

CONFLICTING VIEWPOINTS**Passage I**

How are white blood cells formed?

Human blood contains many different types of cells, including red blood cells (RBCs) and several types of white blood cells (WBCs). Most of these blood cells are formed in the bone marrow. There are numerous theories regarding the formation of the different types of white blood cells. In particular, scientists and physicians have questioned whether all white blood cells arise from one single parent cell known as a universal stem cell, or if each type of white blood cell has its own individual family with separate parent stem cells.

Scientist 1

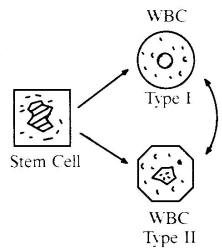
Small samples of circulating blood and bone marrow can be taken from normal healthy persons and carefully examined with a microscope. Using this method, Scientist 1 was able to visually identify all the stages of growth of these cells, from the most primitive stem cell through the fully mature adult white cell. Based on these observations, Scientist 1 concluded that each type of white blood cell has its own separate family, each with a separate stem cell. According to this theory, one type of white blood cell could never turn into any other type of white blood cell and once a white blood cell is formed it cannot change.

Scientist 2

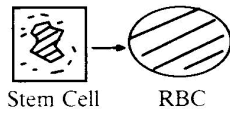
Using many different techniques including centrifugation, filtration, and chemical gradients, Scientist 2 was able to prepare pure samples of each of the different types of white blood cell from the blood and marrow of volunteers. These pure samples were then each placed in separate test tubes with special nutrients and allowed to grow. When samples from these tubes were examined with a microscope, some contained two or more different types of white blood cells. From this evidence, Scientist 2 concluded that white blood cells have the ability to develop or change into the other different types. All white blood cells therefore, develop from a common ancestor or single universal stem cell which can give rise to all the white cells found in the blood. Additionally, some cells can change into cells of different types.

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| <p>1. According to the hypothesis of Scientist 1, if a person had abnormalities in one of the stem cells, would this abnormality also be seen in the white blood cells of that person?</p> <ul style="list-style-type: none">A. No, the red blood cells would be abnormal.B. Yes, but all types of white blood cells would be abnormal.C. No, the white blood cells would all be normal.D. Yes, but only one type of white blood cell would be abnormal. | <p>2. Which of the following is the most likely technical error of Scientist 2 that could have resulted in his difference of opinion with Scientist 1?</p> <ul style="list-style-type: none">F. Some red blood cells became mixed with the white blood cells in the test tubes.G. The white blood cells put in the test tubes were not all of one type.H. The blood was taken from volunteers.J. Many different techniques were used to prepare and separate the white blood cells. |
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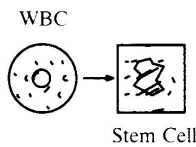
3. Which of the following diagrams best describes the conclusion of Scientist 2? [WBC = white blood cells; RBC = red blood cells]



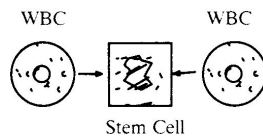
A.



B.



C.



D.

4. An experiment was performed in which a special chemical marker that “tags” only stem cells was injected into the body of a test subject. The special tag was later found on all the white blood cells in the subject’s blood. This experiment

- F. supports the hypothesis of Scientist 1.
- G. supports the hypothesis of Scientist 2.
- H. does not provide support for either Scientist 1 or Scientist 2.
- J. serves as a control for the experiment of Scientist 2.

5. Which of the following procedures would be most effective to test which of the hypotheses regarding formation of white blood cells is most likely to be correct?

- A. Mark several different white blood cells and inject them into a test subject where they will grow.
- B. Mark a stem cell and then inject it into a test subject where it will grow.
- C. Add a chemical that destroys all stem cells to a test tube containing blood.
- D. Place some white blood cells in a tube and let them grow.

6. Scientist 1 and Scientist 2 would most likely agree on which of the following statements regarding the formation of white blood cells?

- F. White blood cells arise from a common ancestor.
- G. The origin of white blood cells cannot be determined using only a microscope.
- H. Each type of white blood cell arises from a separate stem cell.
- J. The origin of white blood cells is a complex and not yet fully understood process.

7. Which of the following known facts provides support for the hypothesis of Scientist 2?

- A. Serious diseases of individual stem cells also affect many different types of mature white blood cells.
- B. Some blood diseases affect either white or red blood cells.
- C. When a person loses blood, both white and red blood cells are replaced naturally by the body.
- D. When there is an infection, many different types of white blood cells appear to defend the body.

Passage II

How do humans age? Two differing views are presented below.

Scientist 1

The body's replaceable cells, constantly abused by stress, improper nutrition, lack of fresh air, insufficient exercise, and excessive toxins are forced to use up their longevity potential decades before nature intended. Experiments reveal that most human cells can duplicate and replace themselves only a finite number of times before they lose this capacity and die. Not unlike the metaphorical nine lives of a cat, each human cell has fifty lives, that is, approximately fifty duplications before the cell automatically shuts down and dies.

How we choose to stretch these lives out over time is largely related to the way we live and how we care for our health. The combination of stressful living with unhealthy lifestyles can serve to speed up the cellular aging process considerably, leading to disease and death long before our true biological potential has been realized.

Scientist 2

The major components of the body's natural immune system are two types of white blood cells, "B" cells and "T" cells. B cells are primarily concerned with fighting bacteria and viruses by releasing appropriate antibodies in the bloodstream, while the main job of T cells is to attack and destroy cells foreign to the body such as transplant and cancer cells. For reasons not now understood, the body's immunological system sometimes breaks down and becomes less able to rid the body of harmful agents and therefore less able to deter aging. In addition, when the immunological system degenerates in this fashion, its capacity for discrimination is diminished, creating a situation in which the body's own disease fighting system turns against itself and kills healthy tissue. The gradual deterioration and degeneration of the body's immune system is at the root of most age-related sickness and breakdown.

—Adapted from *Theories of Aging*, © 1981 by Alberto Villoldo and Ken Dychtwald.
From *Millennium: Glimpses into the 21st Century*.

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| <p>8. Scientist 1's theory of aging would be best supported by demonstrating that</p> <ul style="list-style-type: none">F. B cells fail to fight invading bacteria.G. dead cells are replaced by new cells a finite number of times.H. proper nutrition causes cells to die prematurely.J. T cells lose the ability to destroy foreign cells. <p>9. If true, which of the following findings would NOT be consistent with Scientist 1's theory?</p> <ul style="list-style-type: none">A. A damaged cell is irreplaceable.B. A cell that is damaged can be replaced a finite number of times.C. Our life span depends on how we stretch out the life of each cell.D. Stressful living and unhealthy lifestyles speed up the cellular aging process. | <p>10. Scientist 2's theory on aging would be most weakened if it were found that</p> <ul style="list-style-type: none">F. there is strong evidence for the cell duplication theory.G. the blood count on white blood cells is the same for young and old people.H. the aging process is a complex biological process and is not totally dependent on the performance of B and T cells.J. weakening of the immune system causes sickness, but not aging. |
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11. The hypothesis of Scientist 2 that gradual weakening of the immune system causes aging would be best supported if it were found that
- I. old people in general had weaker immune systems compared to those of younger people.
 - II. the immune system loses its capacity to differentiate body cells from foreign cells with increasing age of the person.
 - III. the longevity of a cell is shown to increase for persons with healthful habits.
- A. I only
 - B. III only
 - C. I and II only
 - D. I and III only
12. To refute Scientist 2's theory on aging, Scientist 1 might best demonstrate that
- F. damaged cells are replaced a finite number of times before loss of this capability.
 - G. the immune system does not weaken with age.
 - H. B and T cells protect and defend the body.
 - J. the immune system loses its capability to differentiate healthy body cells from foreign cells.
13. How does Scientist 1's theory on aging differ from that of Scientist 2?
- A. Scientist 1 believes that the cells die because of the attack from the immune system and not because of their inability to replace themselves.
 - B. Scientist 1 believes that cells die when they are incapable of duplicating and not because of the failure of the immune system.
 - C. Scientist 1 believes that cells die when the B and T cells fail to defend them from invading bacteria and not because of their inability to replace.
 - D. There is essentially no difference between their theories.
14. If Scientist 2's theory on aging is correct, in order to increase the life span of an individual one should
- F. eliminate the toxins in the cell produced by stress and poor health habits.
 - G. maintain an immune system that efficiently carries out its function.
 - H. increase the longevity of each cell by incorporating proper diet and exercise.
 - J. increase the number of times the cell can duplicate itself.

Passage III

The following two theories on the process of burning were held by different scientists late in the eighteenth century.

Theory 1

When an object burns in air, it releases a substance called phlogiston. An object that burns readily contains a great deal of phlogiston and generally leaves only a small amount of ash when it burns. Ordinary air is able to permit or support such burning because it does not contain much phlogiston. It absorbs phlogiston or phlogiston-rich smoke from the burning object. If burning occurs in a closed container, the air can become too rich in phlogiston. The air can then accept no more of it, and the burning process is prevented from continuing. If the products of an object that has burned are heated, they can in some cases be made to give off a gas called dephlogisticated air. This air, because it contains no phlogiston, can support the burning of objects for longer periods than can ordinary air.

Theory 2

There is no such thing as phlogiston. When an object burns, it does not release phlogiston, but instead combines with a substance called oxygen that has mass and is present in the air. In a closed container, the process of burning is prevented from continuing when the air has given up all its oxygen. The gas that can in some cases be released by heating the products of burning is not dephlogisticated air, but oxygen.

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| <p>15. Which of the following assumptions about burning is being made in Theory 2 but not in Theory 1?</p> <ul style="list-style-type: none">A. Burning is a combining process.B. Burning is a decomposition, or breakdown, process.C. Ordinary air does not contain oxygen.D. Ordinary air is pure oxygen. <p>16. Which of the following observations, if true, would NOT be consistent with Theory 1?</p> <ul style="list-style-type: none">F. Phlogisticated air cannot support burning as long as dephlogisticated air can.G. Some objects leave a great deal of ash when they burn.H. The total mass of all the ashen substances produced when an object burns is greater than the mass of the object before burning.J. A candle sealed in a jar of dephlogisticated air burns more brightly than one sealed in a jar of ordinary air. | <p>17. Which of the following hypotheses would proponents of Theory 2 most likely make to explain the fact that objects do not burn in a vacuum?</p> <ul style="list-style-type: none">A. A vacuum contains phlogiston.B. A vacuum does not contain oxygen.C. It is impossible to create a perfect vacuum.D. Oxygen is not always necessary to support burning. <p>18. Proponents of Theories 1 and 2 would be in agreement that</p> <ul style="list-style-type: none">F. the mass of an object can change during the burning of the object.G. energy is not conserved during burning.H. “phlogiston” and “oxygen” are different names for the same substance.J. phlogiston can be transferred between objects. |
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19. The “burning” reaction that takes place when mercury is heated in air produces no smoke. Its only visible product is solid. In order to find out whether Theory 2 is less valid than Theory 1, a scientist could study this burning reaction to determine whether
- A. the total mass of solids and gases is conserved during the reaction.
 - B. the products of the reaction are less able to react with air than was the original mercury.
 - C. smoky air is less able to support the reaction of the mercury than is clean air.
 - D. the mass of the air above the mercury becomes less during the reaction.
20. Theory 2 could be disproved if experiments demonstrated conclusively that
- F. phlogiston does not exist.
 - G. the more oxygen air contains, the less well it supports burning.
 - H. the products of burning contain oxygen.
 - J. some burning objects produce little or no ash.
21. If Theory 1 is valid, how would an object made of pure phlogiston behave, assuming such an object could be found?
- A. It would burn spontaneously, even if no air were present.
 - B. It would not burn under any circumstances.
 - C. It would burn only in dephlogisticated air.
 - D. It would burn readily in air.

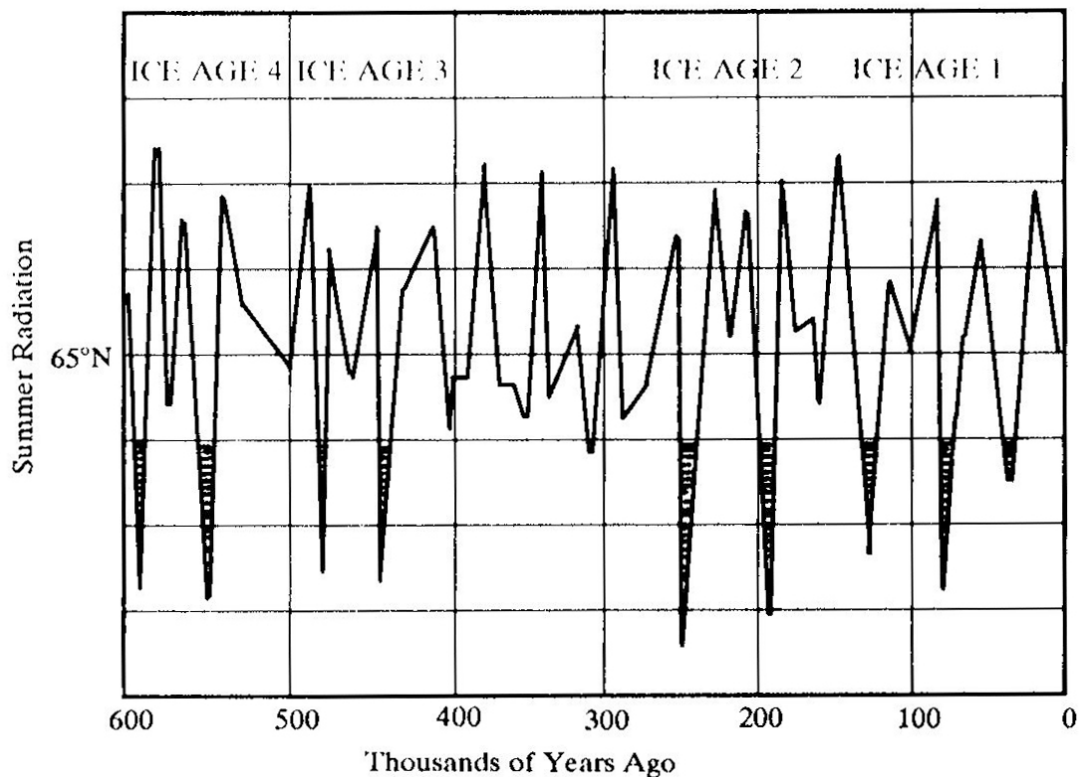
Passage IV

The causes for ice ages have remained one of the most enduring and fascinating mysteries of geology. Among the several theories proposed, the two theories that best describe this process are as follows:

Milankovitch's Theory

Milankovitch proposed that the ice ages in the past were due to reduced energy the earth received from the sun because of the earth's changing orbital characteristics. Milankovitch found that three orbital parameters determine how the sun's radiation is distributed over the planetary surface: the eccentricity of the orbit, the tilt of the axis of rotation, and the position of the equinoxes in their precessional cycle. He established that the critical factor that initiated the glaciation was the diminution of radiation during the summer. He argued that since only during the summer do the glaciers melt, any decrease in intensity of summer sunlight would inhibit melting, and lead to glacial expansion. Based on these assumptions, Milankovitch calculated how the summer radiation curve at 65°N latitude varied over the past 600,000 years (Figure 1). The low points on his curve corresponded very well with the observed European ice ages, thus validating his theory.

Figure 1



Modern Carbon Dioxide Theory

The concentration of carbon dioxide in the earth's atmosphere is the starting point for the modern ice age theory. Although this gas occurs in only minute quantities, studies indicate that it exercises an important influence on global climate. This is because carbon dioxide has a peculiar property: while it is transparent to show wave radiation that it receives from the sun, it is relatively opaque to the long wave radiation that is reflected back into space. Many scientists are convinced that the ice age would result if the levels of carbon dioxide dropped low enough. But why should such a decrease happen? Actual measurements of the CO₂ trapped in ancient ice core samples, however, do confirm the hypothesis that the carbon dioxide concentrations in the atmosphere were at the minima level during the ice ages.

22. Which of the following best supports Milankovitch's theory about ice ages?
- F. The reduced level of carbon dioxide in the atmosphere during the ice ages
 - G. The increased level of carbon dioxide in the atmosphere during the ice ages
 - H. The correspondence between the last four European ice ages and the low points on this radiation graph
 - J. The reduced level of sunlight intensity during the winter
23. The modern carbon dioxide theory for the causes of the ice ages is weakened because
- A. there is too much carbon dioxide in the earth's atmosphere to cause any ice age.
 - B. it cannot account for sufficient lowering of carbon dioxide levels to initiate ice ages.
 - C. carbon dioxide actually traps heat in the earth's atmosphere.
 - D. carbon dioxide is present only in trace amounts and cannot influence the earth's climate in a major way.
24. If true, which of the following observations would NOT be consistent with Milankovitch's theory?
- F. The position of the equinoxes in the earth's precession cycle affects the total radiation energy received.
 - G. The changes in the eccentricity of the earth's orbit actually affect the total radiation energy received.
 - H. The maximas in the radiation curve and the recorded ice ages show one-to-one correspondence.
 - J. The changes in the inclination of the earth's axis actually affect the total radiation energy received.
25. If the modern carbon dioxide theory is correct, how will the rapidly increasing carbon dioxide levels of the present age affect the next ice age?
- A. It will not affect it, because the level of carbon dioxide is not the most important component causing the ice age.
 - B. Will be delayed, because the increased carbon dioxide will warm the earth's surface and offset the cooling trend due to natural causes.
 - C. Will be delayed, because the increased level of carbon dioxide is still very insignificant compared to the total atmosphere's volume.
 - D. It will not affect it, because the increased level of carbon dioxide will dissolve in the oceans of the world and exert no influence on the planet's climate.
26. How do Milankovitch's reasons for the ice ages differ from those of the modern carbon dioxide theory?
- F. Milankovitch believes that ice ages are due to variations in the earth's orbital parameters and not decreases in the atmospheric CO₂.
 - G. Milankovitch believes that the ice ages are due to increases in the earth's atmospheric CO₂ and not decreases in summer radiation.
 - H. Milankovitch believes that the ice ages are due to increased summer radiation and not decreases in atmospheric carbon dioxide levels.
 - J. There is essentially no difference in the reasons for the ice ages.
27. To refute Milankovitch's theory, modern scientists might best demonstrate that the
- A. eccentricity of the earth's orbit has a dominant effect on the climate.
 - B. periods of the ice ages determined by modern dating methods do not coincide with the minima of the radiation curves.
 - C. position of the equinoxes in the earth's precession cycle affects the total summer radiation with the minima of the radiation curves.
 - D. tilt of the earth's axis has a dominant effect on the climate.
28. The hypothesis of modern scientists that low levels of carbon dioxide cause ice ages would be supported if
- I. air trapped in the ancient ice core samples indicates that concentrations of carbon dioxide dipped to low levels during ice ages.
 - II. evidence was found that reduced levels of summer radiation during ice ages were due to earth's changing orbital parameters.
 - III. large deposits of calcium carbonate trapping the free carbon dioxide were found to exist during ice ages.
- F. II only
 - G. I and II only
 - H. I and III only
 - J. II and III only

Passage V

The nature of light is still one of the greatest mysteries of science. Two theories that describe the nature of light are as follows:

Newton's Particle Theory

Newton tended to visualize light as a shower of tiny particles or corpuscles shot from a luminous object, with each particle traveling in a straight line until it was reflected, refracted, absorbed, or somehow acted upon. He based his theory on the known properties of light—for example, he argued that light travels in a straight line based on the sharp edges of the shadow cast on the screen by an opaque object (Figure 1). To explain how light is bent as it passes through glass or water, Newton assumed that the corpuscles of light are pulled into water when they touch the surface. This force makes them travel faster and shifts them from the straight path they would normally follow (Figure 2). It would also seem that if particles are striking a surface, they would exert pressure on the surface and also cause it to get warmer depending on its absorbing characteristics. This has been verified by sensitive experiments that further reinforce the validity of this theory.

Figure 1

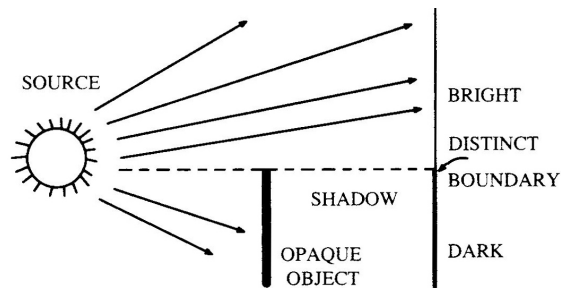
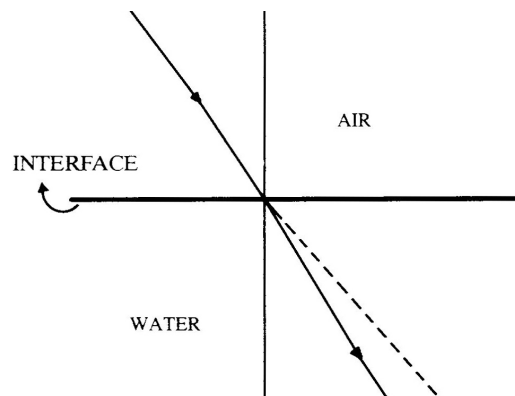


Figure 2



Huygen's Wave Theory

Huygen's theory simply assumes that light is a wave rather than, say, a stream of particles. Experiments performed several years after Newton reveal that light does bend around obstacles (Figure 3). This phenomenon is called diffraction and is readily noticeable when the size of the obstacle is small compared to the wave length (Figure 4, distance between successive troughs or crests) of light. He explained the bending of light in refraction as a consequence of its different velocity in different media. Huygen argued that the velocity of light is inversely

proportional to the refractive index of the media. The more the light was slowed the more it bent. If light were made up of streams of particles, the reverse would be true. Huygen also argued that if light was corpuscular, it could be likened to a flight of arrows, and if two flights crossed some would collide with one another. However, when two beams of light crossed, they appear not to affect each other.

Figure 3

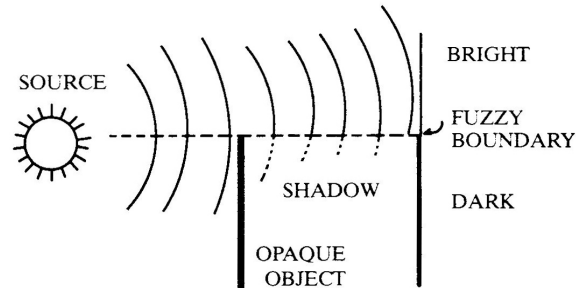
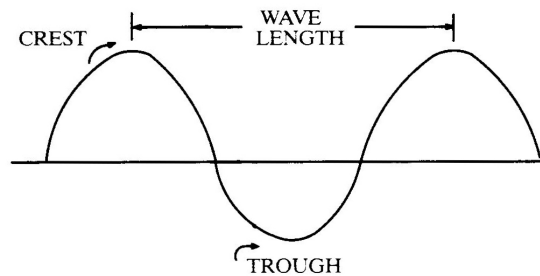


Figure 4



29. Huygen's wave theory of light is supported by
- sharp edges of shadow cast by opaque objects.
 - the pressure exerted on surfaces exposed to light.
 - the phenomenon called diffraction.
 - passing light through water.
30. Which of the following observations would NOT be consistent with the particle theory? The velocity of light
- depends on the refractive index of the medium.
 - in water is less than that in air.
 - in glass is greater than that in air.
 - does not depend on the source of its origination.
31. Which of the following observations, if true, would most weaken Newton's particle theory of light?
- Experimentally confirm the presence of particles.
 - Opaque objects cast sharp shadows.
 - The phenomenon of diffraction.
 - Radiation pressure on surface exposed to light.
32. If Huygen's wave theory is correct, what will happen to the velocity of light when it goes from water to glass, given that glass is optically more dense than water?
- It will slow down because glass is optically more dense than water.
 - It will slow down because glass is optically less dense than water.
 - It will speed up because glass is optically more dense than air.
 - It will remain unchanged because velocity of light is a universal constant.

33. Which of the following is the strongest evidence Newton could use to counter Huygen's wave theory?
- A. Demonstrate that when two beams of light cross, they do not affect each other.
 - B. Demonstrate that when surfaces are exposed to light, they become warmer, due to continuous impact from light particles.
 - C. Demonstrate that the velocity of light in an optically dense medium is slower.
 - D. Demonstrate that the shadow cast by very small objects is not sharp.
34. To best contradict Newton's particle theory, Huygen could provide evidence that light
- F. travels faster in water than in air.
 - G. bends around opaque objects.
 - H. exerts pressure on surfaces.
 - J. travels in a straight line.
35. How does Newton's description of light differ from that of Huygen's?
- A. Newton describes light as waves and not particles.
 - B. Newton describes light as particles and not waves.
 - C. There is no difference between their descriptions.
 - D. Newton describes light as illusive particles.