultural and ideological shifts. Science is not simply the gathering and ordering of data about the outside world. It also requires abstraction—developing theories about the underlying laws of nature that are usually not immediately apparent. This crucial role of theory is not just a feature of the natural sciences.

(6) Einstein argued that "common sense is the prejudices acquired by age 18". Marxist theory, which is a social science topic, challenges "common sense" political ideas. If we, according to this theory, want to change the world, we need to combine our actions with

theory that digs below the surface appearance of society to understand how the system works.

**A. Answer the following comprehension questions.**

1. In what ways do the changes in technology affect science? Name three.

a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

2. According to the writer, how do the attitudes of the authority figures differ towards the developments in social sciences and natural sciences?

\_\_\_\_\_

\_\_\_\_\_

3. In the writer's view, how does capitalism affect science negatively?

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4. Why can Einstein's breakthrough **not** be "reduced simply to changes in technology or wider cultural and ideological shifts"?

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\_\_\_\_\_

**B. Guessing Vocabulary**

1- Find a word or an expression in paragraph 1 which means "to propose":

\_\_\_\_\_

2- Find a word or an expression in paragraph 2 which means "dominant":

\_\_\_\_\_

3- Find a word or an expression in paragraph 5 which means "attribute":

\_\_\_\_\_

**C. Reference Words**

1. (Par.2) "**those**" refers to \_\_\_\_\_

2. (Par. 3) "**doing this**" refers to \_\_\_\_\_

3. (Par. 5) "**this**" refers to \_\_\_\_\_

## ANSWER KEY TO READING COMPREHENSION

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### A. Answer the following comprehension questions.

1. In what ways do the changes in technology affect science? Name three.

- a. Changes in technology can make new experiments possible.
- b. They influence the problems that scientists develop an interest in.
- c. The governments and multinationals that control technology are often able to dictate what is researched.

2. According to the writer, how do the attitudes of the authority figures differ towards the developments in social sciences and natural sciences?

Possible developments and answers found in social sciences raise difficult questions for the ones in authority. However, progress in natural sciences is vital to our rulers if they want to compete effectively with each other.

3. In the writer's view, how does capitalism affect science negatively?

Its distorted worldview (the narrow and specialized body of knowledge created by it) prevents acceptance of revolutionary ideas by the community./ Extremely narrow and specialized bodies of knowledge develop—creating problems for scientists trying to bring about the kind of sweeping revolution heralded by Einstein.

4. Why can Einstein's breakthrough **not** be "reduced simply to changes in technology or wider cultural and ideological shifts"?

(Scientists) Einstein seek(s) to develop logically consistent theories./ Einstein's theory was beyond the dominant or common sense ideas of their time./ Science is not simply the gathering and ordering of data about the outside world. It also requires abstraction—developing theories about the underlying laws of nature that are usually not immediately apparent.

### B. Guessing Vocabulary

- 1- Find a word or an expression in paragraph 1 which means "to propose": put forward
- 2- Find a word or an expression in paragraph 2 which means "dominant": prevalent
- 3- Find a word or an expression in paragraph 5 which means "feature": attribute.

### C. Reference Words

1. (Par.2) "**those**" refers to the (physical) results.
2. (Par. 3) "**doing this**" refers to marrying together the two pillars of 20th century physics — relativity and quantum theory/ marrying together the relativity and quantum theory.
3. (Par.5) "**this**" refers to the fact that scientists seek to develop logically consistent theories/ Seeking to develop logically consistent theories.