TIMSS USA 8

SCIENCE ITEMS

Guide to the Content and Layout of This Book

The *Science Items* book contains, in a ready-to-use form, the released TIMSS 1999 and TIMSS 2003 science assessment items that appeared in Book 5, *Science Concepts and Science Items*. Each item is presented on a separate page to facilitate printing.

The two books are designed to be used in tandem. The *Science Items* book is designed to facilitate the construction of sets of items tailored to the purpose of the user—most likely a classroom teacher. Users can select items for their own purpose based on their reading of the *Science Concepts and Science Items* book, print these and administer them to students. Student responses can be scored using the scoring instructions presented in the *Science Concepts and Science Items* book, and may be compared to the international benchmarks presented there.

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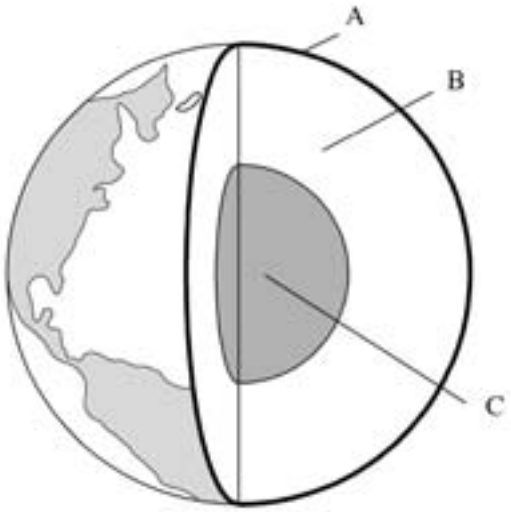
The picture shows the three main layers of the Earth.



Where is it the hottest?

A. Layer A

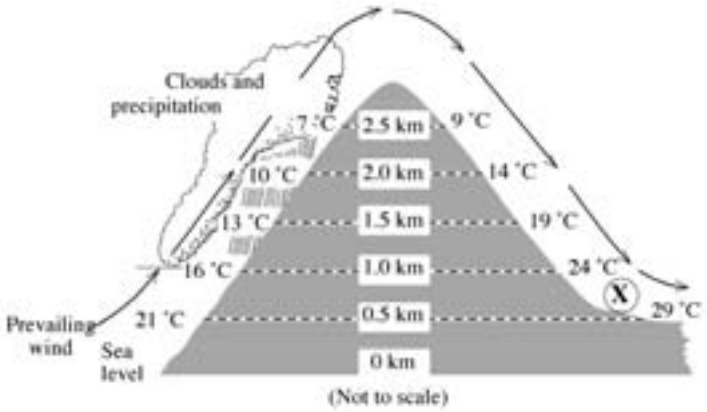
B. Layer B

C. Layer C

D. All three layers are the same temperature.

Item Number: B01

The diagram below shows a mountain. The prevailing wind direction and average air temperatures at different elevations on both sides of the mountain are indicated.



Which feature is probably located at the base of the mountain at location (X)?

A. a dry region

B. a jungle

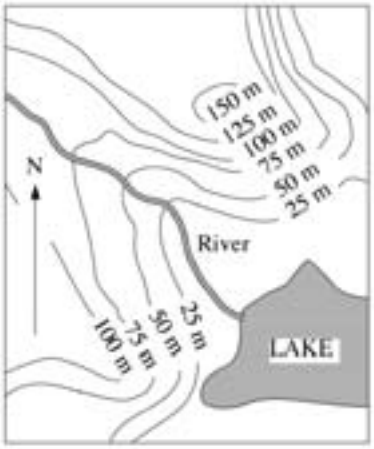
C. a glacier

D. a large lake

E. a rain forest

Item Number: B05

On the diagram, hills and valleys are shown by means of contour lines. Each contour line indicates that all points on the line have the same elevation above sea level.



In which direction does the river flow?

A. Northeast

B. Southeast

C. Northwest

D. Southwest

E. It is not possible to tell from the map.

Item Number: D03

Why do mountain climbers use oxygen equipment at the top of the world's highest mountains?

A. There is less oxygen in the air at great heights.

B. There is little nitrogen in the air at great heights.

C. There is a hole in the ozone layer.

D. There is no air at the top of very high mountains.

Item Number: F05

The Moon produces no light, and yet it shines at night. Why is this?

A. The Moon reflects the light from the Sun.

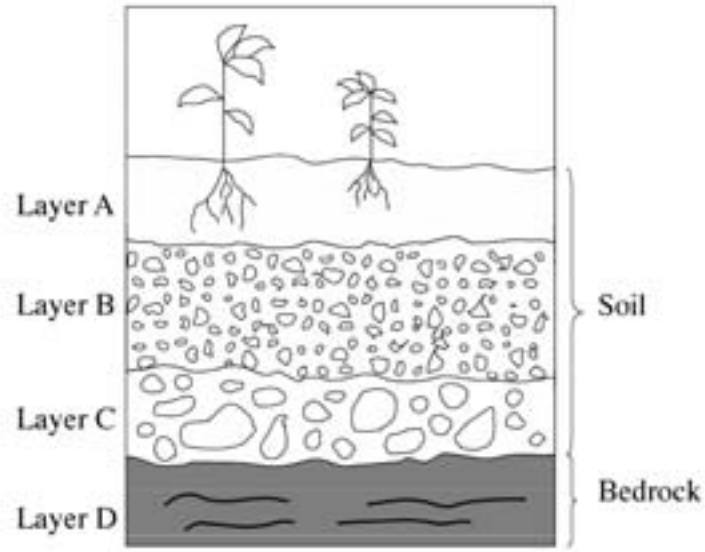
B. The Moon rotates at very high speed.

C. The Moon is covered with a thin layer of ice.

D. The Moon has many craters.

Item Number: H03

Which layer in the diagram contains the most organic material?



A. Layer A

B. Layer B

C. Layer C

D. Layer D

Item Number: H04

Which BEST describes the movement of the plates that make up Earth's surface over millions of years?

A. They moved for millions of years but have now stopped.

B. They stayed the same for millions of years but are now moving.

C. They have been continually moving.

D. They have never moved.

Item Number: J01

Which of the following is an important factor in explaining why seasons occur on Earth?

A. Earth rotates on its axis.

B. The Sun rotates on its axis.

C. Earth's axis is tilted.

D. The Sun's axis is tilted.

Item Number: J06

Diana and Mario were discussing what it might be like on other planets. Their science teacher gave them data about Earth and an imaginary planet Proto. The table shows these data.

	Earth	Proto
Distance from a star like the Sun	148 640 000 km	902 546 000 km
Atmospheric pressure at surface of planet	101 325 Pa	100 Pa
Atmospheric conditions • gas components	21% oxygen 0.03% carbon dioxide 78% nitrogen	5% oxygen 5% carbon dioxide 90% nitrogen
• ozone layer	yes	no
• cloud cover	yes	no

Write down one important reason why it would be difficult for humans to live on Proto if it existed. Explain your answer.

Item Number: J09

Jet aircraft typically fly at altitudes of approximately 10,000 meters. Atmospheric conditions at this altitude are different from those at ground level. Write down one difference that exists and explain why it must be controlled for in order for people to survive inside jet aircraft.

Item Number: R04

Draw a diagram to show how water from the sea can fall as rain on land.

Item Number: Z02

Immediately before and after running a 50 meter race, your pulse and breathing rates are taken. What changes would you expect to find?

A. no change in pulse but a decrease in breathing rate

B. an increase in pulse but no change in breathing rate

C. an increase in pulse and breathing rate

D. a decrease in pulse and breathing rate

E. no change in either

Item Number: B04

Sensory messages are taken to the brain by

A. arteries and veins

B. arteries and hormones

C. nerves and hormones

D. muscles and veins

Item Number: D05

Seeds develop from which part of a plant?

A. Flower

B. Leaf

C. Root

D. Stem

Item Number: D06

A small animal called the duckbilled platypus lives in Australia. Which characteristic of this animal shows that it is a mammal?

A. It eats other animals.

B. It feeds its young milk.

C. It makes a nest and lays eggs.

D. It has webbed feet.

Item Number: F01

Humans interpret seeing, hearing, tasting and smelling in the

A. brain

B. spinal cord

C. receptors

D. skin

Item Number: F03

Which of these is NOT a function of the blood?

A. Digesting food

B. Protecting against disease

C. Carrying waste materials away from the cells

D. Carrying oxygen to different parts of the body

Item Number: H01

What are vitamins?

A. Substances that break down food

B. Bacteria that people get when they eat some foods

C. Substances that people make from protein

D. Substances that people need in small amounts in order for their bodies to function normally

Item Number: H02

What feature is shared by ALL insects?

A. External skeleton

B. Two pairs of wings

C. Jumping legs

D. Stinging mechanism

Item Number: J02

The BEST reason for including protein in a healthy diet is because it is the main source of

A. energy for the body

B. fiber for digestion

C. raw materials for cell growth and repair

D. vitamins for fighting disease

Item Number: J07

What is the primary function of the large leaves found on seedlings growing in a forest?

A. To provide shade for the root systems

B. To get rid of excess water that is entering through the roots

C. To allow for leaf damage by insects

D. To gather as much light as possible for photosynthesis

Item Number: L02

Which one of the following characteristics is most likely to be found in mammals that are preyed on by other mammals for food?

A. Eyes on the sides of the head

B. Teeth that are long and pointed

C. Claws on the feet

D. Ears that cannot move

Item Number: L03

When male wolves place their scent on trees, they most likely are doing this in order to

A. attract female wolves

B. attract prey

C. mark their territory against other wolves

D. mark the location of food supplies

Item Number: L05

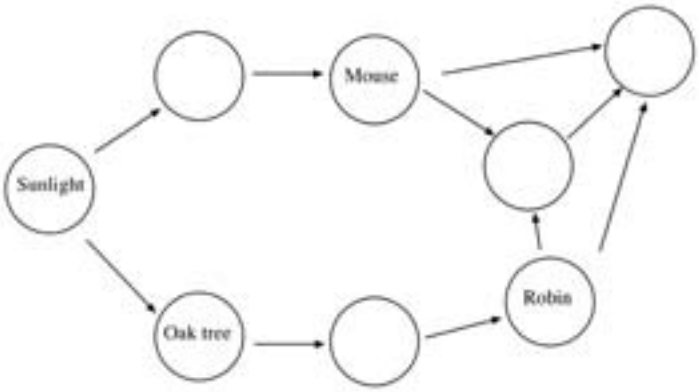
An incomplete food web has been drawn for you. Complete it by filling in each of the empty circles with the number of the correct animal or plant from the list. Remember that the arrows represent energy flow and go from the provider to the user.

1) Caterpillar

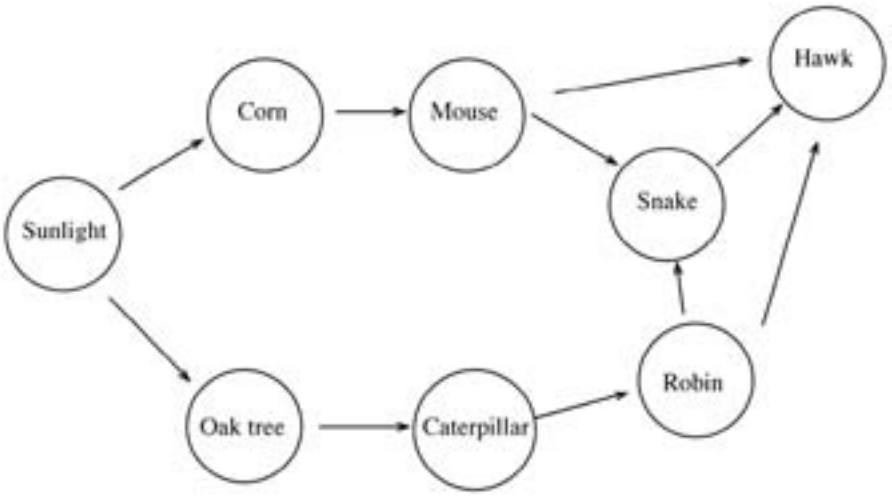
2) Corn

3) Hawk

4) Snake



Item Number: L08



Look at the food web above. If the corn crop failed one year what would most likely happen to the robin population? Explain your answer.

Item Number: N02

Which of the following organisms are used to convert milk to yogurt?

A. Bacteria

B. Protozoa

C. Viruses

D. Algae

Item Number: N03

Some plants grow better if bone meal (ground-up bones) is spread around their roots. What does bone meal supply to plants that makes them grow better?

A. Energy

B. Minerals

C. Vitamins

D. Carbon dioxide

E. Water

Item Number: N05

Tissues are found in living things. What is the definition of a tissue?

A. A group of cells with similar structure and function

B. A group of cells with different structure and function

C. A group of organelles contained inside a cell

D. A group of substances that make up the walls of a cell

Item Number: N06

Which statement best explains why mammals are found in very cold regions of the world but lizards are not?

A. Both mammals and lizards are cold-blooded, but mammals have fur to keep them warm.

B. Both mammals and lizards are warm-blooded, but lizards get too cold when they shed their skin.

C. Since mammals, but not lizards, are warm blooded, their body temperature will adjust to match the external temperature.

D. Since mammals, but not lizards, are warm-blooded, they will maintain their body temperature using heat from metabolic processes.

Item Number: N08

Ethan hammered a nail into the trunk of a young tree. Explain why the nail was still at the same height from the ground twenty years later even though the tree had grown to a height of 22 meters.

Item Number: P03

Animals hibernate to survive cold weather and poor food supplies. Which of the following occurs in animals when they hibernate?

A. Their blood stops circulating.

B. Their body temperature increases.

C. Their body fat remains constant.

D. Their rate of metabolism decreases.

Item Number: P04

What digestive substance is found in the stomach? What does it do?

Item Number: P06

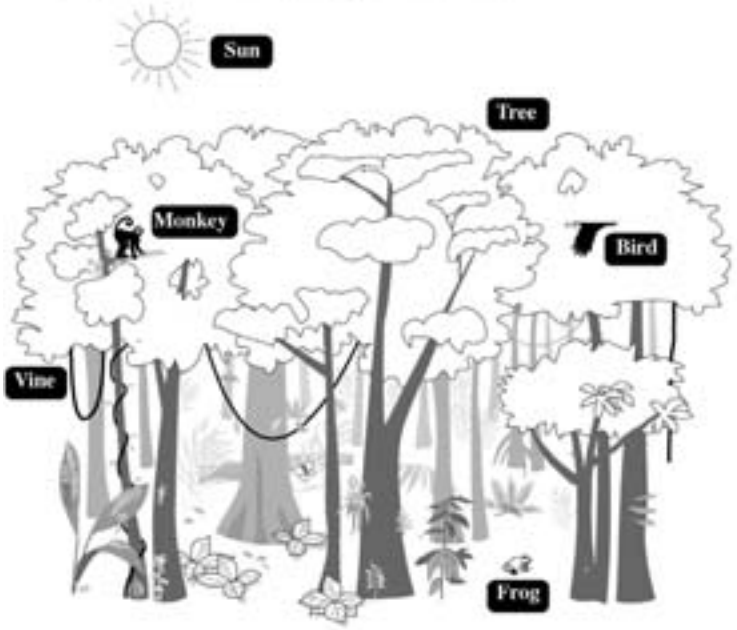
A new species of fish was released into a lake. State two unwanted outcomes that could arise from the introduction of this new species.

1.

2.

Item Number: R03D

In the picture of a rainforest, six objects have been labeled.



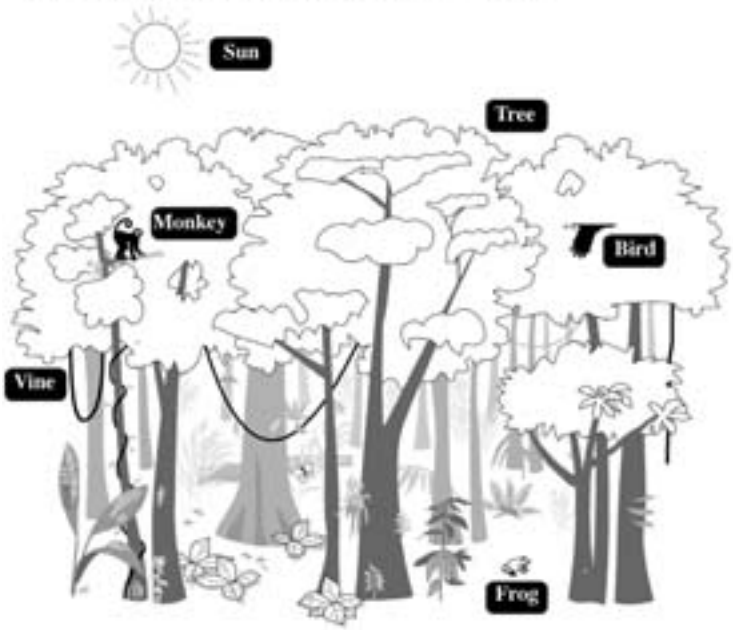
Explain why each of the following is important in maintaining the ecosystem in the rainforest.

A. The Tree

B. The Sun

Item Number: X02A

In the picture of a rainforest, six objects have been labeled.



Explain why each of the following is important in maintaining the ecosystem in the rainforest.

A. The Tree

B. The Sun

Item Number: X02B

Most of the chemical energy released when gasoline burns in a car engine is not used to move the car, but is changed into

A. electricity

B. heat

C. magnetism

D. sound

Item Number: B02

Which object listed in the table has the greatest density?

Object	Mass of Object	Volume of Object
W	11.0 grams	24 cubic centimeters
X	11.0 grams	12 cubic centimeters
Y	5.5 grams	4 cubic centimeters
Z	5.5 grams	11 cubic centimeters

A. W

B. X

C. Y

D. Z

Item Number: B03

The walls of a building are to be painted to reflect as much light as possible. What color should they be painted?

A. White

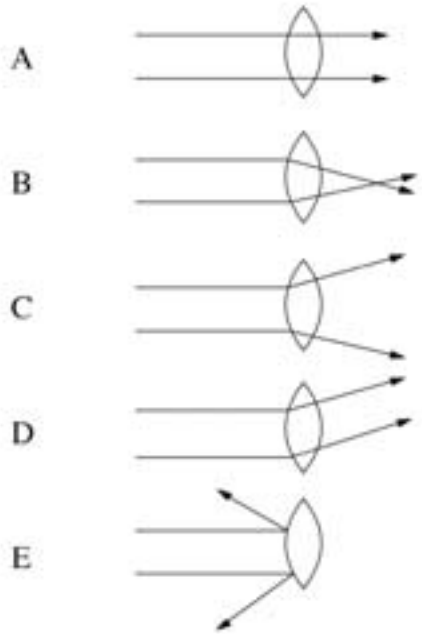
B. Red

C. Black

D. Pink

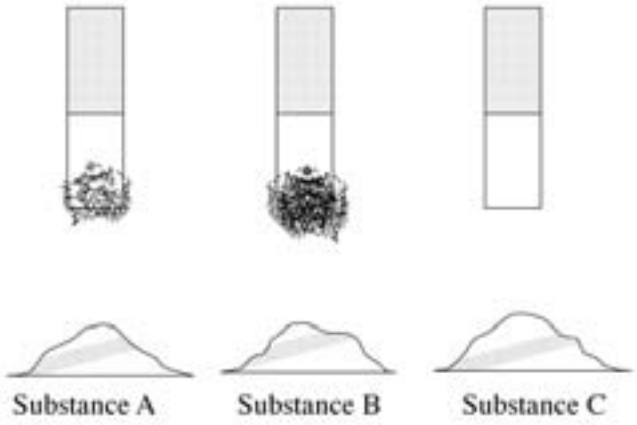
Item Number: B06

Which diagram best shows what happens when light passes through a magnifying glass?



Item Number: D01

Each of the three magnets shown has been dipped into the substance below it. Which of the substances could be coffee?



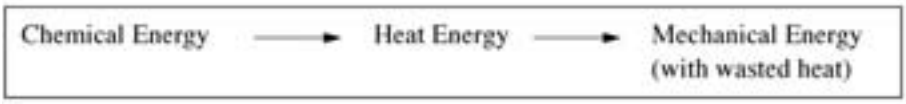
A. A only

B. B only

C. C only

D. A and B only

Item Number: D02



The sequence of energy changes shown in the diagram explains which event?

A. A flashlight is on.

B. A candle burns.

C. Gasoline burns to power a car.

D. Electric current runs a refrigerator.

Item Number: D04

On a warm sunny day, you will feel cooler wearing light-colored clothes because they

A. reflect more radiation

B. prevent sweating

C. are not as heavy as dark clothes

D. let more air in

Item Number: F02

People get energy from the food they eat. Where does the energy stored in food come from?

A. Fertilizer

B. The Sun

C. Vitamins

D. The soil

Item Number: H05

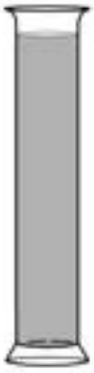
A student put 100 mL of water in each of the open containers and let them stand in the sun for one day. Which container would probably lose the most water due to evaporation?

A.

B.

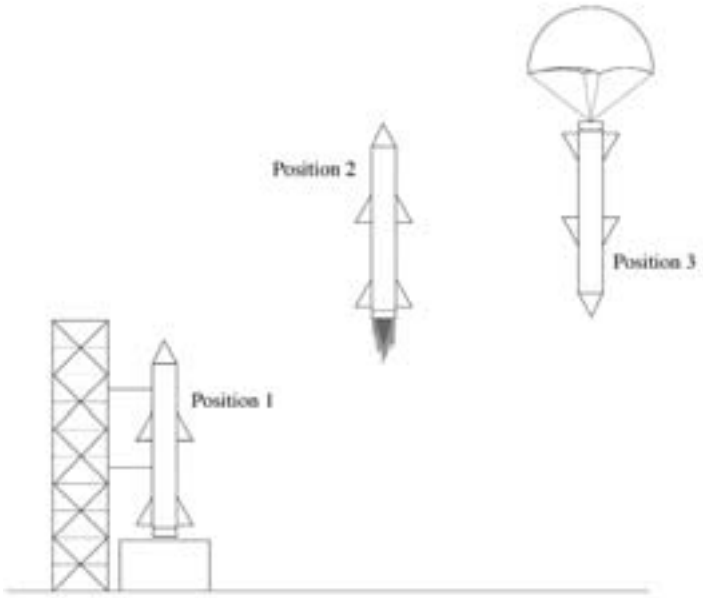
C.

D.



Item Number: J04

The drawings show a rocket being launched from Earth and then returning.



In which of the three positions does gravity act on the rocket?

A. 3 only

B. 1 and 2 only

C. 2 and 3 only

D. 1, 2 and 3

Item Number: J05

Sunscreen is used to protect the skin from exposure to which type of solar radiation?

A. Visible

B. X-rays

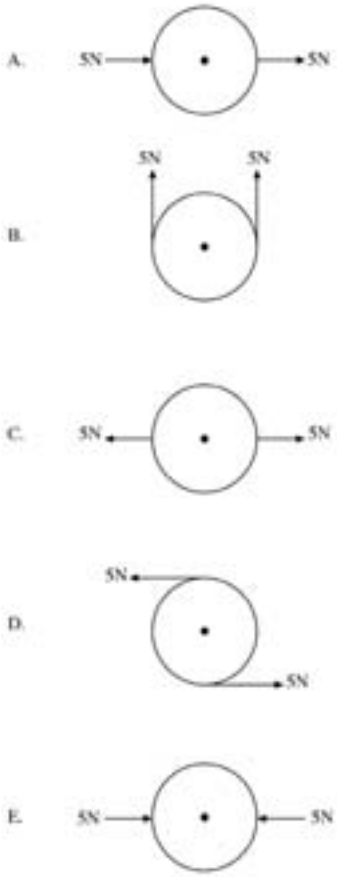
C. Infrared

D. Ultraviolet

E. Microwaves

Item Number: J08

A uniform wheel is free to rotate on its axle at its center. It is acted on by two forces in the same plane. Each force has the same size, equal to 5N (Newtons). In which case will the wheel rotate?



Item Number: L01

Machine A and Machine B are each used to pump water from a river. The table shows what volume of water each machine removed in one hour and how much gasoline each of them used.

	Volume of Water Removed in 1 Hour (liters)	Gasoline Used in 1 Hour (liters)
Machine A	1000	1.25
Machine B	500	0.5

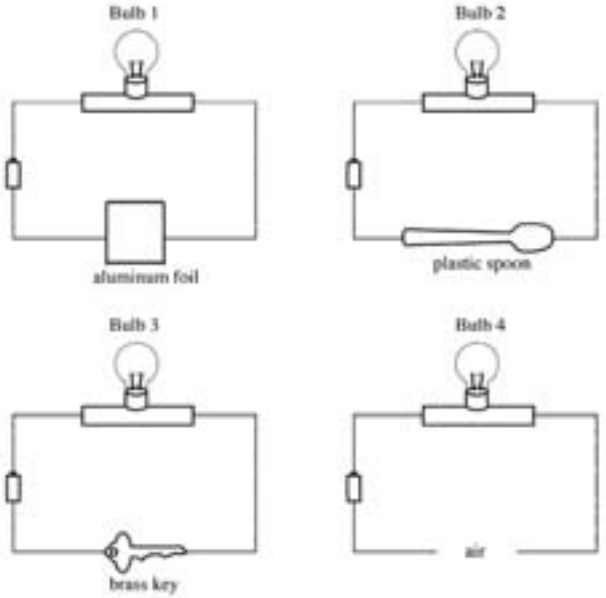
a) Which machine is more efficient in converting the energy in gasoline to work?

Answer:_____

b) Explain your answer.

Item Number: L04

The following diagrams show a battery and a bulb connected by wires to various materials.



Which of the bulbs will light?

A. 1 only

B. 2 and 3 only

C. 1 and 3 only

D. 1, 3 and 4 only

E. 1, 2 and 3 only

Item Number: N01

Which picture shows the best way for the man to balance a ten-liter bucket of water and a five-liter bucket of water?

A.

B.

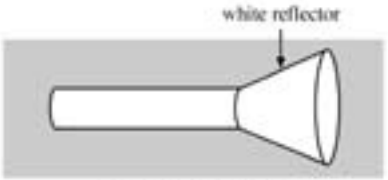
C.

D.

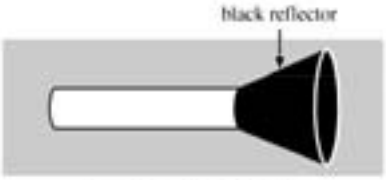
Item Number: N09

Roddy and Stephanie each make a flashlight using identical batteries and bulbs.

They then add cardboard reflectors to their flashlights as shown below. Roddy's reflector is made of white cardboard and Stephanie's reflector is made of black cardboard.



Roddy's Flashlight



Stephanie's Flashlight

The flashlights are then switched on.

a) Which flashlight shines more light on a wall two meters away? (check one)

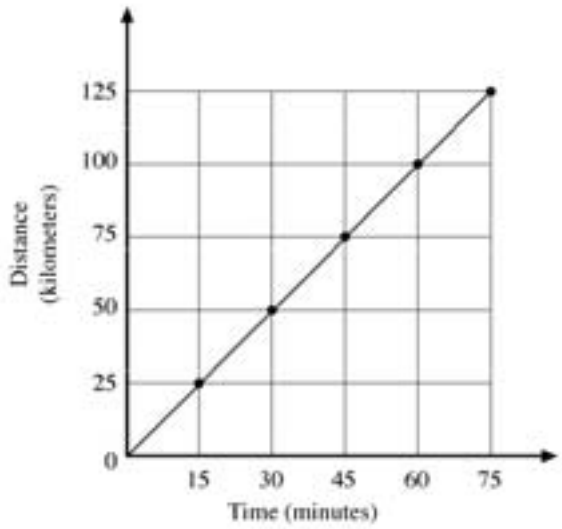
☐ Roddy's (white reflector)

☐ Stephanie's (black reflector)

b) Explain your answer.

Item Number: N10

The graph shows the progress made by a car traveling along a straight road.



What is the speed of the car?

A. 25 kilometers per hour

B. 50 kilometers per hour

C. 75 kilometers per hour

D. 100 kilometers per hour

Item Number: P01

James turns on a flashlight in his bedroom and shines it on his wall one meter away to produce a small circle of light. He then shines the flashlight on his ceiling two meters away to produce a larger circle of light.

a) Does more light reach the ceiling than the wall? (Check one)

☐ Yes

☐ No

b) Explain your answer.

Item Number: P02

As a play begins, white stage lights shine on an actress wearing a red dress. Suddenly, the lights go off and a green light is shone on the actress. The dress looks black. Why does the dress look black?

A. The dress reflects the green part of light.

B. The dress absorbs the red part of light.

C. The dress absorbs the green part of light.

D. The dress reflects the black part of light.

Item Number: R02

Electrical energy is used to power a lamp. How does the amount of electrical energy used compare to amount of light energy produced?

a) The amount of electrical energy used is:
(Check one)

☐ more than the amount of light energy produced.

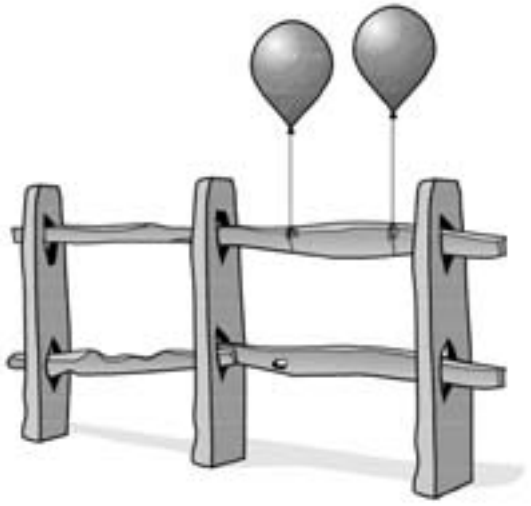
☐ less than the amount of light energy produced.

☐ the same as the amount of light energy produced.

b) Give a reason to support your answer.

Item Number: X01

Balloons filled with helium gas are taken outside on a hot, sunny day and tied to a fence as shown in the diagram.



Over a period of a few hours, the balloons increase in size.
Explain why.

Item Number: Z03

Paint applied to an iron surface prevents the iron from rusting. Which ONE of the following provides the best reason?

A. It prevents nitrogen from coming in contact with the iron.

B. It reacts chemically with the iron.

C. It prevents carbon dioxide from coming in contact with the iron.

D. It makes the surface of the iron smoother.

E. It prevents oxygen and moisture from coming in contact with the iron.

Item Number: F06

If you are burning wood, the reaction will

A. release energy

B. absorb energy

C. neither absorb nor release energy

D. sometimes release and sometimes absorb energy, depending on the kind of wood

Item Number: H06

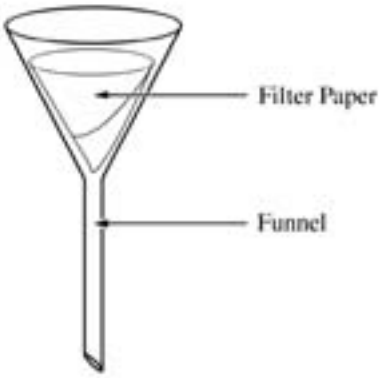
The words *organs, tissues*, and *cells* can be used in the following sentence:

Lungs are *organs* composed of *tissues* which are made up of *cells*.

Use the words *molecules*, *atoms*, and *compounds* to complete the following sentence:

Sugars are _____ composed of _____ which are made up of _____.

Item Number: J03



Filtration using the equipment shown above can be used to separate which materials?

A. A mixture of salt and pepper

B. A mixture of pepper and water

C. A mixture of oxygen and water

D. A solution of silver nitrate in water

E. A solution of sugar in water

Item Number: L06

Which is an example of a chemical reaction?

A. Water boiling

B. Sugar dissolving

C. Nails rusting

D. Wax melting

Item Number: N07

A large log of wood will burn more slowly than the same log chopped into smaller pieces. Explain why.

Item Number: R05

A steel manufacturer uses a chemical process called 'galvanization' to protect the surface of steel beams that are used to construct high-rise buildings. It takes a crew of steel workers 8 hours to 'galvanize' a large batch of steel.

a) Why MUST the surface of the steel be protected?

b) A new 'galvanization' process is developed that shortens the procedure to 4 hours. Describe two consequences of the steel manufacturer switching to the shorter 'galvanization' process.

1.

2.

Item Number: Z01A

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b) A new 'galvanization' process is developed that shortens the procedure to 4 hours. Describe two consequences of the steel manufacturers switching to the shorter 'galvanization' process.

1.

2.

Item Number: Z01D

Rain and running water can wash away soil. From which area is soil most likely to be washed away?

A. A sloping area with bushes

B. A flat area with grasses

C. A flat area that is barren

D. A sloping area that is barren

Item Number: F04

Insecticides are used to control insect populations so that they do not destroy crops. Over time, some insecticides become less effective at killing insects, and new insecticides must be developed. What is the most likely reason insecticides become less effective over time?

A. Surviving insects have learned to include insecticides as a food source.

B. Surviving insects pass their resistance to insecticides to their Soffspring.

C. Insecticides build up in the soil.

D. Insecticides are concentrated at the bottom of the food chain.

Item Number: L07

What are two reasons why famine (a great shortage of food) occurs?

1.

2.

Item Number: P05D

What is predicted to be a result of global warming?

A. Rising ocean level

B. More severe earthquakes

C. Larger volcanic eruptions

D. Thinning ozone layer

Item Number: R06

Two open bottles, one filled with vinegar and the other with olive oil, were left on a window sill in the Sun. Several days later it was observed that the bottles were no longer full. What can be concluded from this observation?

A. Vinegar evaporates faster than olive oil.

B. Olive oil evaporates faster than vinegar.

C. Both vinegar and olive oil evaporate.

D. Only liquids containing water evaporate.

E. Direct sunlight is needed for evaporation.

Item Number: N04

The primary reason scientists repeat the measurements they take during experiments is so that they can

A. check that the equipment is working

B. list all the results in a table

C. estimate experimental error

D. change the experimental conditions

Item Number: P07

Alexander Fleming noticed that bacteria growing on a plate of agar did not grow next to a mold that was growing on the same plate. He wrote in his laboratory report: "The mold may be producing a substance that kills bacteria." This statement is best described as

A. an observation

B. a hypothesis

C. a generalization

D. a conclusion

Item Number: R01

Suppose you want to investigate how long it takes for the heart rate to return to normal after exercising. What materials would you use and what procedures would you follow?

Item Number: X03