Sc!ence

**Name:** …… **(  )**

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## Multiple-Choice Questions on Forces, Work, Energy and Power

**1.** What is the weight (on Earth) of an object with a mass of 25 kg?

**A** 2.5 N **B** 25 N **C** 250 N **D** 500 N

**2.** Which properties of an object can be changed by a force?

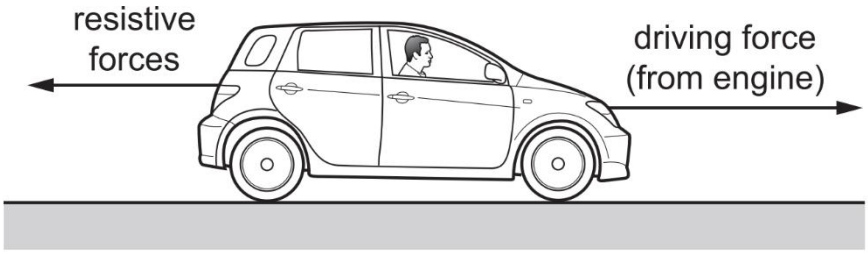
**A** Direction of motion, mass and speed.

**B** Direction of motion, shape and speed.

**C** Direction of motion and speed only.

**D** Mass, shape and speed.

**3.** A car's engine provides a driving force. An equal and opposite resistive force acts on the car. What happens to the car?




**A** The car changes direction.

**B** The car moves at a constant speed.

**C** The car slows down.

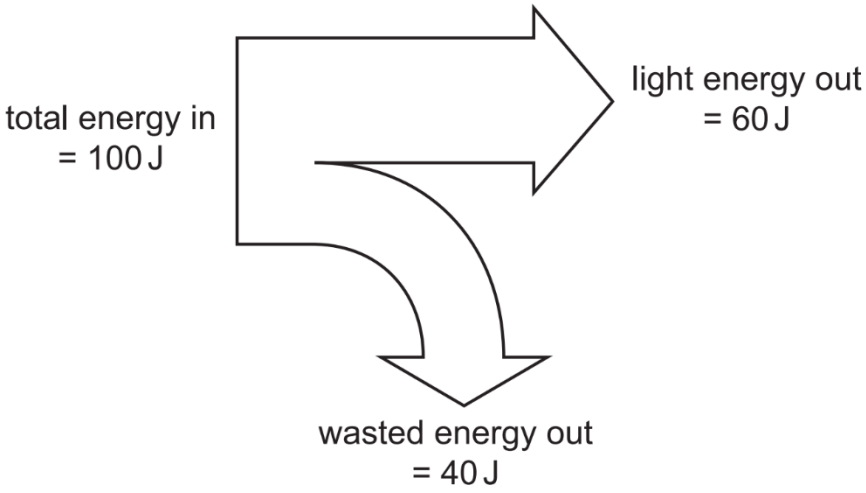
**D** The car speeds up.

**4.** Which options shows the correct relationship between mass and weight?

| | mass | weight |
|---|---|---|
| **A** | 60 N | 600 kg |
| **B** | 60 kg | 600 N |
| **C** | 600 kg | 60 N |
| **D** | 600 N | 60 kg |

**5.** The diagram shows the energy transferred in a lamp in one second.

Which type of wasted energy is produced by the lamp?

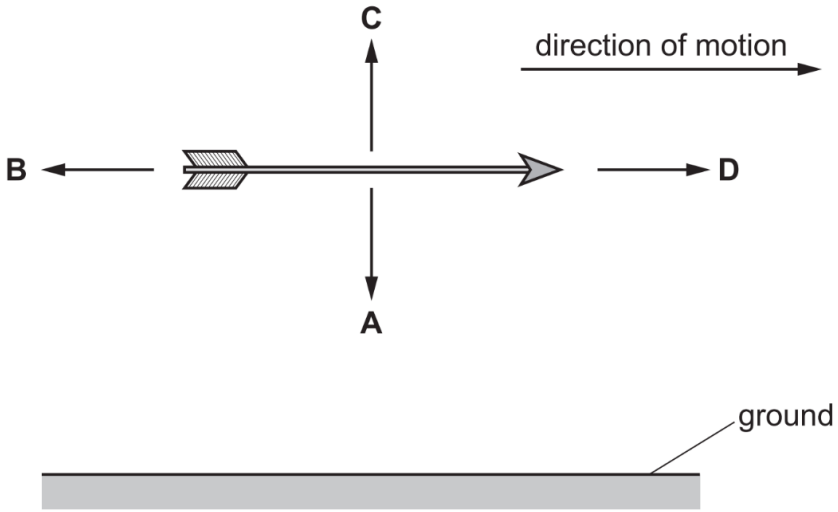



**A** Chemical potential energy. **B** Electrical energy.

**C** Gravitational potential energy. **D** Thermal energy.

**6.** An arrow travels horizontally in a straight line at constant speed.

In which direction does the weight act?




**7.** An object with a mass of 6.0 kg is raised through a distance of 7.5 m.

What work is done on the object?

**A** 45 J **B** 60 J **C** 75 J **D** 450 J

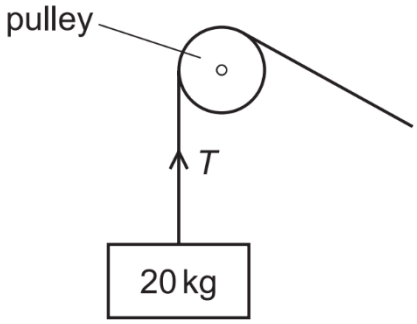
**8.** An object of mass of 600 kg is on the planet Mars. The acceleration due to gravity on Mars is 4.0 m / $s^2$.

What is the object's weight on Mars?

**A** 60 N **B** 150 N **C** 2 400 N **D** 6 000 N

**9.** A mass of 20 kg is held stationary by a rope passing over a frictionless pulley.

What is the tension ***T*** in the rope?




**A** 10 kg **B** 20 kg **C** 100 N **D** 200 N

**10.** A rocket accelerates upwards.

Which **two** statements about the forces acting on the rocket are correct?

I The forces acting on the rocket are balanced.

II The thrust is greater than the weight + air resistance.

III The weight + air resistance is greater than the thrust.

IV The forces acting on the rocket are unbalanced.

**A** I and II **B** I and III

**C** II and IV **D** III and IV

**11.** A machine is very efficient.

What does this mean?

**A** It produces a large amount of power.

**B** It uses very little energy.

**C** It wastes very little energy.

**D** It works very quickly.

**12.** An object is lifted vertically by a motor.

In which example is the power produced the greatest?

**A** Lifting it a shorter distance in a longer time.

**B** Lifting it the same distance in a longer time.

**C** Lifting it a shorter distance in the same time.

**D** Lifting it the same distance in a shorter time.

**13.** A woman has a mass of 60 kg. The area of her feet in contact with the floor is 0.050 $m^2$.

What pressure does she exert?

**A** 1 200 N / $m^2$ **B** 2 400 N / $m^2$ **C** 12 000 N / $m^2$ **D** 24 000 N / $m^2$

**14.** A body is lifted against gravity.

Which equation shows the work done on the body?

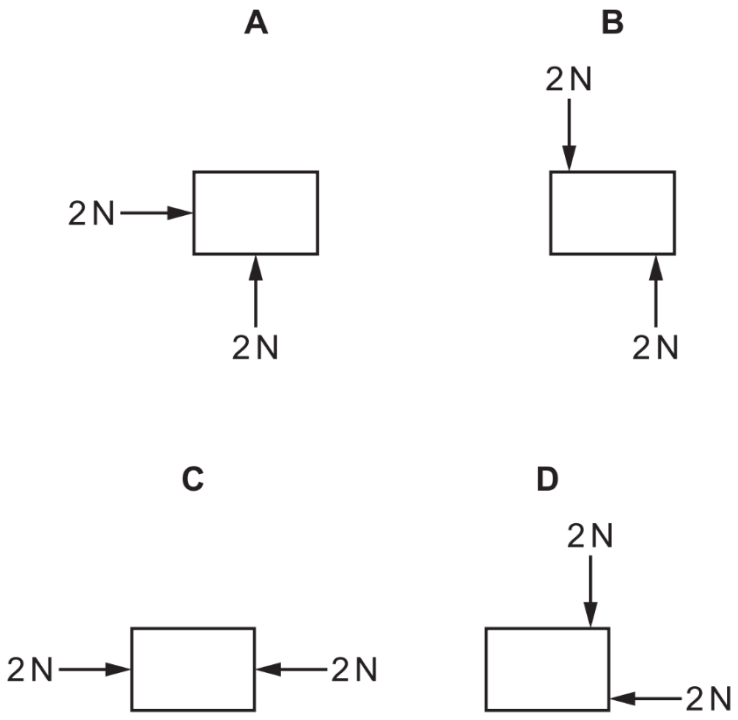
**A** Work done = change in distance moved by the body

**B** Work done = change in energy of the body

**C** Work done = change in force on the body

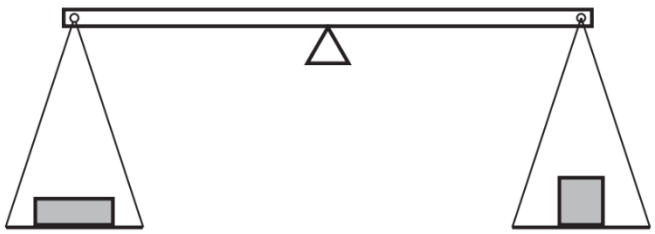
**D** Work done = change in power of the body

**15.** Which object is in equilibrium?




**16.** Two objects are placed on a balance one on each side.

Which properties of the objects can be compared using the balance?



**A** Weight, mass and volume.

**B** Weight and mass.

**C** Volume and density.

**D** Density only.

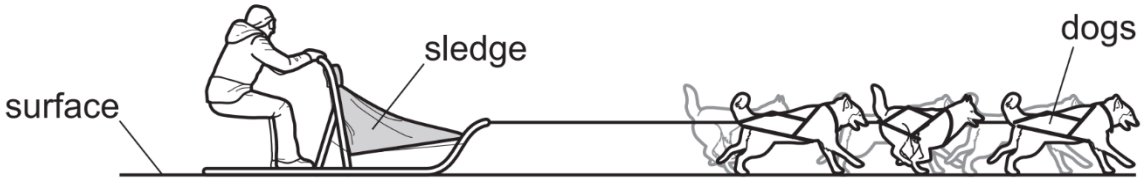
**17.** A team of dogs pulls a sledge across the snow.

The driving force of the dogs = 600 N

Air resistance = 450 N

Friction = 150 N

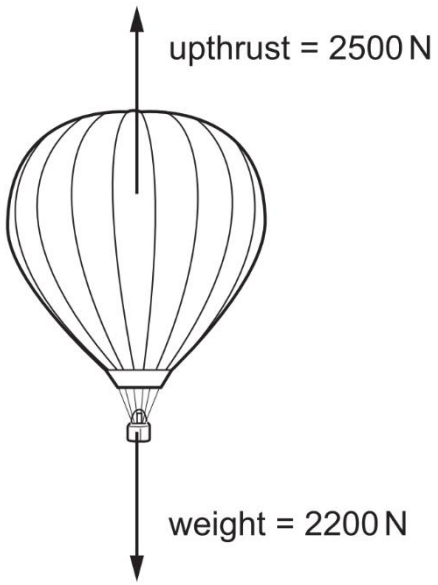
What is the resultant force on the sledge?




**A** 0 N **B** 300 N **C** 900 N **D** 1200 N

**18.** The hot-air balloon is moving upwards at constant speed.

What is the air resistance acting on the hot-air balloon?




**A** 300 N downwards **B** 300 N upwards

**C** 4700 N downwards **D** 4700 N upwards

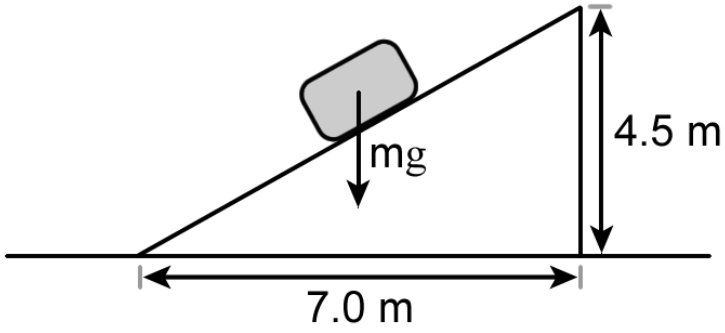
**19.** A mass of 5.0 kg is raised through 2.0 m in 40 s.

What is the power of the system?

**A** 0.25 W **B** 2.5 W **C** 4.0 W **D** 40 W

Questions **20.** and **21.** both refer to the following information.

An object of mass 8.0 kg was pushed up an inclined surface as shown in the diagram given below.




**20.** What is the change in the object's gravitational potential energy once it has reached the top of the slope?

**A** 36 J **B** 252 J **C** 360 J **D** 560 J

**21.** The object is released and allowed to slide down the slope to the ground.

Assuming that no energy is lost to the surroundings, what is the maximum velocity of the object just before it reaches the ground?

**A** 6.7 m / s **B** 9.5 m / s **C** 19 m / s **D** 90 m / s

**22.** The diagram shows the only three forces acting on an object.


What is the resultant force on the object?

**A** 0 N **B** 5.0 N towards the left

**C** 5.0 N towards the right **D** 10.0 N towards the right

**23.** A helicopter takes off from the ground and rises vertically. It then hovers at a constant height above the ground.

Which sequence of energy changes takes place during the gain in height?

**A** chemical → gravitational potential → kinetic

**B** chemical → kinetic → gravitational potential

**C** gravitational potential → chemical → kinetic

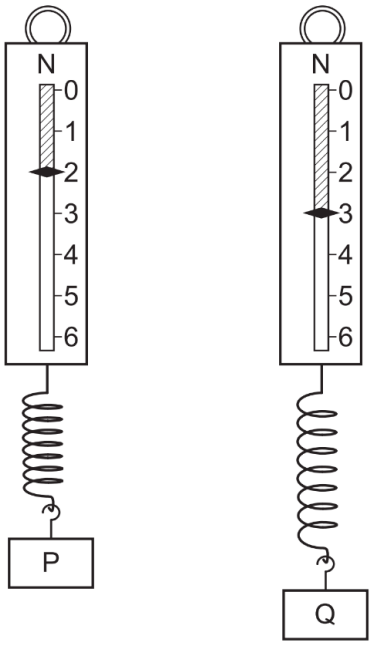
**D** kinetic → chemical → gravitational potential

**24.** An object has a mass of 6 kg and a weight of 120 N on another planet.

What is the value of *g* on the planet?

**A** 5.0 N / kg **B** 10 N / kg **C** 20 N / kg **D** 40 N / kg

**25.** Two metal blocks, **P** and **Q**, have identical dimensions. They hang on identical spring balances.




What can be deduced about **P** and **Q**?

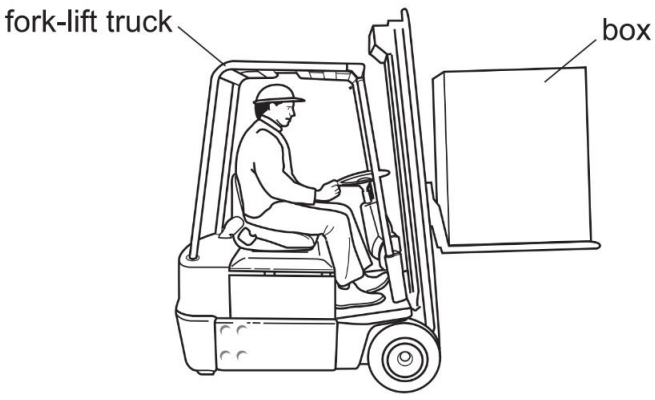
**A** They have different volumes and different weights.

**B** They have different volumes, but equal masses.

**C** They have equal volumes and equal weights.

**D** They have equal volumes, but different masses.

**26.** A box is being lifted by a fork-lift truck.

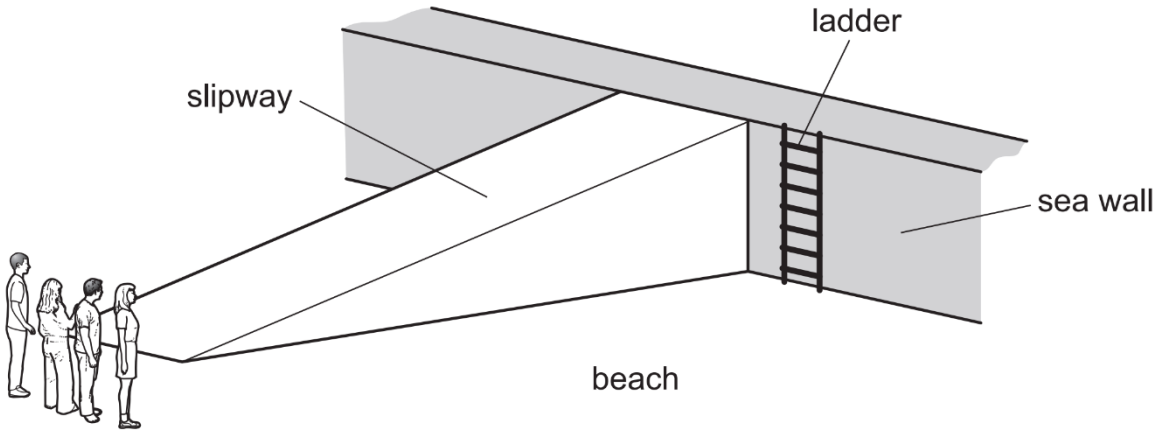



The weight of the box is 3000 N. The force exerted by the fork-lift truck on the box is 3 500 N vertically upwards. What is the resultant force on the box?

**A** 500 N downwards **B** 500 N upwards

**C** 6500 N downwards **D** 6500 N upwards

**27.** Four people of equal weight on a beach use different routes to get to the top of a sea wall.




Which person produces the greatest average power?

| person | route | time taken / s |
|---|---|---|
| **A** | runs across the beach, then climbs the ladder | 8 |
| **B** | walks across the beach, then climbs the ladder | 16 |
| **C** | runs up the slipway | 5 |
| **D** | walks up the slipway | 10 |

**28.** A vehicle sinks into soft ground.

The vehicle is changed so that it does not sink as far. Which change is made?

**A** A lower centre of mass.

**B** A more powerful engine.

**C** Wheels that are further apart.

**D** Wider tyres.

**29.** A force acts on an area to produce a pressure.

Which changes produce the same pressure?

**A** Double the area and double the force.

**B** Double the area and halve the force.

**C** Double the area and make the force four times bigger.

**D** Halve the area and double the force.

**30.** Which statement about the masses and weights of objects on the Earth is correct?

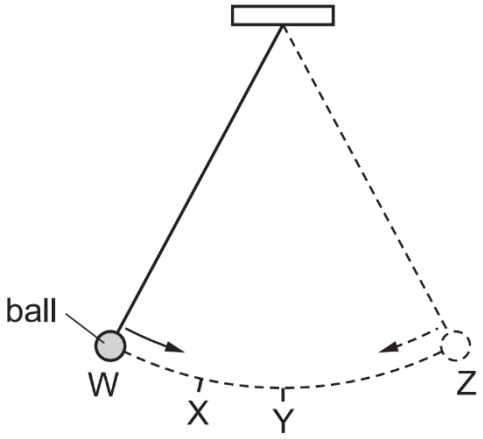
**A** A balance can only be used to compare weights, not masses.

**B** Heavy objects always have more mass than light ones.

**C** Large objects always have more mass than small ones.

**D** Mass is a force but weight is not.

**31.** The diagram shows a ball hanging on a string. The ball swings from point **W** to point **Z** and back to point **W**. Which statement is correct?



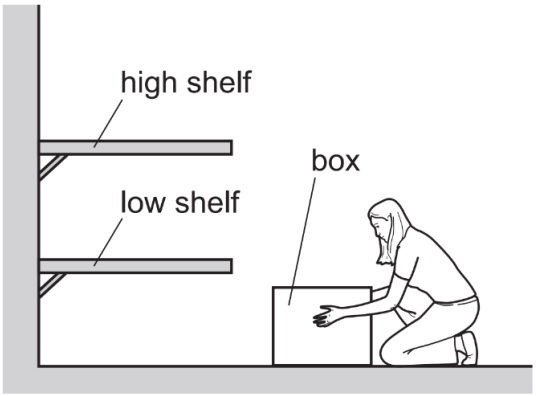

**A** The kinetic energy of the ball is greatest at point **W**.

**B** The kinetic energy of the ball is greatest at point **X**.

**C** The kinetic energy of the ball is greatest at point **Y**.

**D** The kinetic energy of the ball is the same at all points of the swing.

**32.** A person in a factory has to lift a box onto a shelf.




Which action involves the person doing the least amount of work?

**A** Lifting the box quickly to the high shelf.

**B** Lifting the box slowly to the high shelf.

**C** Lifting the box to the low shelf first then lifting it to the high shelf.

**D** Lifting the box to the low shelf instead of to the high shelf.

**33.** A skydiver jumps from a stationary helicopter and reaches a steady vertical speed. She then opens her parachute.

Which statement about the falling skydiver is correct?

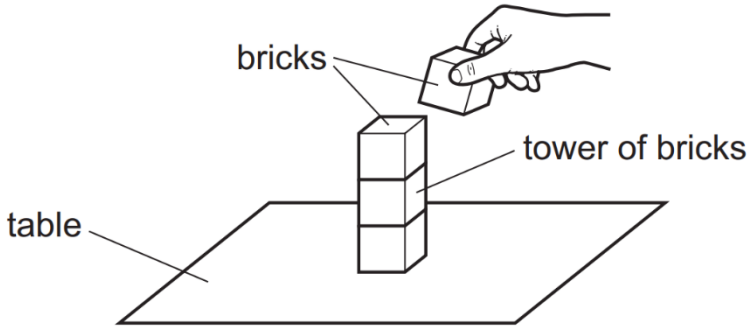
**A** As her parachute opens, her acceleration is upwards.

**B** As she falls at a steady speed with her parachute open, her weight is zero.

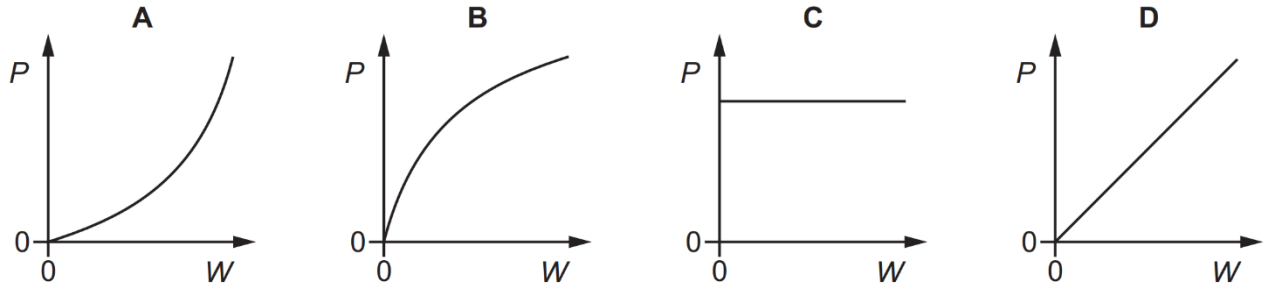
**C** When she accelerates, the resultant force on her is zero.

**D** When she falls at a steady speed, air resistance is zero.

**34.** Identical toy bricks are placed on top of one-another to make a tower on a table.




Which graph shows the relationship between the pressure P that the tower exerts on the table and the weight W of the tower?




**35.** A weight-lifter raises a 2000 N weight through a vertical height of 2.0 m in 0.80 s.

What useful power does he develop in doing this?

**A** 800 W **B** 3200 W **C** 4000 W **D** 5000 W

**36.** A car engine causes a forward force of 100 kN to act on the car. The total resistive force on the car is 20 kN.

What is the resultant force on the car?

**A** 5.0 kN **B** 60 kN **C** 80 kN **D** 120 kN

**37.** The engine of a motor vehicle develops a large amount of power.

Which statement is correct?

**A** The driving force acting on the vehicle must be large.

**B** The engine must have a very large volume.

**C** The engine must transfer large amounts of energy each second.

**D** The vehicle must be very fast.

**38.** A stone has a weight of 5.7 N. The gravitational field strength g is 10 N / kg.

What is the mass of the stone?

**A** 0.57 kg **B** 5.7 kg **C** 57 kg **D** 570 kg

**39.** An object in a space probe above the Earth weighs 3.5 N.

The gravitational field strength at the height of the space probe is 7.0 N / kg.

The gravitational field strength on the Earth's surface is 10 N / kg.

What are the mass and the weight of the object on the Earth's surface?

| | mass / kg | weight / N |
|---|---|---|
| **A** | 0.50 | 3.5 |
| **B** | 0.50 | 5.0 |
| **C** | 2.0 | 3.5 |
| **D** | 2.0 | 20 |

**40.** Four cars are driven along a road.

The table shows the work done by the engine in each car and the time taken by each car.

Which engine produces the most power?

| | work done by engine / J | time taken / s |
|---|---|---|
| **A** | 50 000 | 20 |
| **B** | 50 000 | 40 |
| **C** | 100 000 | 20 |
| **D** | 100 000 | 40 |

**41.** Which situation is an example of a force acting over a large area to produce a small pressure?

**A** A builder hammering a nail into a piece of wood.

**B** A cook using a sharp knife to cut vegetables.

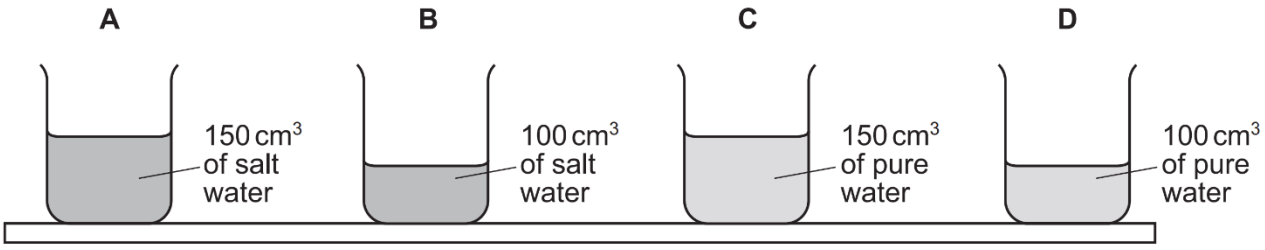
**C** A nurse pushing a needle into a patient's arm.

**D** A soldier marching in flat-soled boots.

**42.** A student places four identical beakers on a bench.

Two beakers contain salt water of density 1.1g / $cm^3$ and two beakers contain pure water of density 1.0g / $cm^3$.

Which beaker exerts the greatest pressure on the bench?



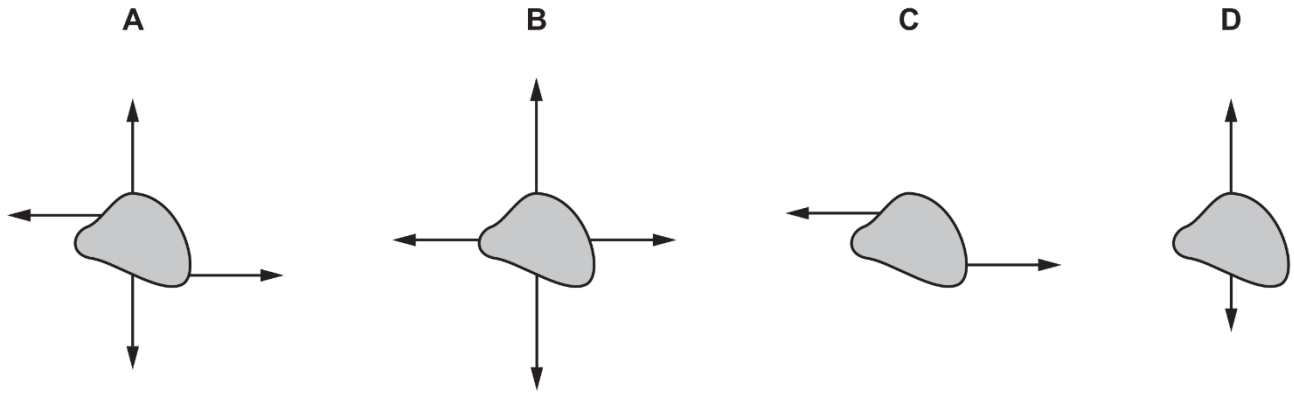
**43.** A mass of 6.0 kg rests on the surface of a planet. On this planet, $g$ = 20 N / kg.

What is the weight of the object?

**A** 0.30 N **B** 0.60 N **C** 60 N **D** 120 N

**44.** Forces are applied to four identical objects. The lengths of the arrows represent the magnitude of each force.

Which object is in equilibrium?




**45.** Two motors **X** and **Y** lift loads of the same weight through the same vertical distance.

Motor **X** is more efficient than motor **Y**.

Which statement about the motors is correct?

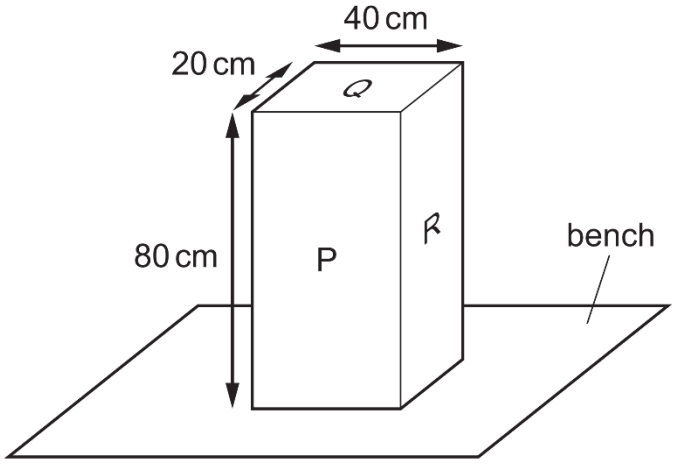
**A** The useful energy output of motor **X** is larger than that of motor **Y**.

**B** The useful energy output of motor **X** is smaller than that of motor **Y**.

**C** The energy input of motor **X** is larger than that of motor **Y**.

**D** The energy input of motor **X** is smaller than that of motor **Y**.

**46.** The diagram shows a solid object resting on a bench.

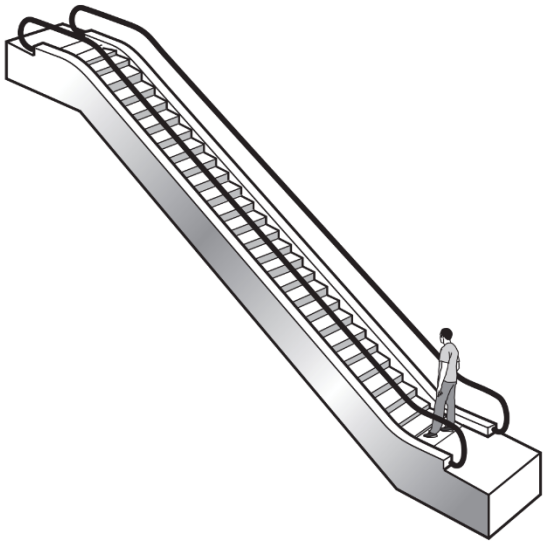



On which labelled surface should the block rest in order to produce the smallest pressure on the bench?

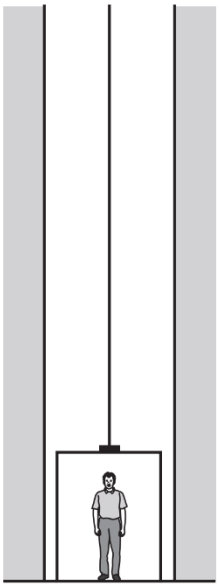
**A** **P** **B** **Q**

**C** **R** **D** **P**, **Q** and **R** produce the same pressure

**47.** A man can either take an escalator or a lift to travel up between two floors in a hotel.



escalator



lift

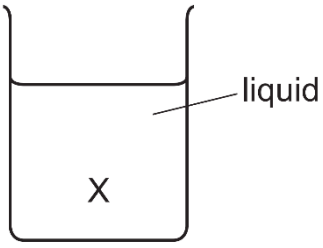
The escalator takes 20 seconds to carry the man between the two floors. The useful work done against gravity is ***W***. The useful power developed is ***P***.

The lift takes 30 seconds to carry the same man between the same two floors.

How much useful work against gravity is done by the lift, and how much useful power is developed by the lift?

| | useful work done against gravity by the lift | useful power developed by the lift |
|---|---|---|
| **A** | more than ***W*** | less than ***P*** |
| **B** | more than ***W*** | ***P*** |
| **C** | ***W*** | less than ***P*** |
| **D** | ***W*** | ***P*** |

**48.** A beaker contains a liquid.




On what does the liquid pressure at position **X** depend?

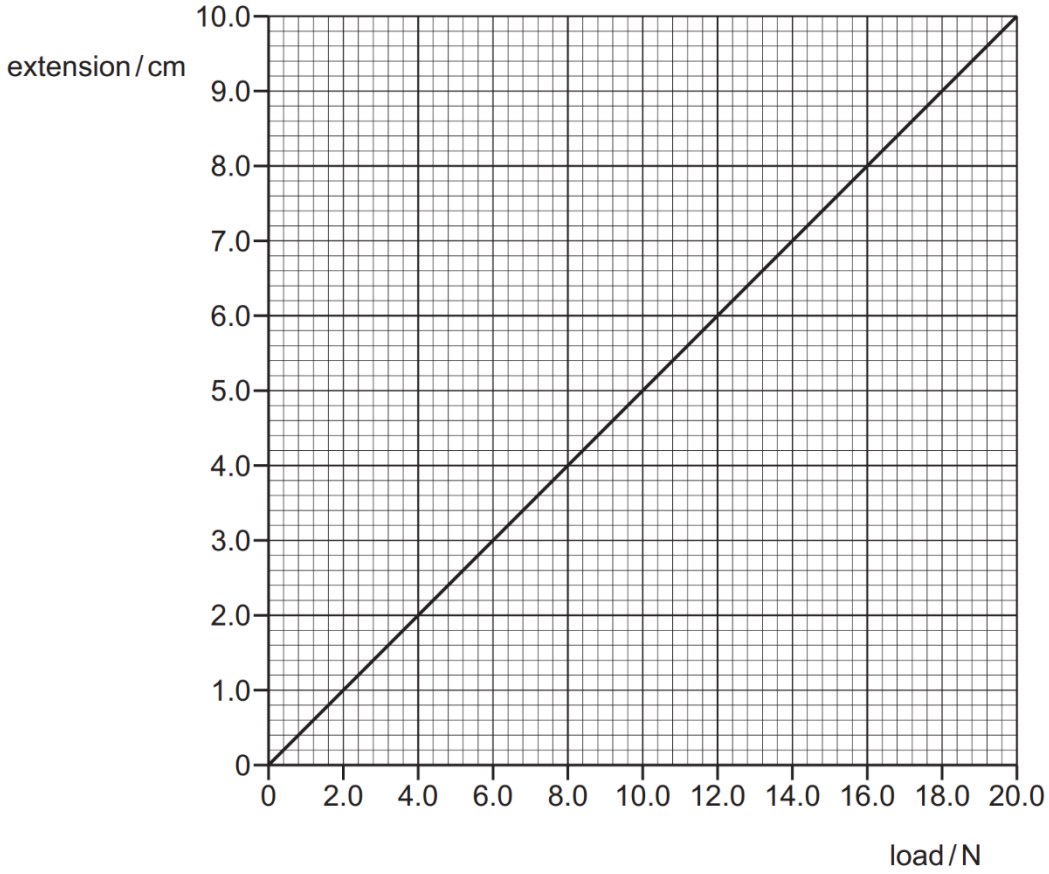
**A** Both the density of the liquid and the depth of **X** below the surface.

**B** Both the surface area of the liquid and the depth of **X** below the surface.

**C** Both the surface area of the liquid and the volume of the liquid.

**D** The depth of **X** below the surface only.

**49.** The diagram shows an extension-load graph for a spring.




An empty can of weight 3.0 N is suspended from the spring. Liquid is poured into the can until the extension is 8.0 cm.

What is the weight of the liquid?

**A** 4.0 N **B** 10.0 N **C** 13.0 N **D** 16.0 N

**50.** A student does work by pulling a box across a horizontal floor.

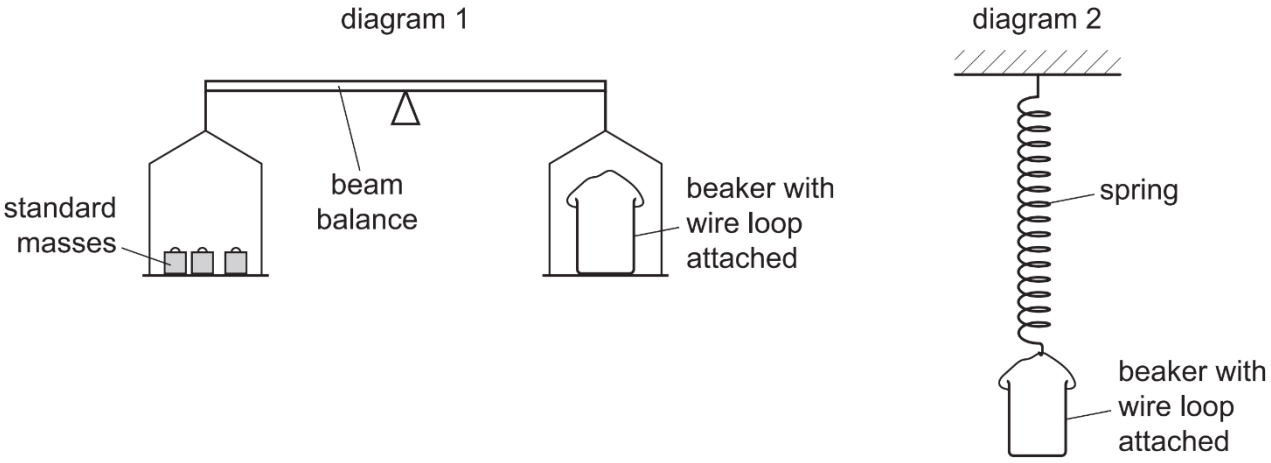
She now pulls a second box along the same floor.

Which row indicates that the student is now doing twice as much work?

| | force used to pull box | distance the box is pulled |
|---|---|---|
| **A** | is doubled | is doubled |
| **B** | is doubled | is halved |
| **C** | stays the same | is doubled |
| **D** | stays the same | is halved |

**51.** Diagram 1 shows a beam balance. A beaker with a wire loop balances the standard masses.

The beaker is then removed and hung from a spring. The spring extends by 5.0 cm as shown in diagram 2.




The experiment is repeated with the same apparatus on the Moon, where the acceleration of free fall is less than on Earth.

Which statement describes what happens on the Moon?

**A** The beam balance is balanced and the spring extends by 5.0 cm.

**B** The beam balance is balanced and the spring extends by less than 5.0 cm.

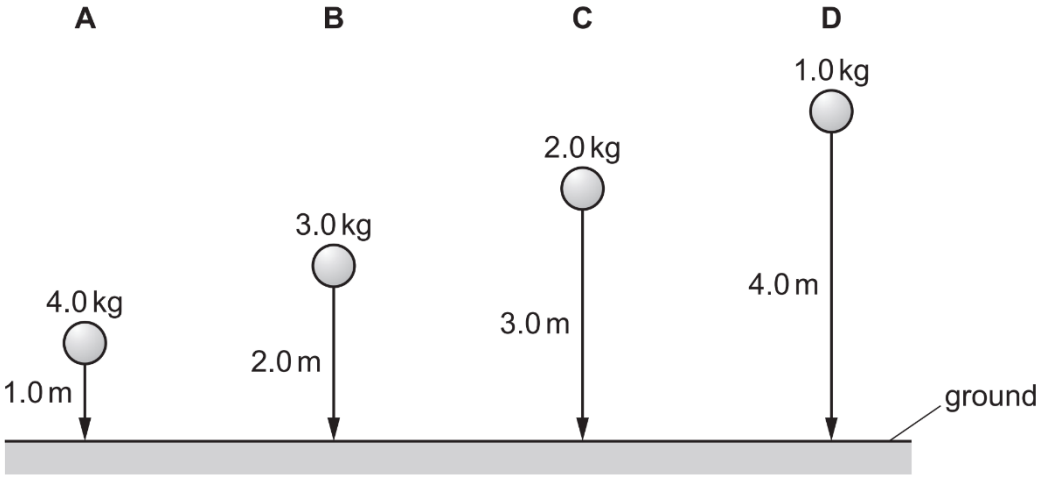
**C** The right-hand balance pan is higher and the spring extends by 5.0 cm.

**D** The right-hand balance pan is higher and the spring extends by less than 5.0 cm.

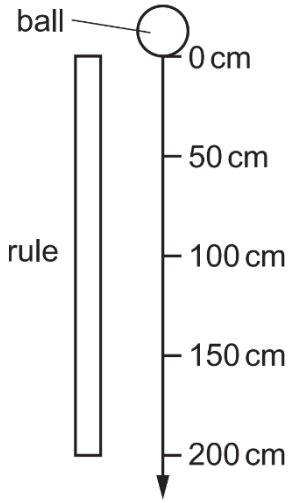
**52.** Four balls with different masses are dropped from the heights shown.

Air resistance may be ignored.

Which ball has the greatest average speed?



**53.** In a laboratory, a ball is dropped in a vacuum and falls 200 cm.




Which statement describes the acceleration of the ball?

**A** It is greater at 10 cm than at 200 cm.

**B** It is greatest at 200 cm.

**C** It is smaller at 50 cm than at 100 cm.

**D** It is the same value at 50 cm as at 150 cm.

**54.** On a hot day, the pressure of the air in a car tyre is greater than on a cold day.

Why is the pressure greater on a hot day?

**A** The air molecules strike each other more frequently.

**B** The air molecules strike each other with greater force.

**C** The air molecules strike the tyre walls more frequently.

**D** The number of air molecules in the tyre increases.

**55.** Student **P** uses a force of 35 N to push a box 3.0 m across the floor.

Student **Q** uses a force of 22 N to push another box 1.8 m across the floor.

Which statement gives a full explanation why student **P** uses more energy than student **Q**?

**A** Student **P** pushes her box a greater distance than student **Q**.

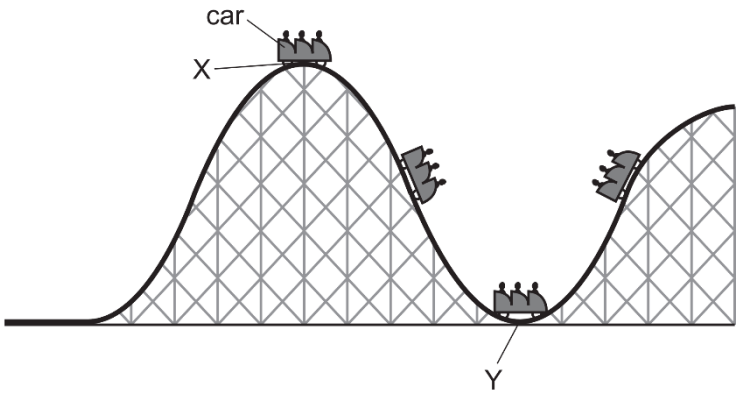
**B** Student **P** pushes her box a greater distance and uses a bigger force than student **Q**.

**C** Student **P** uses a bigger force than student **Q**.

**D** Student **P** pushes a heavier box than student **Q**.

**56.** The diagram shows part of a rollercoaster ride with the car at different positions.

The car runs freely down from position **X** to position **Y** and up the hill on the other side.



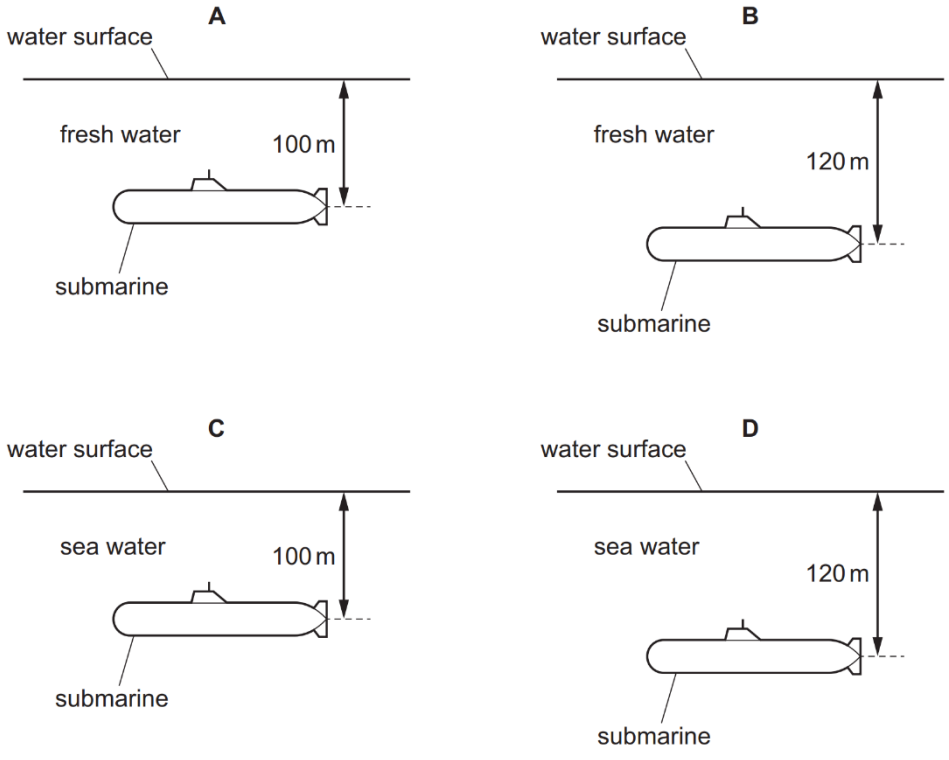

What happens to the kinetic energy and to the gravitational potential energy of the car as it moves from position **X** to position **Y**?

| | kinetic energy | gravitational potential energy |
|---|---|---|
| **A** | decreases | decreases |
| **B** | decreases | increases |
| **C** | increases | decreases |
| **D** | increases | increases |

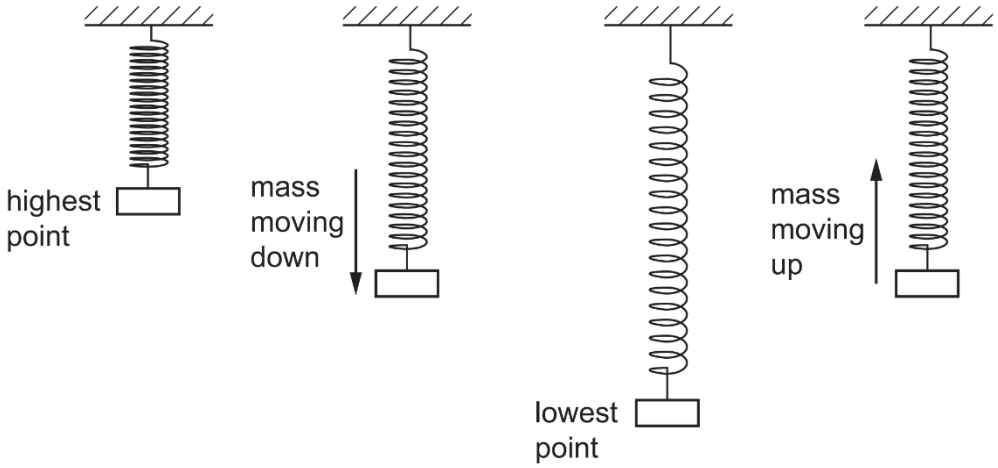
**57.** Four submarines are submerged.

The density of fresh water is 1000 kg/m$^3$ and the density of sea water is 1020 kg/m$^3$.

Which submarine experiences the greatest pressure due to the water? Answer = **D**



**58.** A mass bounces up and down on a steel spring. The diagram shows the mass and the spring at different points during the motion.

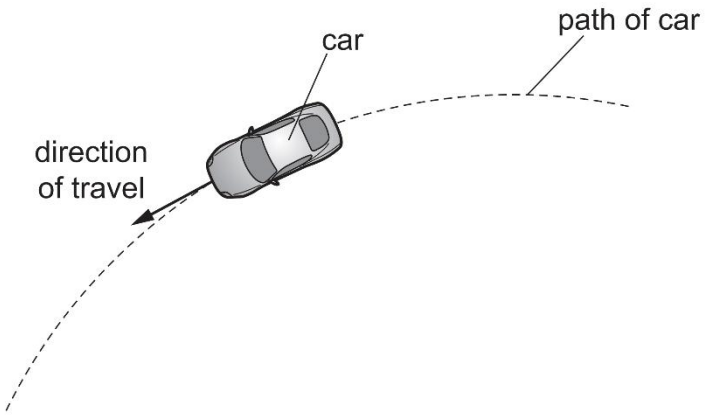



At which point does the mass have the least gravitational potential energy and at which point is the most elastic energy stored in the spring?

| | least amount of gravitational potential energy | most elastic energy stored in spring |
|---|---|---|
| **A** | mass moving down | mass moving up |
| **B** | mass moving down | lowest point |
| **C** | lowest point | mass moving up |
| **D** | lowest point | lowest point |

**59.** A car moves in a circular path as it turns a corner on a horizontal road.

The car moves at constant speed.




Which description of the forces acting on the car is correct?

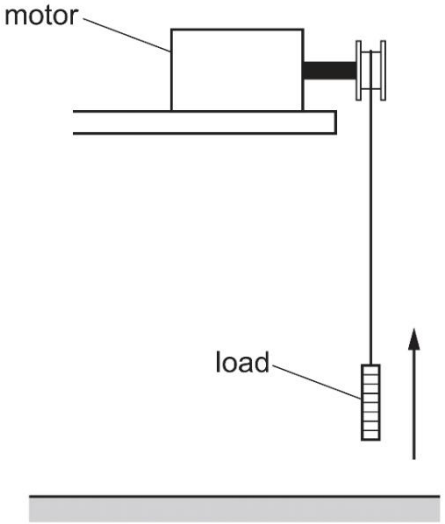
**A** All the forces are balanced as the car is moving at constant speed.

**B** The forces are unbalanced and the resultant force acts away from the centre of the circle.

**C** The forces are unbalanced and the resultant force acts towards the centre of the circle.

**D** The forces are unbalanced and the resultant force is in the direction of travel of the car.

**60.** A student is testing four different electric motors. She measures the time it takes for a motor to lift either a heavy load or a light load through a height of 1 metre.



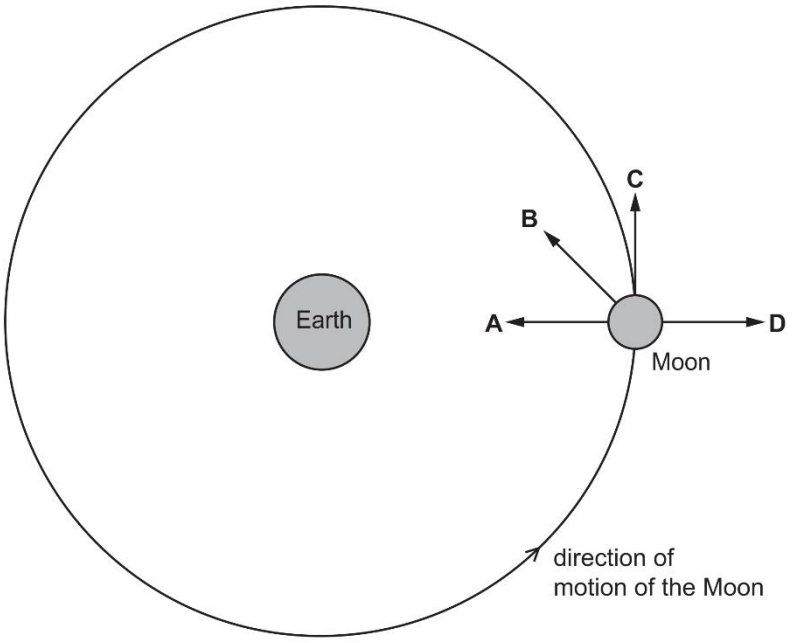

She makes a similar measurement for the other three motors.

The table shows her results.

Which motor produces the most power?

| | load | time taken / s |
|---|---|---|
| **A** | heavy | 12 |
| **B** | heavy | 16 |
| **C** | light | 12 |
| **D** | light | 16 |

**61.** The diagram represents the Moon in its orbit around the Earth. Which arrow represents the direction of the resultant force acting on the Moon at the instant shown?



**62.** The diagram shows a parachutist falling towards Earth.


The lengths of the arrows represent the sizes of the forces on the parachutist and the parachute.

How is the parachutist moving at the instant shown?

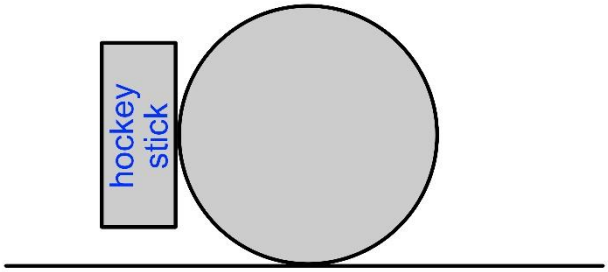
**A** Accelerating downwards

**B** Constant speed

**C** Decelerating downwards

**D** Decelerating upwards

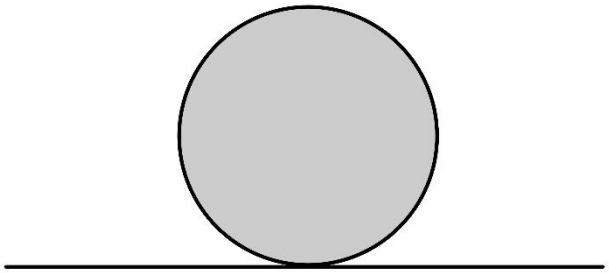
**63.** **(a)** A hockey ball is placed on a horizontal surface. The ball is hit with a hockey stick, which exerts a push force of 6.0 N to the right. The frictional force between the hockey ball and the horizontal surface is 3.0 N. Draw the free body diagram for the hockey ball below.




**(b)** Describe how the hockey ball is moving while it is in contact with the hockey stick.

……...

**(c)** The hockey ball moves to the right, so that it is no longer in contact with the hockey stick. Draw the free body diagram for the hockey ball below.



**(d)** Describe how the hockey ball is moving when it is no longer in contact with the hockey stick.

……...

- Scan the QR code for the answers to this assignment.

http://www.nygh.sg/lower_secondary_science/sec_two_science/sec_two_physics/multiple_choice_forces_answers.pdf