

Science Teacher Attitudes, Skills, & Knowledge Survey (S-TASKS)

Directions to Teacher:

Please respond to the following items by marking the best answer on your answer sheet using a #2 pencil. Please do not write on this survey. Use scratch paper if necessary. If you do not understand what is being asked in an item, please ask the survey administrator for clarification.

Please do not use a calculator.



Arizona Collaborative for Excellence in the Preparation of Teachers
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1. Which best describes your race or ethnic background?

- A. American Indian
- B. Asian/Pacific Islander
- C. Hispanic
- D. Black
- E. White

Different teachers have described very different teaching philosophies to researchers. For each of the following pairs of statements, indicate a letter choice which best describes your own beliefs compared to each of the statements in a given pair. The closer your beliefs are to a particular statement, the closer the letter choice you indicate. *Please indicate only one letter choice for each set.*

2.

"I mainly see my role as a facilitator. I try to provide opportunities and resources for my students to discover or construct statements for themselves."

A B C D E

"Investigation is very nice, but students really won't learn the subject unless you go over the material in a structured way. It's my job to explain, to show students how to do the work, and to assign specific practice."

3.

"The most important part of instruction is the content of the curriculum. The content is the field's judgment about what students need to be able to know and do."

A B C D E

"The most important part of instruction is that it encourages 'sense making' or thinking among students. Content is secondary."

Use the following key to indicate to what degree you agree with items 4 – 7.

A. strongly agree B. agree C. don't know D. disagree E. strongly disagree

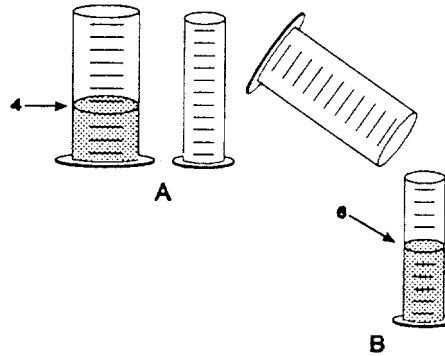
4. I prefer starting with students' own ideas and topics, suggesting where they can find information or resources, without having to direct their questions and provide all the answers myself.
5. Students should help establish criteria on which their work will be assessed, because they are responsible for their own learning.
6. It is very important for my students to share their work with others, because others can learn from what they do.
7. Instruction should be built around problems with clear, correct answers, and around ideas that most students can grasp quickly.

Use the following key to indicate to what degree you agree with items 8 – 19.

A. strongly agree B. agree C. don't know D. disagree E. strongly disagree

8. The central goal of science is to explain natural phenomena.
9. Hypotheses are derived from controlled observations of nature.
10. A hypothesis is an educated guess of what will be observed under certain conditions.
11. A conclusion is a statement of what was observed in an experiment.
12. Hypotheses/theories cannot be proved to be true beyond any doubt.
13. Hypotheses/theories can be disproved beyond any doubt.
14. To be scientific, a hypothesis must be testable.
15. To test a hypothesis, you need a prediction.
16. Current scientific theories portray nature more accurately than those they replaced.
17. Scientists think that atoms exist primarily because they have seen them through powerful microscopes.
18. New discoveries depend mostly on luck.
19. Hypothesis formation involves creativity.

20. To the right are drawings of a wide and a narrow cylinder. The cylinders have equally spaced marks on them. Water is poured into the wide cylinder up to the 4th mark (see A).



This water rises to the 6th mark when poured into the narrow cylinder (see B). Water is now poured into the *wide* cylinder up to the 6th mark. How high would this water rise if it were poured into the empty narrow cylinder?

21. because

- A. to about 8
- B. to about 9
- C. to about 10
- D. to about 12
- E. none of these answers is correct

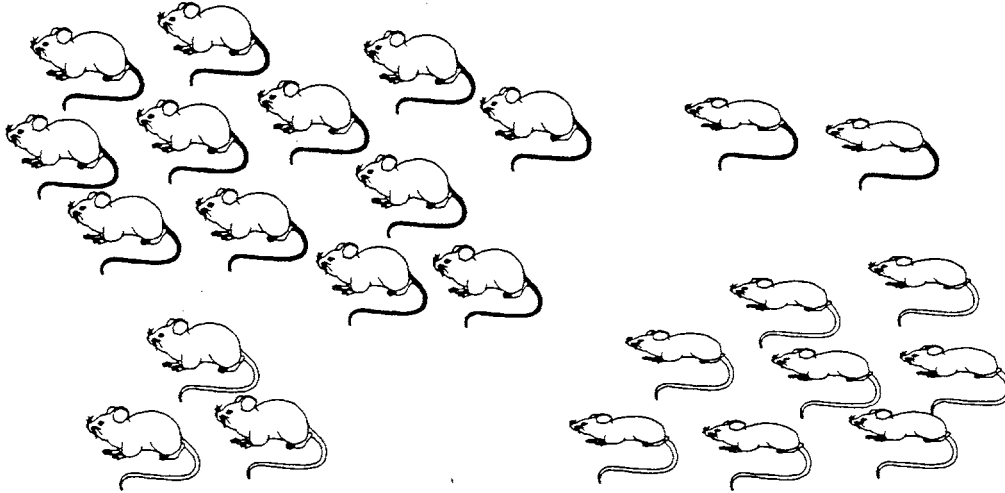
22. Water is poured into the narrow cylinder (described in item 18 above) up to the 11th mark. How high would this water rise if it were poured into the empty wide cylinder?

- A. to about $7 \frac{1}{2}$
- B. to about 9
- C. to about 8
- D. to about $7 \frac{1}{3}$
- E. none of these answers is correct

23. because

- A. the ratios must stay the same.
- B. one must actually pour the water and observe to find out.
- C. the answer can not be determined with the information given.
- D. it was 2 less before so it will be 2 less again.
- E. you subtract 2 from the wide for every 3 from the narrow.

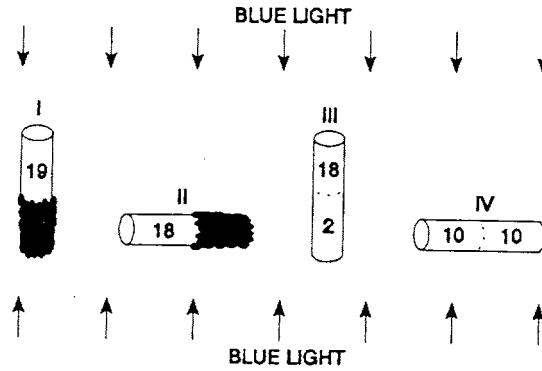
24. Farmer Brown was observing the mice that live in his field. He discovered that all of them were either fat or thin. Also, all of them had either black tails or white tails. This made him wonder if there might be a link between the size of the mice and the color of their tails. So he captured all of the mice in one part of his field and observed them. Below are the mice that he captured.



Do you think there is a link between the size of the mice and the color of their tails?

- A. appears to be a link
 - B. appears not to be a link
 - C. can not make a reasonable guess
25. because
- A. there are some of each kind of mouse.
 - B. there may be a genetic link between mouse size and tail color.
 - C. there were not enough mice captured.
 - D. most of the fat mice have black tails while most of the thin mice have white tails.
 - E. as the mice grew fatter, their tails became darker.

26. Twenty fruit flies are placed in each of four glass tubes. The tubes are sealed. Tubes I and II are partially covered with black paper; Tubes III and IV are not covered. The tubes are placed as shown. Then they are exposed to blue light for five minutes. The number of flies in the uncovered part of each tube is shown in the drawing.



These data show that these flies respond to (respond means move to or away from):

- A. blue light but not gravity
 - B. gravity but not blue light
 - C. both blue light and gravity
 - D. neither blue light nor gravity
27. because
- A. some flies are in both ends of each tube.
 - B. the flies need light to see and must fly against gravity.
 - C. the flies are spread about evenly in Tube IV and in the upper end of Tube III.
 - D. most flies are in the lighted end of Tube II but do not go down in Tubes I and III.
 - E. most flies are in the upper end of Tube I and the lighted end of Tube II.

28. A vehicle with its windows rolled up is traveling down the road at 50 miles an hour. Two balloons are inside. One balloon is hanging straight down from the ceiling by a string. The other balloon is also attached to a string but is floating straight up (see figure). When the driver slams on the brakes, the hanging balloon swings forward and the floating balloon swings backward.



This observation raises an interesting question: Why did the hanging balloon go forward while the floating balloon went backward? Here is a possible explanation: The hanging balloon is relatively heavy; so its momentum carried it forward when the vehicle stopped. The floating balloon, being lighter than air and having less momentum, went backward because as the vehicle stopped, the heavier air molecules inside the vehicle rushed forward and piled up at the front. Thus, the piled-up air molecules at the front pushed harder on the front side of the balloon than the relatively fewer air molecules on the balloon's backside. Thus, the balloon was pushed backward.

Suppose you have two balloons just like those in the vehicle, a large airtight chamber on wheels, and a vacuum pump (a pump that can extract air from airtight chambers). What experiment using these materials would test the possible explanation?

- A. Suck the air out of the chamber. Because air does not weigh anything, nothing will happen to either balloon.
 - B. Attach the two balloons inside the chamber. Extract the air. Push the chamber and then stop it.
 - C. Replicate the experiment using the vehicle just as before so that you have a controlled experiment.
 - D. Place the balloons in the chamber and set it in motion. Then stop it and use the pump to extract the air.
 - E. The hanging balloon is heavier so it will swing with the momentum. The floating balloon is lighter so it falls back.
29. What result of your experiment would show that the explanation is probably wrong?
- A. The momentum will carry the heavier balloon forward.
 - B. The two balloons each do something different.
 - C. If both balloons moved in the direction of the vacuum at the same pace and stopped at the same time, then it does not matter if there are molecules pushing on the balloons.
 - D. The balloons would go backward.
 - E. The floating balloon goes backward.

30. A biologist found two forms of mice living in a valley - those with slight toe webbing and those without toe webbing. The later damming of a river made much of the valley marshy. Years later most of the mice living in the valley were found to have webbed toes. Very few, if any, of the non-webbed form could be found. Which statement best explains the observed change in the mouse population?
- A. Webbed toes in mice are controlled by more than one gene.
 - B. Mice with toe webbing survived at a higher rate and reproduced more often than did the non-webbed form.
 - C. The mice ran in the marshy valley so most developed webbing
 - D. Dampness in the valley increased the mutation rate in the mouse population.
 - E. Mice with non-webbed toes grew webbing because it helped them run and move about in the marshy valley.

31. When a tree grows bigger, most of the new tree material comes from

- A. the sun.
- B. the soil.
- C. the air.
- D. the seed.

32. Assume that eye color in fruit flies is determined by a pair of genes in which the gene for red eyes (R) is dominant over the gene for dark eyes (r). Also assume wing shape is determined by a pair of genes in which the gene for normal wings (N) is dominant over the gene for wrinkled wings (n).

Suppose a male fly with a RrNn genotype produces sperm. What is the probability that any single sperm will have a RN genotype?

- A. 0%
- B. 25%
- C. 50%
- D. 75%
- E. 100%

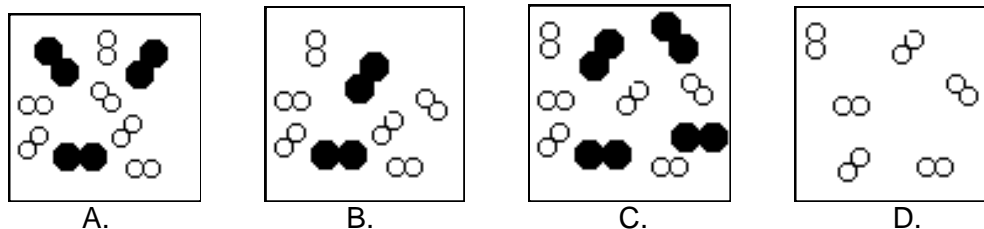
33. A balloon contains a mixture of He(g) and Ne(g). If a small leak occurs, which statement is true?

Atomic Weights: He = 4.0026 Ne = 20.179

- A. Both He(g) and Ne(g) leak from the balloon at the same rate.
- B. All of the He(g) immediately leaks out, leaving all of the Ne(g) in the balloon.
- C. Ne(g) leaks from the balloon about 16 times faster than does He(g).
- D. He(g) leaks from the balloon faster than does Ne(g).
- E. Ne(g) leaks from the balloon about 5 times faster than does He(g).

34. Assume a beaker of pure water has been boiling for 30 minutes. What is in the bubbles in the boiling water?
- Air
 - Oxygen gas and hydrogen gas
 - Oxygen
 - Water vapor
 - Heat

35. Consider the reaction, $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{g})$. In which picture of the reactants is $\text{H}_2(\text{g})$ the limiting reactant?

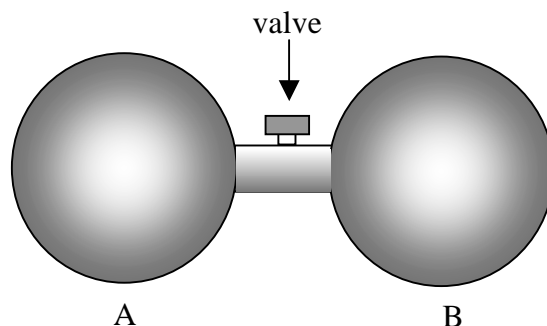


36. A weather balloon filled with hydrogen gas greatly increases in volume as it ascends to high altitudes. The expansion of the balloon is primarily due to:
- a decrease in the average kinetic energy of the hydrogen molecules inside the balloon.
 - an increase in the average kinetic energy of the hydrogen molecules inside the balloon.
 - a decrease in the average kinetic energy of the surrounding atmosphere molecules.
 - an increase in the rate of collision of the hydrogen molecules against the inside walls of the balloon.
 - a decrease in the rate of collisions of the atmosphere molecules on the outside walls of the balloon.
37. Below is a list of properties of a sample of solid sulfur:
- Brittle, crystalline solid
 - Melting point of 113°C
 - Yellow color
 - Combines with oxygen to form sulfur dioxide

Which, if any, of these properties would be the same for one single atom of sulfur obtained from the sample?

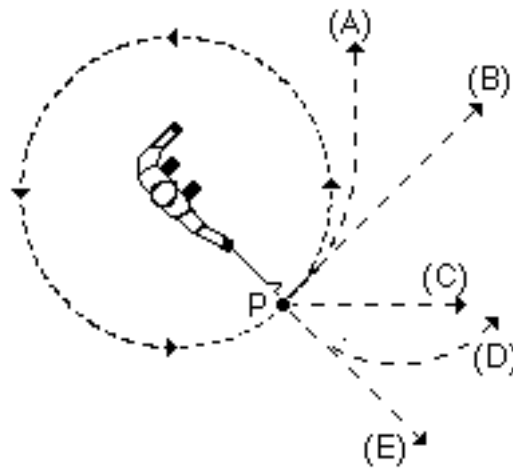
- i and ii only
- iii and iv only
- iv only
- All of these properties would be the same
- None of these properties would be the same

Use the following illustration when answering item 38.

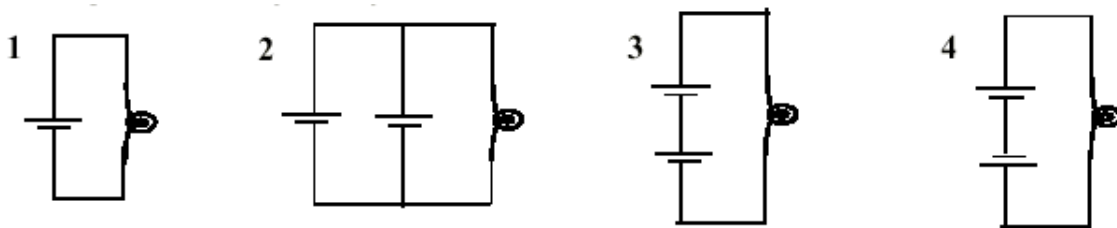


38. Two bulbs of equal volumes contain a gas. The gas pressure is equal in both bulbs. Bulb 'B' is heated to a temperature of 100°C while Bulb 'A' remains at room temperature. During the heating the valve is open. After heating, the valve is closed and the system is allowed to cool. What happens?
- A. Bulb 'B' will have more molecules than Bulb 'A'.
 - B. Bulb 'A' will have more molecules than Bulb 'B'.
 - C. Bulb 'B' will have greater pressure than Bulb 'A'.
 - D. Bulb 'A' and Bulb 'B' will possess equal pressures.
39. A stone dropped from the roof of a single story building to the surface of the Earth:
- A. reaches a maximum speed soon after release and then falls at a constant speed thereafter.
 - B. speeds up as it falls because the gravitational attraction gets considerably stronger as the stone gets closer to the Earth.
 - C. speeds up because of an almost constant force of gravity acting upon it.
 - D. falls because of the natural tendency of all objects to rest on the surface of the Earth.
 - E. falls because of the combined effects of the force of gravity pushing it downward and the force of the air pushing it downward.
40. A boy throws a steel ball straight up. Consider the motion of the ball only after it has left the boy's hand but before it touches the ground, and assume that forces exerted by the air are negligible. Under these conditions, the force(s) acting on the ball is (are):
- A. a downward force of gravity along with a steadily decreasing upward force.
 - B. a steadily decreasing upward force from the moment it leaves the boy's hand until it reaches its highest point; on the way down there is a steadily increasing downward force of gravity as the object gets closer to the Earth.
 - C. an almost constant downward force of gravity along with an upward force that steadily decreases until the ball reaches its highest point; on the way down there is only a constant downward force of gravity.
 - D. an almost constant downward force of gravity only.
 - E. none of the above. The ball falls back to ground because of its natural tendency to rest on the surface of the Earth.

41. A steel ball is attached to a string and is swung in a circular path in a horizontal plane as illustrated in the figure to the right. At the point P indicated in the figure, the string suddenly breaks near the ball. If these events are observed from directly above as in the figure, which path would the ball most closely follow after the string breaks?

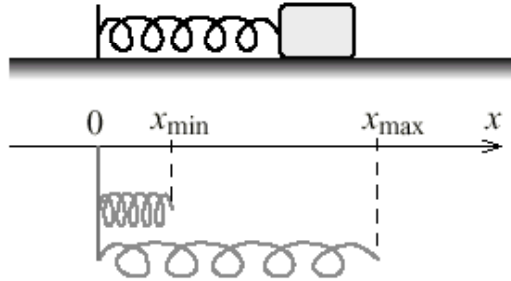


- A. A
 B. B
 C. C
 D. D
 E. E
42. The bulbs and batteries illustrated below are identical, and the battery orientations are indicated in the circuit diagrams shown. Which circuit produces the brightest light bulb?

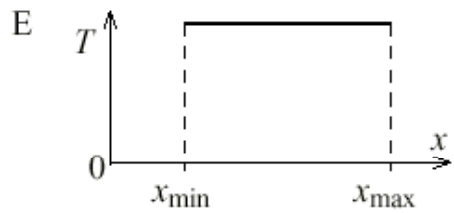
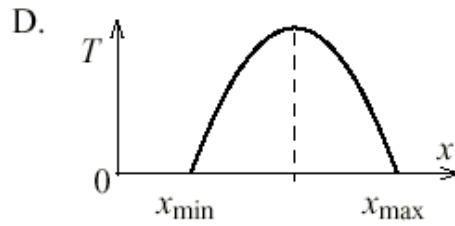
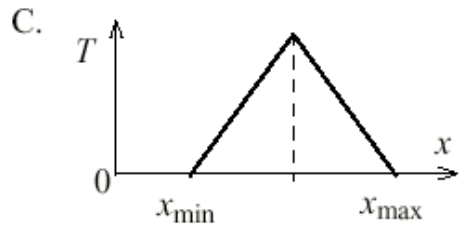
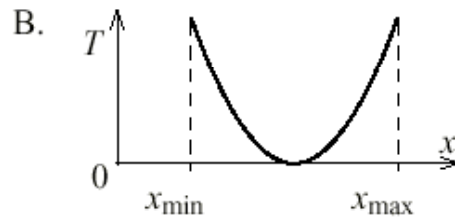
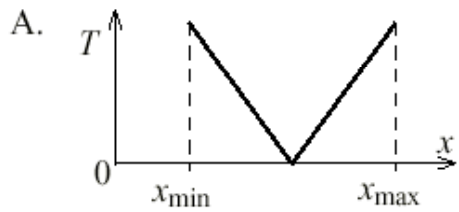


- A. Circuit 1 because one battery does not have to work against another battery
 B. Circuit 2 because two batteries connected in parallel produce more voltage than either one or two batteries connected in series
 C. Circuit 3 because two batteries connected in series with the same orientation produce about twice the voltage of a single battery, and more than any other combination shown
 D. Circuit 4 because two batteries connected in series and oriented in opposite directions produce about twice the voltage of a single battery, and more voltage than any other combination shown.
 E. Circuits 2 and 3 produce bulbs with the same brightness.

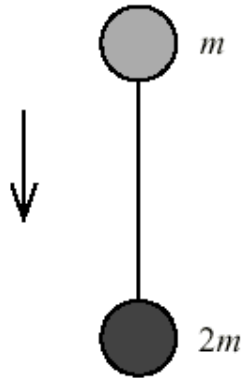
43. A block oscillates with negligible friction on the end of a spring as shown in the figure below. The minimum and maximum lengths of spring as it oscillates are, respectively, x_{\min} and x_{\max} .



Which one of the following graphs represents the total energy (T) of the block and spring system as a function of x ?

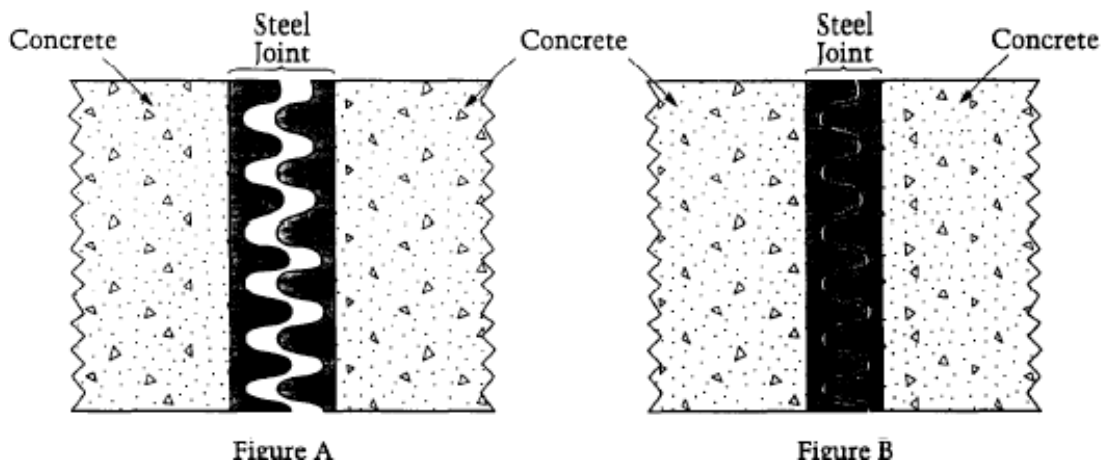


44. Two spheres with masses m and $2m$ respectively are connected by a light string and suspended at rest. The system is released by an astronaut standing on the moon. The system falls freely, as shown in the figure.



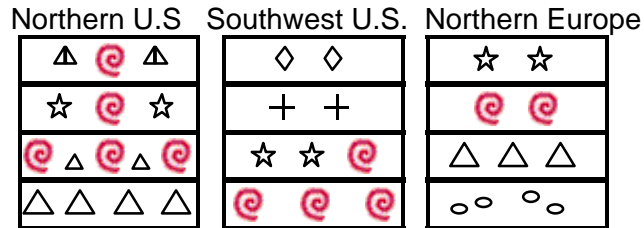
If g is the acceleration due to gravity, what is the tension in the string as the system falls?

- A. 0
 B. $1mg$
 C. $2mg$
 D. $3mg$
45. A concrete bridge was built using special steel joints between the sections of concrete. The figures below show one of these joints at two different times. Which of the following best explains why Figure A and Figure B look different?



- A. Figure A shows the joint on a hot day and Figure B shows the joint on a cold day.
 B. Figure A shows the joint on a cold day and Figure B shows the joint on a hot day.
 C. Figure A shows the joint on a warm, dry day and Figure B shows the joint on a cool, rainy day.
 D. Figure A shows the joint during the day and Figure B shows the joint at night.

46. If the diagrams below represent rock layers at three different places on Earth and the shapes in the diagrams represent the type of fossils found in each rock layer, which of the following is most likely to be found immediately below the lowest rock layer in the Southwest U.S.?



- A. ◇
 B. ○
 C. ☆
 D. △
47. How would you explain the phases of the moon?
- A. The apparent size of the moon changes.
 B. The part of the lighted side of the moon that we see changes.
 C. The shadow of the earth falls on the moon.
 D. The amount of light falling on the moon changes.
48. What's the reason for your answer in question #47:
- A. The distance from the earth to the moon changes.
 B. The earth comes between the sun and the moon.
 C. The position of the moon, earth and sun changes.
 D. The distance from the sun to the moon changes.
49. An insulated bottle keeps a cold liquid in the bottle cold by
- A. destroying any heat that enters the bottle
 B. keeping cold energy within the bottle
 C. trapping dissolved air in the liquid
 D. slowing the transfer of heat into the bottle
50. Which of the following properties of the Earth is the result of the processes of living things?
- A. The Earth's oceans are salty
 B. The Earth has magnetic poles
 C. The Earth's atmosphere contains a lot of oxygen
 D. The Earth's crust contains a lot of volcanic rock