

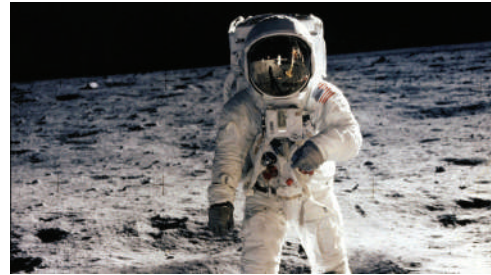
ALL QUESTIONS WORTH 4 POINTS

1. For long-distance walking or hiking, it is more advisable to wear sports shoes than high-heeled shoes. People who wear high-heeled shoes for extended periods of time develop blisters and feel pain in their legs.

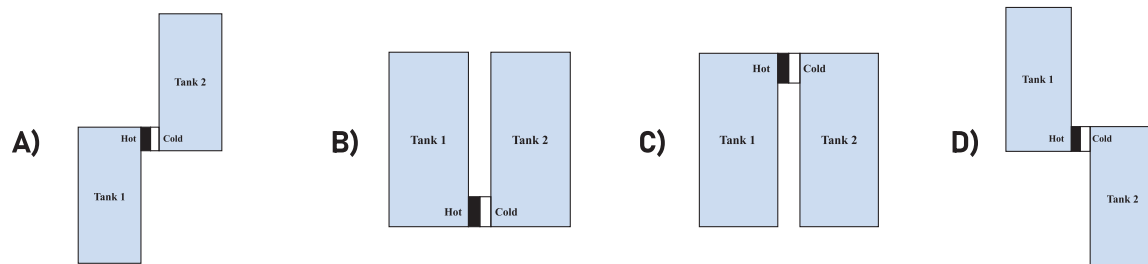


Which statement is true about sports shoes?

- A) High-heeled shoes exert greater pressure since the base area is larger.
 B) Sports shoes exert greater pressure on the floor.
 C) Sports shoes exert the same pressure on the ground as high heeled shoes.
 D) Sports shoes have a larger base area onto which the weight is exerted.
2. Sound travels through the air when an object vibrates and causes nearby air molecules to vibrate. However, sound can travel through solids and liquids at higher speeds as the particles are closer to each other. Hence, sound travels the fastest in the solid state. Why are astronauts unable to hear each other speaking when they are in space?



- A) There is no air in space.
 B) There are no waves in space.
 C) The suits that astronauts wear are sound proof.
 D) There is no gravity in space.
3. A Peltier heat pump is a device that is commonly used to cool small objects. When electricity flows through the heat pump, one side of it becomes very hot while the other side becomes very cold. Bob has two water tanks on his roof, and wants to heat up one tank to have hot water for showering, and cool down the other tank to have cold drinking water. How should he arrange the two tanks and the Peltier heat pump in order to heat and cool the water most efficiently?



4. There are many different types of forces present in the world around us. Certain forces are present all the time on Earth, such as weight due to gravity. However, other forces such as friction are only present in some situations like when objects slide against one another. In the past, people used friction to create heat and start fires to provide warmth. Which of the following scenarios shows an example of frictional force?



- A) A football comes to a stop on a field a few moments after being kicked.
- B) A swimmer kicks forcefully against the wall to propel himself forward.
- C) A boxer feels pain in his knuckles after landing a powerful punch on his opponent.
- D) A basketball returns to a lower height after it bounces than the height it is dropped from.

5. Static electricity occurs when electrons move from one object to another. This happens when there is contact between objects which allows for the flow of electrons. A rod is rubbed against a cloth. A negatively-charged bar is then brought close to the rod and the rod is repelled by the bar. Which of the following statements describes the flow of charges between the rod and the cloth?



- A) Electrons flow from the cloth to the rod.
 - B) Electrons flow from the rod to the cloth.
 - C) Positive charges flow from the cloth to the rod.
 - D) Positive charges flow from the rod to the cloth.
6. In festivals all around the world, people light fireworks which create beautiful patterns in the night sky. A firework rocket consists of two parts. The first part, the "motor", contains a chemical propellant that sends the rocket into the sky when the fuse is lit. The second part, the "effect", contains a chemical explosive that causes the firework to explode with a beautiful colour and pattern. Which of the following is not an energy conversion that takes place in the firework rocket's flight and explosion?



- A) Kinetic energy \rightarrow Heat energy and Light energy
- B) Kinetic energy \rightarrow Gravitational potential energy
- C) Chemical potential energy \rightarrow Kinetic energy
- D) Chemical potential energy \rightarrow Heat energy and Light energy

7. There are many optical phenomena that cause wonder and amazement, especially for ancient observers. Which of the following phenomena cannot be captured with a camera?

- A) Short-sightedness B) Mirage
C) Double rainbow D) Auora borealis



8. Stephen Curry is a professional basketballer. Basketball involves bouncing the ball across the court away from your opponents, and landing it in the hoop. Which statement does not correctly describe the energy or forces acting on the basketball as it bounces?

- A) The higher the basketball when it is bounced, the more gravitational potential energy it has.
B) The higher the ball bounces, the more gravitational force acts on it.
C) Kinetic energy is converted to gravitational potential energy for Stephen Curry to bounce the basketball upwards.
D) Gravitational force is acting on the basketball at all times.



9. Dry ice is usually placed inside ice cream cake boxes to prevent the cakes from melting too quickly. When exposed to heat, dry ice transforms directly to carbon dioxide gas, without first becoming a liquid. What process describes the formation of carbon dioxide gas from dry ice?

- A) Condensation B) Sublimation C) Melting D) Evaporation



10. Amy is preparing a batch of chocolate chip cookies but she suddenly realises that she does not have any more baking powder. Therefore, she decides to use baking soda and add some lemon juice to the dough. The lemon juice helps the cookies rise.

When lemon juice is added to a baking recipe containing baking soda, the reaction that occurs produces carbon dioxide gas, causing the dough to rise. What type of reaction occurred between the lemon juice and baking soda?

- A) Redox reaction B) Precipitation reaction
C) Acid-base reaction D) Acid-carbonate reaction



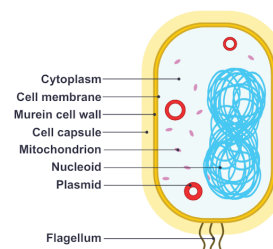
11. Patients who have recently gone for eye surgery will be given eyedrops to use. Eyedrops are like artificial tears, which help to moisten the eye, promoting healing and reducing irritation. One type of eyedrops is made by dissolving very pure sodium chloride in very pure water. Which of the following best describes these eyedrops?



- A) Solution B) Compound C) Element D) Suspension
12. Chefs frequently sharpen their knives so that it is easier to cut food. A whetstone is used to grind knife blades. These are used by chefs to sharpen blunt knives. Why do chefs find it easier to cut with knives after sharpening them?
- A) The knives become more lightweight and easier to handle.
 B) The cutting area of the knife is reduced, hence less force is needed to exert the same amount of pressure needed to slice.
 C) The cutting area of the knife is increased, hence less force is needed to exert the same amount of pressure needed to slice.
 D) Particles of the whetstone bond with the knife blade to harden it, making it stronger to cut with.
13. Baked Alaska is a popular dessert. The preparation involves coating a scoop of ice cream on some cake with whipped fluffy cream, before baking it. Alice decides to make the snack as a reward for studying. For her first baked Alaska, she did not whip the cream. She realizes this and whips the cream properly to achieve a fluffy texture. She then makes her second dessert. Both desserts were chilled before baking. She bakes them both at the same time. After baking, her first baked Alaska was melted, while her second dessert was not. Why did the whipping contribute to the second dessert not melting?
- A) Whipping cools the cream to a lower temperature than the ice cream. Thus, in the second snack, heat is transferred away from the ice cream into the cream coat.
 B) Whipping introduces air bubbles in the cream coating, and thus making the cream a better insulator of heat.
 C) Whipping provides heat energy to maintain the latent heat of fusion.
 D) Whipping causes the cream to be more runny and liquid. The liquid state keeps the ice cream cold.



14. Miso soup is a Japanese broth made using miso paste, seafood stock and water. Miso paste is a fermented bean paste. Some claim that miso paste has gut health benefits, due to the presence of good gut bacteria in the paste. The gut bacteria is called *A. oryzae*, and follows a structure similar to the cell in the image. Some people claim that using boiling water to make miso soup



decreases the health benefits. Why does using boiling water to make miso soup decrease health benefits?

- A) Boiling water could introduce high temperatures that could kill the good gut bacteria.
- B) Boiling water could result in the growth of bad gut bacteria instead.
- C) The boiling water would dilute the paste and make it more difficult for the good gut bacteria to grow.
- D) The bacteria in the paste would absorb the water and undergo cytolysis.

15. Professional cyclists were involved in doping scandals where they injected themselves with hormone E before races. They were able to cycle longer distances without feeling tired or sore. Which component of their blood does hormone E most likely affect?

- A) Hormone E increases the production of red blood cells, increasing the transport of carbon dioxide for respiration.
- B) Hormone E increases the production of white blood cells, increasing the transport of oxygen for respiration.
- C) Hormone E increases the production of red blood cells, increasing the transport of oxygen for respiration.
- D) Hormone E increases the production of white blood cells, increasing the transport of carbon dioxide for respiration.



16. Irekia and her family joined a strawberry picking activity in Seoul, where she observed that the plants have both flowers and strawberries. What processes have occurred for the flowers to develop into the strawberries?

- A) Seed dispersal and germination
- B) Germination and fertilization
- C) Pollination and fertilization
- D) Pollination and germination



17. Belinda had her first visit to the indoor skydiving in a new theme park. The instructor explains that there is a fan blowing upwards to keep her afloat at certain positions. Which of the following statements correctly describes the forces acting on Belinda as she floats without moving?

- A) The forces acting on Belinda are different in magnitude and opposite in direction.
- B) The forces acting on Belinda are equal in magnitude and acting in the same direction.
- C) The forces acting on Belinda are equal in magnitude but opposite in direction.
- D) The forces acting on Belinda are different in magnitude but acting in the same direction.

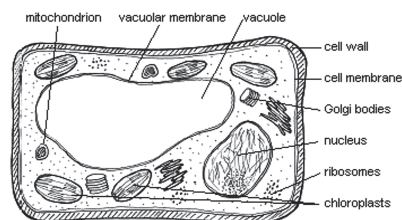


18. George had a learning journey to the local science laboratory. He saw many biologists looking at cells under the microscope. One of the biologists explained that sometimes, to better visualize the parts of the cells, they would submerge the cells into a solution. Which of the following statements are true about the preparation process?



- A) Biologists immerse cells in hypertonic solutions, where the higher solute concentration prompts water to enter cells through osmosis.
- B) Biologists immerse cells in hypertonic solutions, where the lower solute concentration prompts water to enter cells through osmosis.
- C) Biologists immerse cells in hypotonic solutions, where the lower solute concentration prompts water to enter cells through osmosis.
- D) Biologists immerse cells in hypotonic solutions, where the higher solute concentration prompts water to enter cells through osmosis.

19. Sandra is learning about cells in school. She found this diagram of a cell in her textbook. Where may this cell come from?



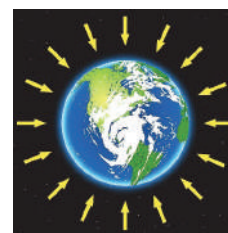
- A) Root of a plant
- B) Leaf of a tree
- C) Stomach of a cow
- D) Blood of a chicken

20. Andy was singing songs at the karaoke with his friends. What are the energy changes that enable the microphone to make his voice louder and be played through the speakers?



- A) Kinetic energy → Sound energy → Electrical energy
- B) Kinetic energy → Electrical energy → Sound energy
- C) Sound energy → Kinetic energy → Electrical energy
- D) Sound energy → Electrical energy → Sound energy

21. In 1687, Newton published his groundbreaking work "Philosophiae Naturalis Principia Mathematica," where he described the principles of gravity. Which of the following is not an example of gravity working?



- A) The moon revolves around the Earth
- B) Dropping a pen on the floor
- C) Magnet attracting nails
- D) Pouring a cup of coffee

22. Donovan was using a calculator when he realised that his calculator has a solar panel. When he pasted a black duct tape over the solar panel, the calculator was unable to be switched on. What is the energy conversion that happens in a solar calculator?



- A) Electrical energy → Light energy
- B) Light energy → Chemical energy
- C) Light energy → Electrical energy
- D) Electrical energy → Potential energy

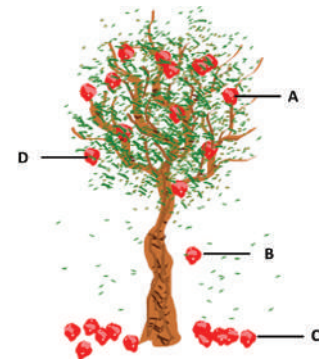
23. Stephanie was taking a walk in the garden and saw a bird feeding on a fruit. Which traits help a fruit to be dispersed by animals?



- A) Fruits lighter than water
 B) Light and fluffy hooks
 C) Fruits with wing-like structures
 D) Fruits with sticky hooks
24. Jia Wen went to Bird Paradise and saw some penguins. Which of the statements describing the adaptations that penguins have is correct?
- A) Penguins have black feathers to reflect heat from the sun.
 B) Penguins have closely packed feathers to help them swim faster in the water.
 C) Penguins have flippers to slow down heat loss to the ground.
 D) Penguins have a streamlined body shape to reduce water resistance and enable them to swim faster.



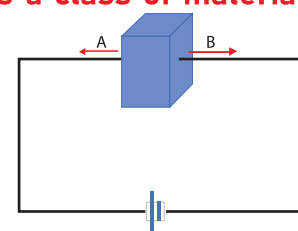
25. Newton discovered gravity when an apple fell on his head. Gravitational force is a force that draws objects to the ground. In the diagram below, gravitational force acts on which apple?



- A) A, D
 B) A, B, D
 C) C
 D) A, B, C, D
26. Sammy was waiting in line for a roller coaster in Universal Studios Japan. Sammy became very excited as he heard the roller coaster coming down the steep hill at high speed. The roller-coaster ride starts by descending a steep hill. Which of the following options describes the possible conversion of energy from the top of the hill to the end of the ride?



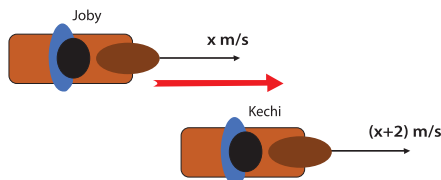
- A) Chemical energy → heat energy + sound energy
 B) Heat energy → kinetic energy + electrical energy + sound energy
 C) Gravitational potential energy → kinetic energy + heat energy + sound energy
 D) Sound energy → heat energy + elastic potential energy
27. We know that in metals, electrons act as free charge carriers, allowing the metal to be a good conductor of electricity. There exists a class of materials, very important for the microelectronics industry, called semiconductors. In a semiconductor, both negatively charged electrons and positively charged "holes" act as the charge carriers, allowing the material to conduct electricity. A semiconductor was connected to the circuit as shown.



Which statement is correct?

- A) The electrons in the semiconductor move in direction A, and the holes in the semiconductor also move in direction A.
- B) The electrons in the semiconductor move in direction B, and the holes in the semiconductor move in direction A.
- C) The electrons in the semiconductor move in direction A, and the holes in the semiconductor move in direction B.
- D) The electrons in the semiconductor move in direction B, and the holes in the semiconductor also move in direction B.

28. Joby and Kechi are seasoned horse-riders who are also professional archery experts. One day, Joby and Kechi were riding their horses through the grasslands, with Joby riding at a speed of x m/s and Kechi in front of him at a speed of $x+2$ m/s. Suddenly, Joby saw a target in front of him and fired an arrow forwards. The arrow zoomed past Kechi, who observed that the arrow travelled 10 m/s faster than him. If the arrow was seen to be moving at 15 m/s by a stationary observer on the ground, what is Joby's speed?



- A) 10 m/s
- B) 5 m/s
- C) 3 m/s
- D) 12 m/s

29. Semiconductors are of great importance in the technology age, being required for the microelectronics that power our smartphones, computers, and even household electronic appliances. The most common type of semiconductor material is silicon. Silicon is in Group 14 of the Periodic Table and has 14 electrons. An n -type silicon semiconductor can be made by introducing an additional element into silicon, with that element being from the same period as Si but having one more electron. What is this element?

- A) Nitrogen
- B) Aluminum
- C) Phosphorus
- D) Carbon

30. A salted calamansi drink is a very refreshing drink on a hot summer's day. It consists of sour lime juice, sugar, and a pinch of table salt (NaCl).



Which of the following cannot be found in a cup of salted calamansi drink?

- A) Chloride ions
- B) Hydrogen ions
- C) Sodium atoms
- D) Sugar molecules