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Introduction to Physics

Have you ever noticed that the more you learn about a topic, the more questions you have? The study of physics works this way! Physics stretches our imagination about and understanding of the world around us. From the smallest particles on the planet to the largest objects known in the universe, scientists called *physicists* use physics to learn what *matter* is and why it behaves as it does (everything in the universe is made up of matter). Even today, physicists do research to find answers to hard questions.

To learn how complex the universe can be, let's start from the beginning...

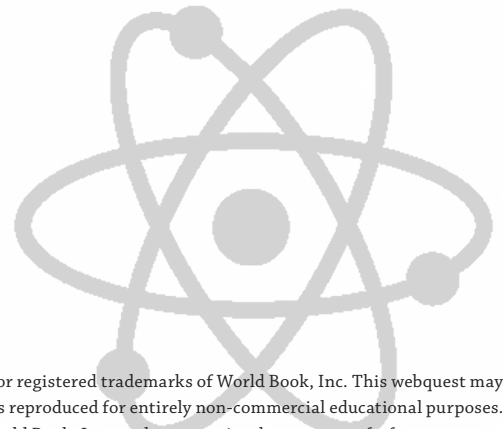
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Click on "Student." If prompted, log on with ID and password

Find the answers to the questions below by using the "Search" tool to search key words. Since this activity is about physics, you can start by searching the key word ***Physics***.

Write the answers on the lines provided or in the space below the question.

1. Physics is the science devoted to the study of _____ and _____.
2. The word *physics* comes from a Greek word meaning _____.
3. Name at least four other types of sciences that benefit from the study of physics.
4. In what way does the existence of Stonehenge show that people, even in prehistoric times, had some understanding of physics?



5. In the timeline below, describe the advances in physics that occurred during each time period.

Timeline

3000 B.C. in Egypt, and Mesopotamia	600 B.C. Greece	300 B.C.	A.D. 100 Egypt

6. During the early Middle Ages in Europe (years 400 to 1000), why were there few scientific discoveries in Western Europe?

7. How was physics re-introduced to Western cultures around the year 1000?

8. In the timeline below, describe the advances in physics that occurred during each time period.

Timeline

1300's Europe	1400's Europe	1543 Poland	1609 Italy

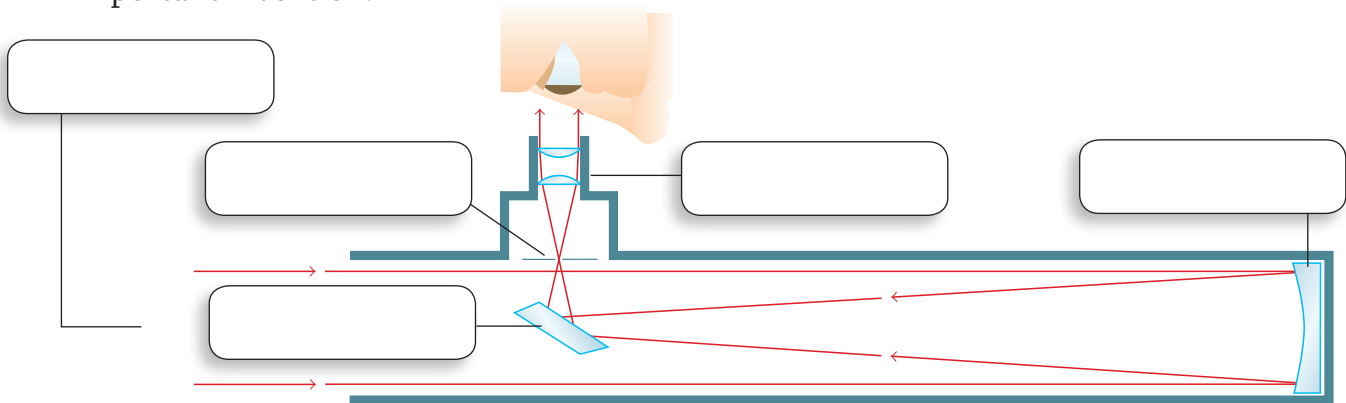
9. What change in attitude towards science occurred during the Renaissance, largely because of the contributions of Galileo, Kepler, and Descartes?

10. In the mid-1600's, Rene Descartes proposed that objects have *inertia*. What is inertia?

11. Sir Isaac Newton was a brilliant English scientist. What form of mathematics did he create?

12. Who also developed this new form of mathematics, working independently from Newton?

13. Newton constructed the world's first reflecting telescope. Label the parts of this simple, but important invention.



14. What allowed scientific research to become more complex in the 1800's?

15. As the science of physics became more complex, what three areas of physics became more narrowly defined?

16. Near the end of the 1800's, many physicists thought that the work of discovering the physical laws of the universe was nearly finished. Were they correct?

17. Use the article on physics to fill in a short timeline of discoveries that were made towards the end of the 1800's. All of these discoveries told scientists that their research was far from over!

1895 –

1896 –

1897 –

1898 –

1900 –

1905 –

1913 –

1924 –

18. What are *postulates*?

19. What two postulates did Albert Einstein create in 1905?

20. What conclusion did he draw from these two postulates?

21. In what way did the study of physics lead to the creation of the atomic bomb?

The study of physics becomes more complex as new discoveries are made!

Match the branches of physics to the correct description to see which fields are studied today.

- | | |
|------------------------------|--|
| ____ 22. Acoustics | A. studies the nature and behavior of light. |
| ____ 23. Nuclear physics | B. studies the behavior and properties of elementary particles. |
| ____ 24. Optics | C. studies the physical properties of solid materials. |
| ____ 25. Biophysics | D. studies highly ionized gases. |
| ____ 26. Fluid physics | E. studies heat and other forms of energy. |
| ____ 27. Electrodynamics | F. studies living things and life processes. |
| ____ 28. Health physics | G. studies Earth and its atmosphere and waters. |
| ____ 29. Thermodynamics | H. studies the protection of people who work with or near radiation. |
| ____ 30. Plasma physics | I. studies the production and properties of sound. |
| ____ 31. Solid-state physics | J. studies the relationship between electrical and magnetic forces. |
| ____ 32. Particle physics | K. studies the structure and properties of the atomic nucleus. |
| ____ 33. Cryogenics | L. studies the behavior and movement of liquids and gases. |
| ____ 34. Geophysics | M. studies extremely low temperatures. |

Extension Activity 1:

Check out the “Related Information” tab in the “Physics” article. Under the heading “Back in Time” you can read articles from early editions of the *World Book Year Book*, dating back to the 1920’s. Each article is preserved as it was written originally for the time.

Describe how our understanding of physics has evolved as new discoveries were made!

Extension Activity 2:

You are a physicist in need of funding! Your university has to cut costs and is considering reducing your research funds. This means that all of your research will come to a screeching halt! You’ve worked hard at your chosen field and have made discoveries that could potentially help people all over the world!

To start, decide which one of the branches of physics to call your own and research its history. Know who has made important contributions and what questions remain unanswered. Then, write a persuasive essay outlining major accomplishments in your field and the benefits of continuing your research. You may even include questions that still need to be answered and how your branch of physics may help find answers!

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Learning Playground. *World eBook*. Web. 15 Oct. 2015.

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Teacher Page

Answers:

1. *Physics* is the science devoted to the study of matter and energy.
2. The word *physics* comes from a Greek word meaning *natural things*.
3. Knowledge obtained from the study of physics is important in other sciences, including astronomy, biology, chemistry, geology, engineering, medicine, and technology.
4. An understanding of physics would have been necessary for prehistoric people to transport these rocks and to place them on top of one another to create Stonehenge and other similar huge rock structures.

5. Timeline

3000 B.C. in Egypt, and Mesopotamia	600 B.C. Greece	300 B.C.	A.D. 100 Egypt
Development of the first number system and algebraic formulas for following and predicting movements in the sun, stars, moon, and planets.	Development of general theoretical systems of mathematics and natural science. Mathematician Euclid organized the general principles of geometry into a unified system.	Aristotle provided proofs, based on physical evidence, of the spherical shape of Earth.	Ptolemy, an astronomer in Alexandria, Egypt, developed a model for predicting the positions of the sun, moon, stars, and planets.

6. From about 400 to 1000, most educated people in Western Europe felt that religion, rather than scientific investigation, should provide the answers to questions about the universe.
7. Trade between the Arab cultures of the East and the Christian cultures of the West increased during the 1000's, providing the opportunity for Greek scientific documents to be reintroduced to the West.

8. Timeline

1300's Europe	1400's Europe	1543 Poland	1609 Italy
Richard Swineshead and Nicole Oresme investigated the problem of the description of motion.	Leonardo da Vinci conducted studies of motion and hydraulics.	Nicolaus Copernicus published a revolutionary astronomical system in which he placed the sun—instead of Earth—at the center of the universe.	Galileo built a number of telescopes for observing the heavens. Galileo also perfected the idea of the laboratory experiment in his study of the motion of falling bodies.

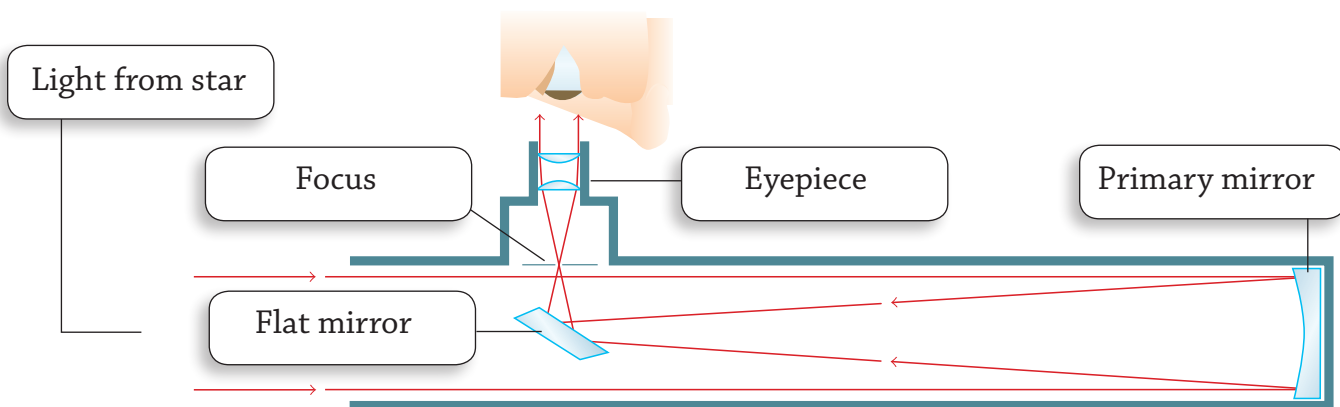
9. During the Renaissance, people had begun to believe that the physical world was governed by natural laws, and that it was possible to discover those laws with careful measurements carried out, if possible, under controlled laboratory conditions.

10. Objects maintain whatever their state of motion unless otherwise disturbed.

11. Newton invented a new form of mathematics, called calculus.

12. Gottfried Wilhelm Leibniz, of Germany, independently developed calculus about the same time.

13.



14. The Industrial Revolution led to the production of scientific instruments that were extremely accurate for their time and which enabled scientists to perform more complicated experiments.

15. Three areas of particular interest in the 1800's were heat and energy, light, and electricity and magnetism.

16. No, physicists later discovered that the study of physics was far more complex.

- 17.
- 1895** – Wilhelm Roentgen of Germany discovered X rays.
- 1896** – French physicist Antoine Henri Becquerel discovered natural radioactivity.
- 1897** – English physicist Joseph John Thomson discovered the first subatomic particle, later called the *electron*.
- 1898** – French physicists Marie Curie and her husband, Pierre, discovered the radioactive element *radium*.
- 1900** – German physicist Max Planck published his quantum theory of energy transfer to explain the spectrum of light emitted by certain heated objects.
- 1905** – Albert Einstein, the German-born American physicist, proposed a new particle, later called the *photon*, as the carrier of electromagnetic energy.
- 1913** – Danish physicist Niels Bohr explained in terms of *quanta* how atoms absorb and radiate energy.
- 1924** – Louis de Broglie, a French physicist, proposed that electrons could also exhibit wave properties.

18. *Postulates* are fundamental principles.

19. The first postulate states that for all observers moving uniformly relative to each other, the laws of physics have the same form. The second postulate states that for all observers, the speed of light is invariant (has the same value; does not change or vary).

20. Einstein concluded that mass and energy are related.

21. Scientists realized that, as Einstein's $E = mc^2$ formula indicated, fission could liberate huge quantities of energy that could be used for explosive power.

22. I

23. K

24. A

25. F

26. L

27. J

28. H

29. E

30. D

31. C

32. B

33. M

34. G