General Physics

1.

Four objects are moving in a straight line.

The table shows the distances moved by each object in each second of its motion.

Which object is moving with constant non-zero acceleration?

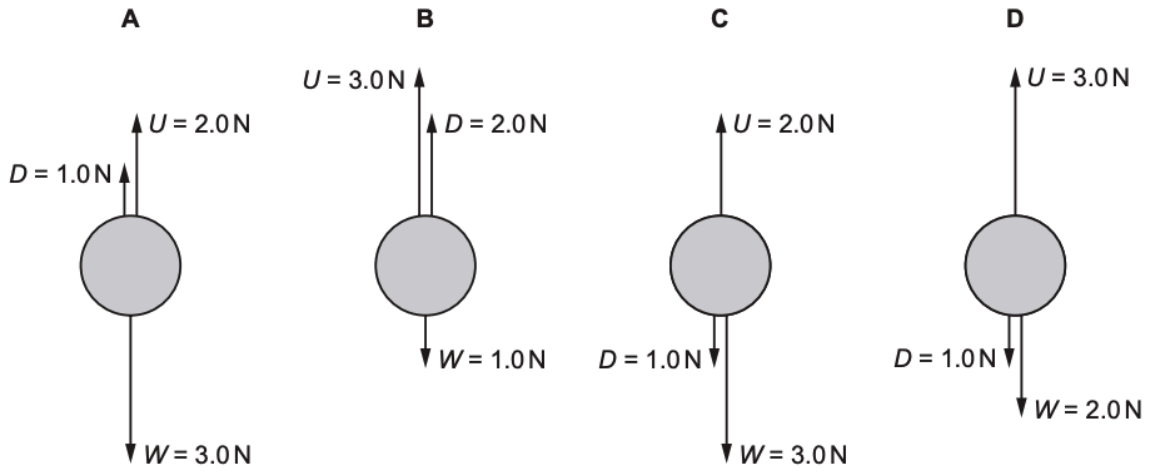
	distance moved in 1st second / m	distance moved in 2nd second / m	distance moved in 3rd second / m	distance moved in 4th second / m
A	5	5	5	5
B	5	6	7	8
C	5	7	10	14
D	5	8	14	26

Answer: B

2.

6 An object is rising vertically at constant speed through water. There are three vertical forces acting on it: the weight *W*, the drag force *D*, and the upward force *U*.

Which diagram shows the magnitude and direction of the vertical forces acting on the object?



Answer: D

3.

The momentum of a body is changed by a force acting on it for a period of time.

Which action increases the change in momentum?

A doubling the force and halving the time

B doubling the force for the same time

C halving both the force and the time

D halving the force and doubling the time

Answer: B

4.

On the Earth, a spring stretches by 5.0 cm when a mass of 3.0 kg is suspended from one end.

The gravitational field strength on the Moon is $\frac{1}{6}$ of that on the Earth.

Which mass, on the Moon, would stretch the spring by the same extension?

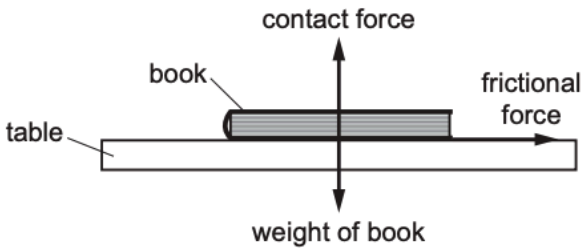
A 0.50 kg **B** 3.0 kg **C** 5.0 kg **D** 18 kg

Answer: D

5.

A train is travelling horizontally in a straight line. A book is on a table in the train.

The diagram shows all the forces acting on the book.



How is the train moving?

A accelerating to the left of the diagram

B accelerating to the right of the diagram

C moving at uniform speed to the left of the diagram

D moving at uniform speed to the right of the diagram

Answer: B

6.

An object of mass 1.2 kg is moving with a velocity of 2.0 m/s when it is acted on by a force of 4.0 N. The velocity of the object increases to 5.0 m/s in the same direction.

For which period of time does the force act on the object?

A 0.90 s **B** 1.1 s **C** 1.5 s **D** 3.6 s

Answer: A

7.

Which row about the change of energy in the energy store must be correct?

	process	energy store	change of energy in store
A	water pumped up to a high-altitude dam	gravitational potential energy of water	increases
B	water pumped up to a high-altitude dam	kinetic energy of water	decreases
C	air passes through a wind turbine	gravitational potential energy of air	increases
D	air passes through a wind turbine	kinetic energy of air	increases

Answer: A

8.

A sphere P, made of steel, has a weight of 10 N on Earth.

Another sphere Q, also made of steel, has a weight of 10 N on Mars.

The gravitational field strength on Earth is greater than the gravitational field strength on Mars.

Which statement is correct?

A The mass of sphere P is the same as the mass of sphere Q.

B The mass of sphere P is less than the mass of sphere Q.

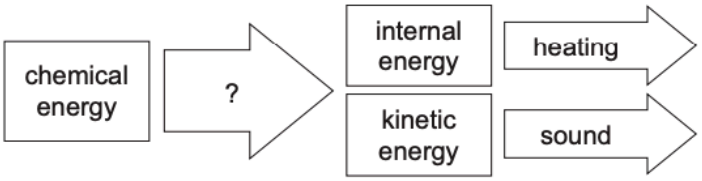
C On Mars, the weight of sphere P is the same as the weight of sphere Q.

D On Earth, the weight of sphere Q is less than 10 N.

Answer: B

9.

The diagram shows the energy stores for a mobile (cell) phone and how the energy is transferred between stores.



What describes how the chemical energy is transferred?

A electrical work done

B mechanical work done

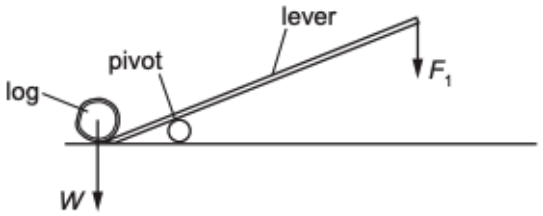
C electromagnetic waves

D sound waves

Answer: A

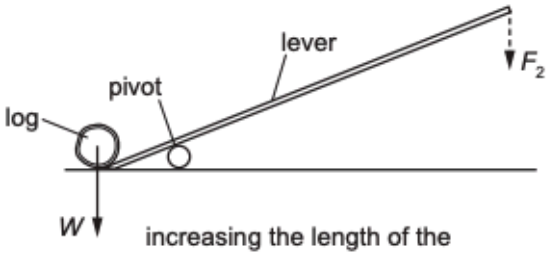
10.

8 The diagram shows the minimum force F_1 acting vertically on a lever required to lift a heavy log of weight W.



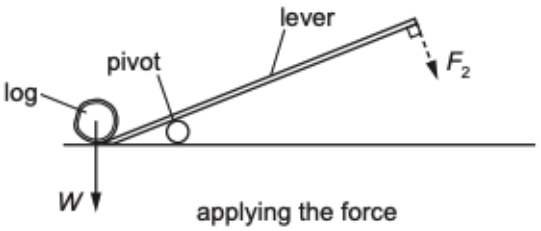
The log needs to be lifted by a smaller force than F_1. The diagrams show the changes tried. Each diagram has only **one** change from the original diagram. In each case, F_2 is the minimum force required to lift the log.

P



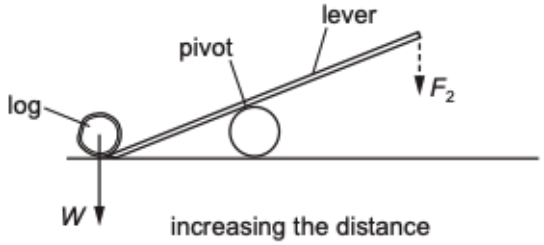
increasing the length of the lever to the right of the pivot

Q



applying the force perpendicular to the lever

R



increasing the distance from the log to the pivot

In which situations will F_2 be smaller than F_1?

A P, Q and R **B** P and Q only **C** P only **D** Q and R only

Answer: B

11.

A ball of mass 0.25 kg hits a wall at a speed of 16 m/s. It then rebounds back along its original path at a speed of 12 m/s.

What is the impulse experienced by the ball during its impact with the wall?

A 1.0 Ns **B** 3.0 Ns **C** 4.0 Ns **D** 7.0 Ns

Answer: D

12.

A bicycle braking system transfers energy from a kinetic energy store to an internal energy store.

A motor converts energy from a chemical energy store (battery) to a kinetic energy store.

What enables these energy transfers?

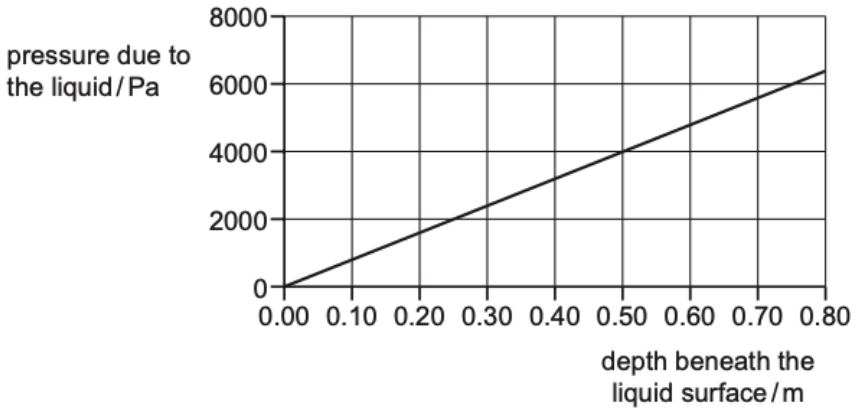
	braking system	motor
A	electrical work	mechanical work
B	electrical work	electrical work
C	mechanical work	mechanical work
D	mechanical work	electrical work

Answer: D

13.

The graph shows how the pressure due to a liquid varies with the depth beneath the liquid surface.

The gravitational field strength g is 9.8 N / kg.



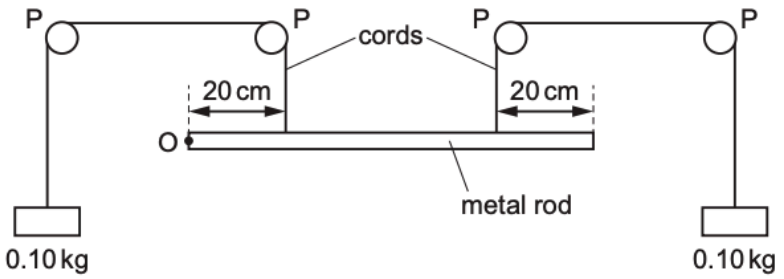
What is the density of the liquid?

A 200 kg / m^3 **B** 820 kg / m^3 **C** 2000 kg / m^3 **D** 8200 kg / m^3

Answer: B

14.

A metal rod of length 80 cm is pivoted at point O. Its centre of mass is at its mid-point. Four pulley wheels are indicated by the letter P.



The rod is in equilibrium, as shown.

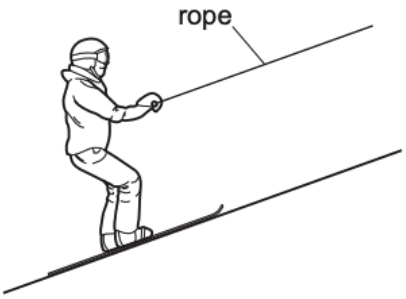
What is the weight of the rod?

A 0.20 N **B** 1.0 N **C** 2.0 N **D** 4.0 N

Answer: C

15.

A skier is pulled up a short straight slope at constant speed by a rope.



The tension in the rope is 100 N and there is a combined frictional and air resistance force of 20 N acting on the skier.

The slope is 10 m long and the skier rises 1.5 m vertically.

How much work is done by the rope pulling the skier up the slope?

A 120 J **B** 150 J **C** 1000 J **D** 1200 J

Answer: C

16.

A measuring cylinder of cross-sectional area 4.0 cm^2 contains 224 cm^3 of liquid.

The pressure of the liquid at the base of the measuring cylinder due to the liquid is 8800 Pa.

What is the density of the liquid?

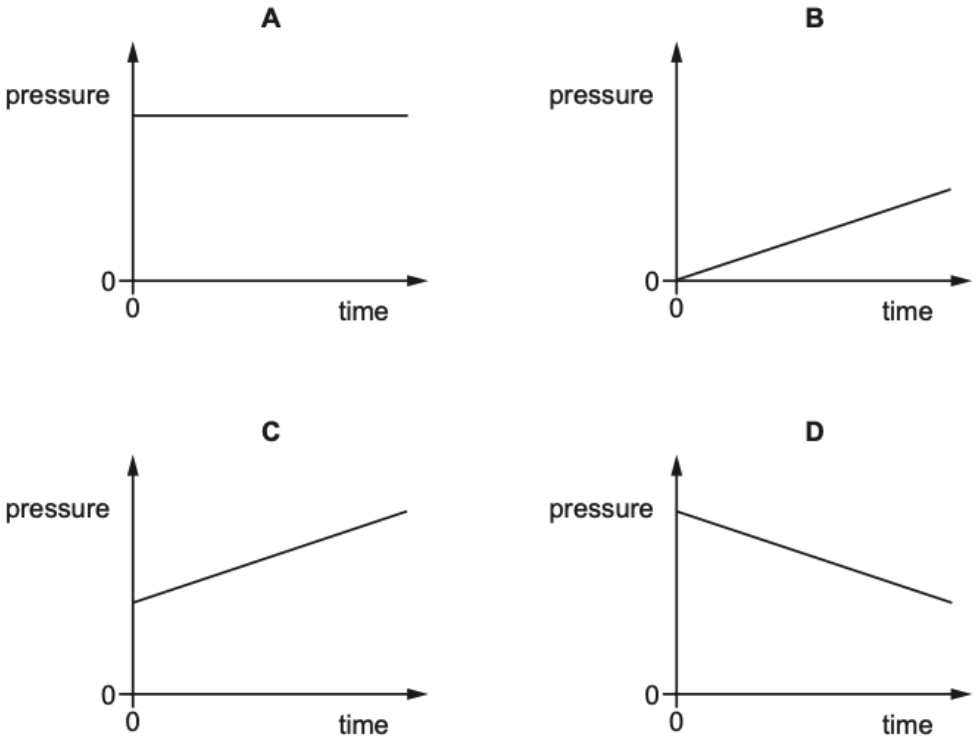
A 224 kg/m^3 **B** 385 kg/m^3 **C** 1600 kg/m^3 **D** 2200 kg/m^3

Answer: C

17.

The pressure of a fixed mass of gas in a cylinder is measured. The volume of the gas in the cylinder is slowly decreased. The temperature of the gas does not change.

Which graph shows how the pressure of the gas changes during this process?

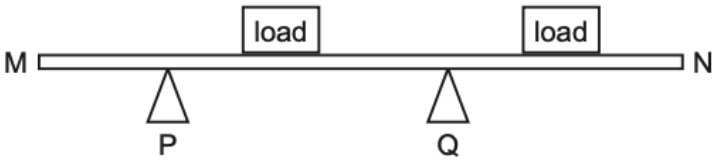


Answer: C

18.

The diagram shows a metre rule MN on two supports, P and Q.

Two loads are placed on the rule, as shown.



The rule rests steadily on the supports.

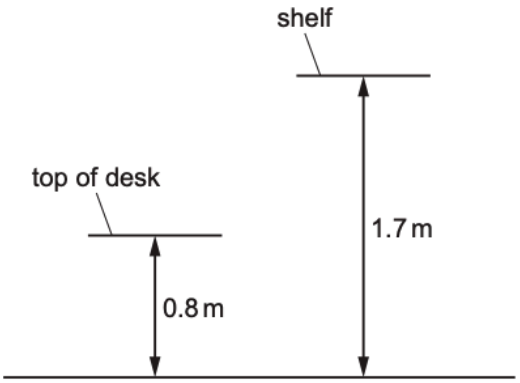
Which row is correct?

	total moment about M	total moment about N
A	is clockwise	is anticlockwise
B	is clockwise	is zero
C	is zero	is clockwise
D	is zero	is zero

Answer: D

19.

A boy takes 0.60 s to lift a book of mass 0.60 kg from the top of a desk and place it on a shelf. The top of the desk is 0.80 m above the floor, and the shelf is 1.7 m above the floor. The gravitational field strength is 10 N / kg.



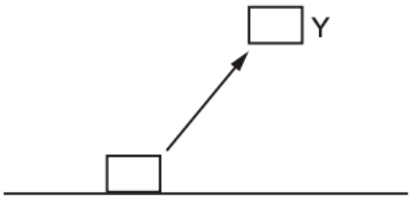
Which power does the boy develop?

A 0.9 W **B** 1.7 W **C** 9.0 W **D** 17 W

Answer: C

20.

A mass is lifted from rest on the ground to Y. There is no air resistance.



P is the increase in gravitational energy of the mass.

Q is the kinetic energy of the mass at Y.

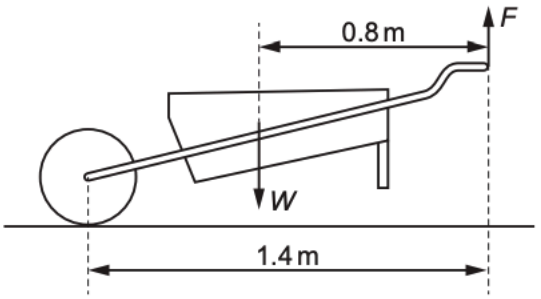
Which expression is equal to the mechanical work done on the mass?

A P + Q **B** P – Q **C** Q – P **D** P × Q

Answer: A

21.

A wheelbarrow has a weight *W* of 140 N.



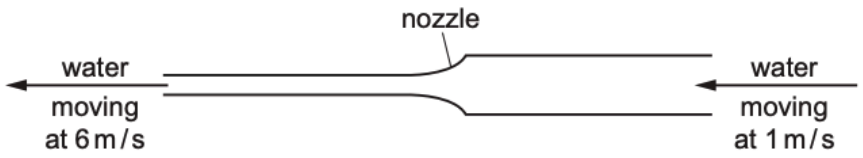
Which vertical force *F* is needed to support the wheelbarrow in the position shown?

A 60 N **B** 80 N **C** 140 N **D** 245 N

Answer: A

22.

The diagram shows part of a hose used by a firefighter.



NOT TO SCALE

15 kg of water flows through the hose each second.

Which force is applied to the hose by the water?

A 15 N **B** 75 N **C** 90 N **D** 105 N

Answer: B

23.

Brakes are used to slow down a moving car.

Into which form of energy is most of the kinetic energy converted as the car slows down?

A chemical

B elastic

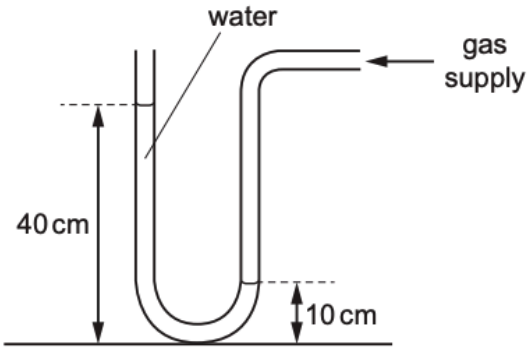
C thermal

D sound

Answer: C

24.

A manometer containing water is used to measure the pressure of a gas supply, as shown.



The density of water is 1000 kg / m^3.

What is the pressure of the gas supply?

A 300 Pa above atmospheric pressure

B 400 Pa above atmospheric pressure

C 3000 Pa above atmospheric pressure

D 4000 Pa above atmospheric pressure

Answer: C

25.

On the Moon, all objects fall with the same acceleration.

Which statement explains this?

A On the Moon, all objects have the same weight.

B The Moon has a smaller gravitational field strength than the Earth.

C The weight of an object is directly proportional to its mass.

D The weight of an object is inversely proportional to its mass.

Answer: C

26.

A box of mass 4.0 kg is pulled along a horizontal floor in a straight line by a constant force *F*.

The constant frictional force acting on the box is 2.0 N.

The speed of the box increases from 0.50 m/s to 2.5 m/s in 2.0 s.

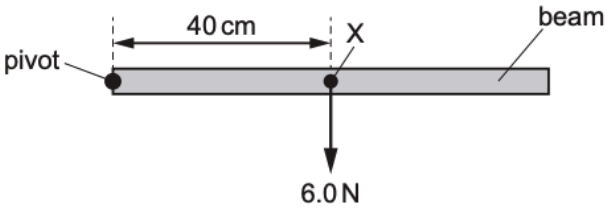
What is the value of *F*?

A 2.0 N **B** 4.0 N **C** 6.0 N **D** 7.0 N

Answer: C

27.

A beam is pivoted at one end, as shown.



The beam weighs 6.0 N and its weight acts at a point X 40 cm from the pivot.

A force of 4.0 N is applied to the beam causing it to balance horizontally.

In which direction and where is the 4.0 N force applied?

A vertically downwards at 20 cm to the left of X

B vertically downwards at 20 cm to the right of X

C vertically upwards at 20 cm to the left of X

D vertically upwards at 20 cm to the right of X

Answer: D

28.

A car moves along a horizontal road. Its initial kinetic energy is 280 kJ. A constant resistive force of 200 N acts on the car. No other horizontal forces act on the car.

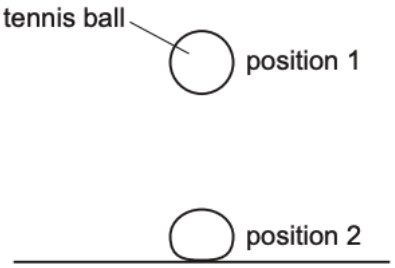
What is the kinetic energy of the car after it has travelled a distance of 300 m?

A 60 kJ **B** 80 kJ **C** 220 kJ **D** 340 kJ

Answer: C

29.

A tennis ball is dropped from position 1. It falls vertically onto a hard surface at position 2.



Which energy changes have taken place between position 1 and position 2?

A gravitational potential → kinetic → chemical

B gravitational potential → kinetic → elastic (strain)

C kinetic → gravitational potential → chemical

D kinetic → gravitational potential → elastic (strain)

Answer: B

30.

Three situations are listed.

1 An object has a resultant force acting on it.

2 A moving object experiences an impulse.

3 An object is decelerating.

In which situations is the momentum of the object changing?

A 1 and 2 only **B** 1 and 3 only **C** 2 and 3 only **D** 1, 2 and 3

Answer: D

31.

A mass hangs vertically from a spring.

The mass is raised to a point P and is then released.

The mass oscillates repeatedly between point P and a lower point Q.

Which energies alternately increase and decrease throughout the oscillations?

A gravitational potential energy, kinetic energy and elastic energy

B gravitational potential energy and kinetic energy only

C gravitational potential energy, kinetic energy and internal energy

D internal energy and elastic energy

Answer: A

32.

A car has 620 kJ of kinetic energy. The car brakes and stops in a distance of 91 m.

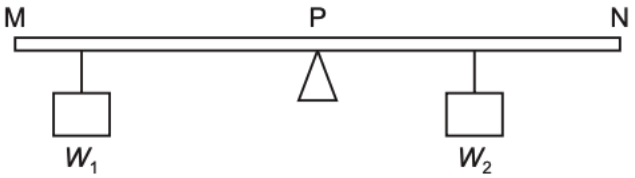
What is the average braking force acting on the car?

A 0.15 N **B** 6.8 N **C** 6800 N **D** 56 000 N

Answer: C

33.

The diagram shows a uniform metre rule, MN, pivoted at its midpoint P.



Two weights, W_1 and W_2, are hung either side of the pivot.

The rule remains balanced.

Which row is correct?

	direction of resultant moment about point M	direction of resultant force on the rule
A	clockwise	downwards
B	clockwise	zero
C	zero	downwards
D	zero	zero

Answer: D

34.

A child pushes a toy car along a horizontal surface and then releases it.

As the car slows down, what is the main energy transfer?

A from chemical to thermal

B from chemical to kinetic

C from kinetic to gravitational (potential)

D from kinetic to thermal

Answer: D

35.

At time = 0, a cannonball is stationary inside a cannon. The cannonball is then fired from the cannon.

At time = *t*, the cannonball moves forwards and the cannon moves backwards.

What happens to the total kinetic energy and the total momentum of the cannon and the cannonball between time = 0 and time = *t*?

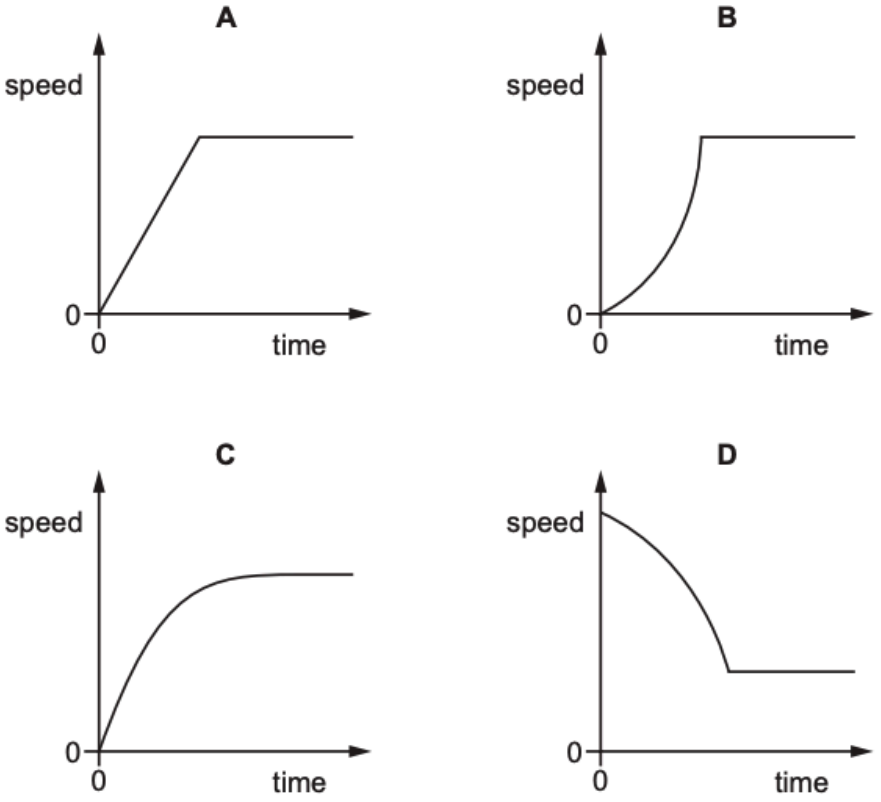
	total kinetic energy of cannon and cannonball	total momentum of cannon and cannonball
A	changes	changes
B	changes	remains the same
C	remains the same	changes
D	remains the same	remains the same

Answer: B

36.

An object reaches terminal velocity after being dropped and falling through air.

Which graph shows how its speed varies with time?



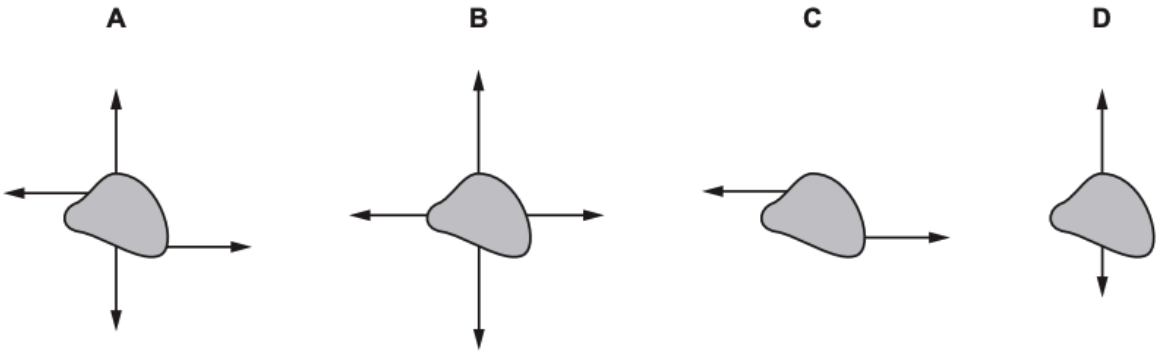
Answer: C

37.

Forces are applied to four identical objects.

The length of each arrow indicates the magnitude of the force.

Which object is in equilibrium?



B

38.

A sphere X collides head on with a second identical sphere Y which is stationary.

The mass of each sphere is 0.15 kg.

Sphere X is travelling at a velocity of 2.0 m/s before the collision and produces an impulse of 0.21 N s on sphere Y.

What is the velocity of sphere X after collision?

A 0.60 m/s in the opposite direction to Y

B 0.60 m/s in the same direction as Y

C 1.4 m/s in the opposite direction to Y

D 1.4 m/s in the same direction as Y

B

39.

A cyclist travels down a hill from rest at point X without pedalling.

The cyclist applies his brakes and the cycle stops at point Y.

Which energy transfers have taken place between X and Y?

A gravitational potential → kinetic → internal (thermal)

B gravitational potential → internal (thermal) → kinetic

C kinetic → gravitational potential → internal (thermal)

D kinetic → internal (thermal) → gravitational potential

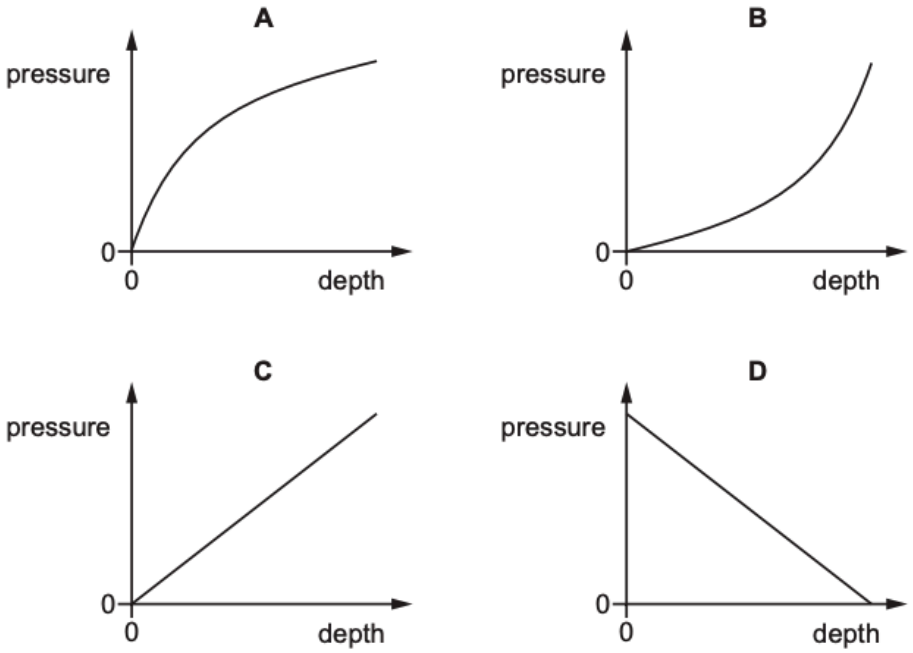
A

40.

The water in a swimming pool exerts a pressure at the bottom of the pool.

Which graph shows the relationship between the pressure exerted by the water and the depth of water in the pool?

(Assume the density of water is constant.)



C

41.

Why can a gas be compressed easily into a smaller volume?

A The particles are far apart.

B The particles do not attract each other.

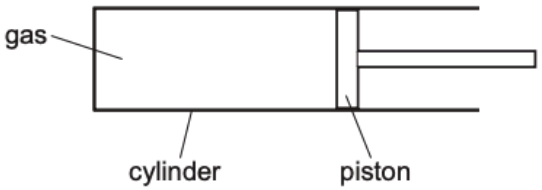
C The particles move randomly.

D The volume of each particle can be reduced.

A

42.

A gas is contained in a cylinder by a movable piston.



The gas is heated so that it expands at **constant pressure**.

How is the force of each collision of a gas particle with the piston affected and how does the frequency of collisions between the gas particles and the piston change?

	force	frequency
A	increases	decreases
B	increases	increases
C	stays the same	decreases
D	stays the same	increases

A

43.

A plastic ball has a mass of 4.0 g and a volume of 20 cm^3.

There is a crack in the ball's surface.

The ball is placed in a bath of water. Water leaks into the ball without changing the volume of the ball and eventually the ball sinks.

The density of water = 1.0 g/cm^3.

Which mass of water has entered the ball when the top of the ball is first level with the water surface?

A 5.0 g **B** 16 g **C** 20 g **D** 24 g

B

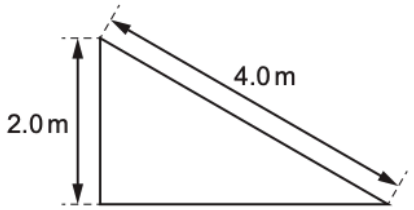
44.

A box is initially at rest at the top of a rough slope.

The box slides down the slope.

The weight of the box is 20 N.

The slope is 4.0 m long and 2.0 m high.



The box does 10 J of work against friction as it slides down the slope.

What is the speed of the box as it reaches the bottom of the slope?

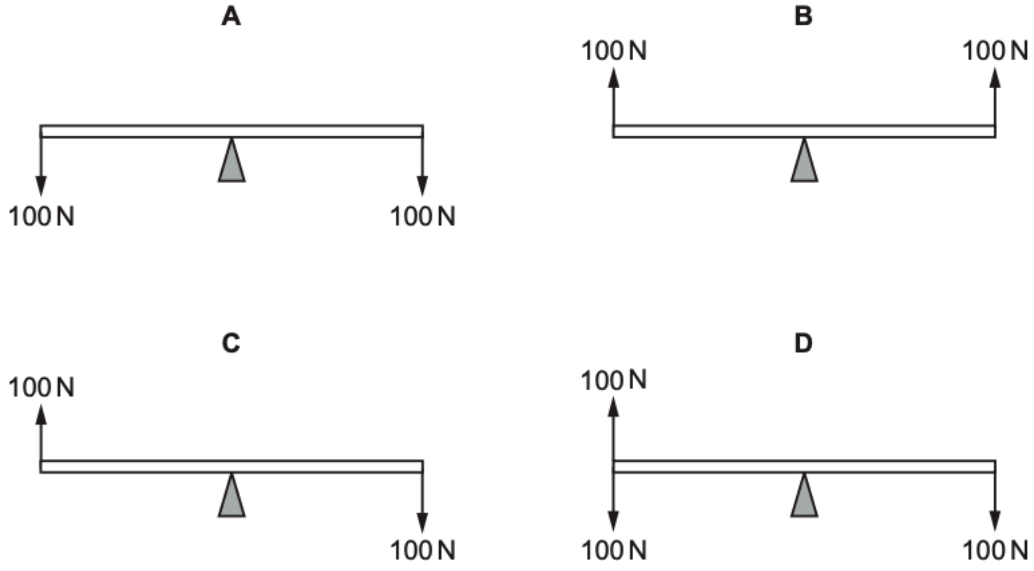
A 5.4 m/s **B** 6.3 m/s **C** 7.1 m/s **D** 9.5 m/s

A

45.

A uniform rod rests on a pivot at its centre. The rod is not attached to the pivot. Forces are then applied to the rod in four different ways, as shown. The weight of the rod can be ignored.

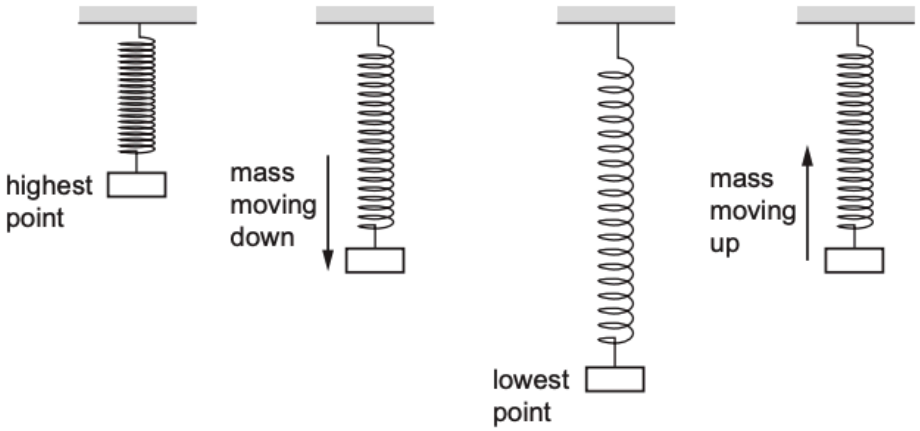
Which diagram shows the rod in equilibrium?



A

46.

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 is the least energy in the gravitational potential store of the mass and at which point is the most energy in the elastic store of the spring?

	least energy in gravitational potential store of the mass	most energy in the elastic store of the 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

D

47.

A microwave oven is rated at 900 watts.

Which statement correctly describes the meaning of this value?

A 900 joules are transferred every second.

B 900 amperes are transferred every second.

C 900 volts are transferred every second.

D 900 ohms are transferred every second.

A

Thermal Physics

1.

A bar of metal, which is a good thermal conductor, is heated at one end.

What is the main method of transfer of thermal energy along the bar?

A lattice vibration

B movement of atoms of the metal along the bar

C transfer by electrons

D vibration of atoms of the metal bar

Answer: C

2.

Four students are asked to state and explain the relative magnitudes of the thermal expansion of solids and gases.

Which student is correct?

A Gases expand more than solids because the molecules in a gas are in random motion.

B Gases expand more than solids because the attractive forces between molecules are much weaker in gases.

C Solids expand more than gases because the molecules are closer together in solids.

D Solids expand more than gases because the molecules in a solid are in a regular pattern.

Answer: B

3.

An ice cube of mass 12 g at 0 °C absorbs thermal energy from the surroundings at a rate of 3 J/s. The specific latent heat of fusion of ice is 330 J/g.

How long will it take for the ice cube to melt?

A 82.5 s **B** 1320 s **C** 3960 s **D** 11 880 s

Answer: B

4.

A scientist is determining the specific latent heat of vaporisation of a liquid.

He puts the liquid in a vacuum flask and heats it with a 100 W heater. The mass of liquid in the vacuum flask when it starts to boil is 300 g. He continues to heat the liquid for a further 12 minutes after which the mass of the remaining liquid is 100 g.

What is the specific latent heat of vaporisation of the liquid?

(Assume that all the thermal energy from the heater is used to vaporise the liquid.)

A 6000 J/kg

B 240 000 J/kg

C 360 000 J/g

D 360 000 J/kg

Answer: C

5.

An object emits infrared radiation.

Which two properties of the object determine the rate of radiation of thermal energy from the object?

A the density and the surface area of the object

B the density and the surface temperature of the object

C the mass and the surface area of the object

D the surface area and the surface temperature of the object

Answer: D

6.

A sealed rigid container has a fixed volume. The container is filled with air.

The container is placed in a freezer cabinet and the temperature of the air in the container decreases.

Which row correctly describes what happens to the air in the container?

	average distance between air particles	average speed of air particles
A	decreases	increases
B	decreases	decreases
C	no change	increases
D	no change	decreases

Answer: D

7.

Water in a beaker gains thermal energy at a rate of 3000 W. The water is at its boiling point.

The specific latent heat of vaporisation of water is 2260 J / g.

How long does it take for 250 g of the water to vaporise?

A 12 s **B** 188 s **C** 332 s **D** 750 s

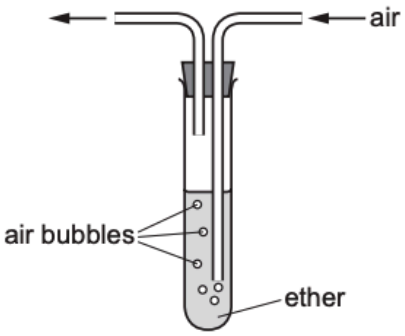
Answer: B

8.

Ether is a liquid that evaporates easily at room temperature.

The rate at which ether evaporates can be increased by bubbling air through it.

The diagram shows this process.



Students give three suggestions why the rate of evaporation increases when air is bubbled through.

Student 1 suggests that the temperature of the ether is decreased.

Student 2 suggests that the surface area of the ether is increased.

Student 3 suggests that evaporated molecules are removed at a greater rate.

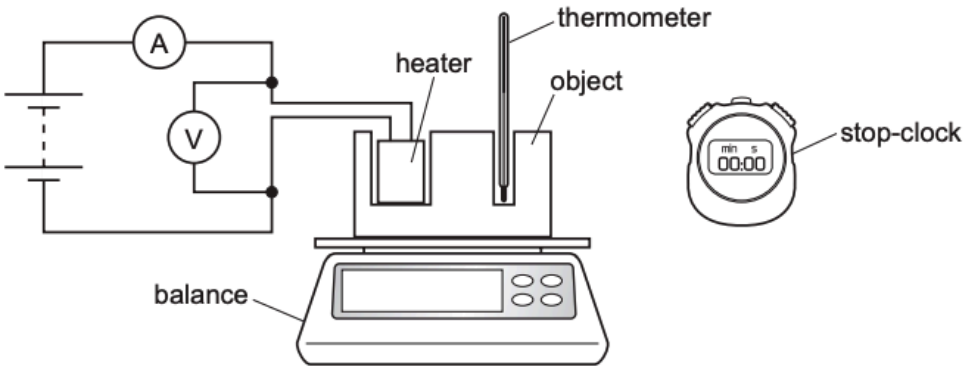
Which students are correct?

A 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 3 only

Answer: C

9.

The diagram shows the apparatus needed for an experiment to determine the specific heat capacity of the material from which an object is made.



Which piece of apparatus could be omitted if the purpose of the experiment is to determine the thermal capacity of the object?

A ammeter

B balance

C stop-clock

D thermometer

Answer: B

10.

On a warm day, a carton of fresh milk is covered with a wet cloth.

Why does this help to reduce the temperature of the milk?

A Some water evaporates from the cloth so the remaining water becomes cooler.

B The water has a very high specific heat capacity.

C The water insulates the milk from the warm air around it.

D Water is always colder than the air around it.

A

11.

A chef heats some water in a pan on a hotplate.

The temperature of the water rises by 10 °C in time t.

She then puts the same volume of oil in an identical pan on the same hotplate.

The specific heat capacity of water is 2.5 times that of oil and water is 1.1 times denser than oil.

What is the time for the temperature of the oil to rise by 10 °C?

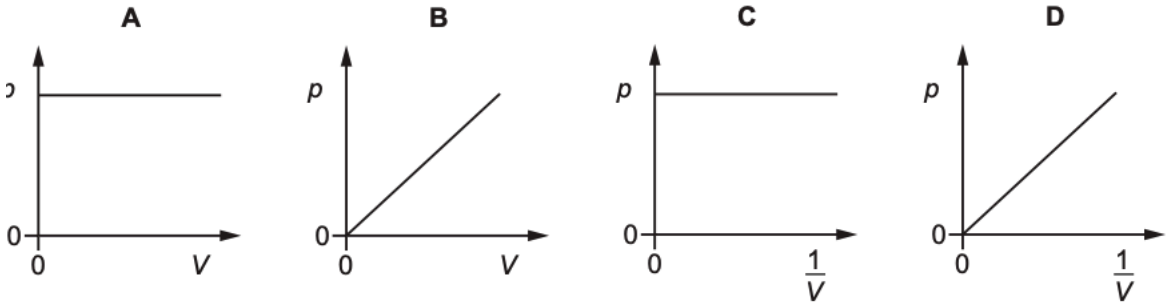
A $0.36t$ **B** $0.44t$ **C** $2.3t$ **D** $2.8t$

A

12.

The volume of a fixed mass of gas is varied. The temperature remains constant.

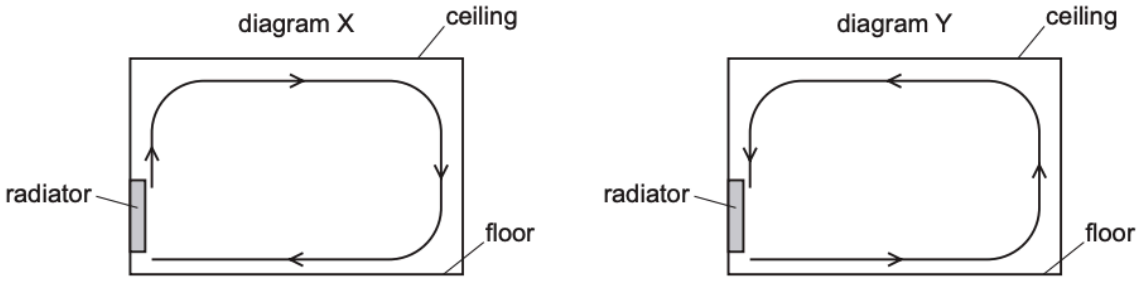
Which graph shows how the pressure p of the gas varies with volume V?



D

13.

16 A room is heated by a radiator. The diagrams X and Y show two possible circulations of hot air, which heat the room.



Which diagram and reason explain the heating of the room by convection?

	diagram	reason
A	X	air density decreases when air is heated
B	X	air density increases when air is heated
C	Y	air density decreases when air is heated
D	Y	air density increases when air is heated

A

14.

A sealed bottle of constant volume contains air.

The air in the bottle is heated by the Sun.

What is the effect on the average speed of the air particles in the bottle and the average distance between them?

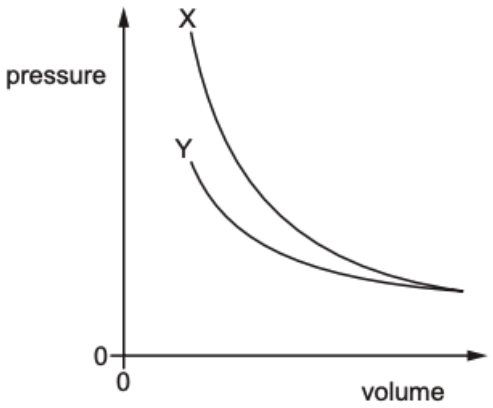
	average speed of air particles	average distance between air particles
A	decreases	decreases
B	decreases	stays the same
C	increases	increases
D	increases	stays the same

D

15.

In an experiment to investigate the relationship between the volume of a sample of air and its pressure, the volume of the sample is decreased and its pressure is measured continuously.

Curve X on the graph shows the results that would be expected for a fixed mass of air at constant temperature. Curve Y shows the results that are obtained in this particular experiment.



Which row shows two possible reasons why curve Y is different from curve X?

	1	2
A	the temperature of the air **increases** as the volume is decreased	air leaks **into** the container as the volume is decreased
B	the temperature of the air **increases** as the volume is decreased	air leaks **out of** the container as the volume is decreased
C	the temperature of the air **decreases** as the volume is decreased	air leaks **into** the container as the volume is decreased
D	the temperature of the air **decreases** as the volume is decreased	air leaks **out of** the container as the volume is decreased

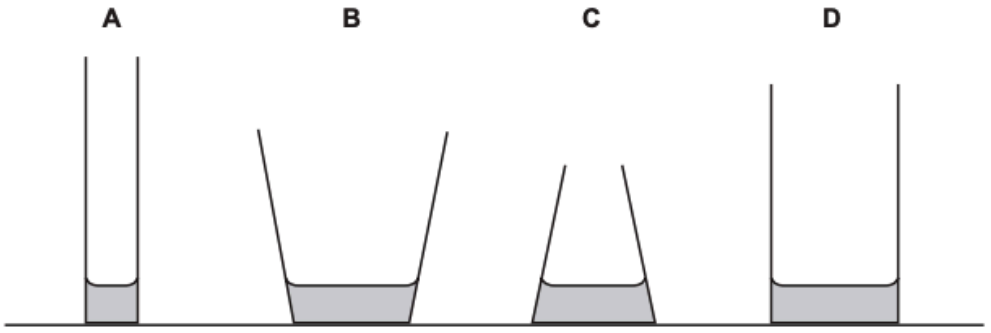
D

16.

Four containers each contain water.

More water at the same temperature is added to each container.

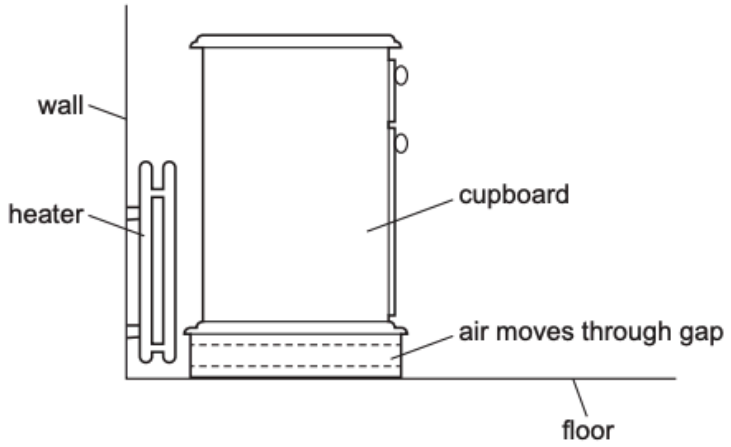
From which container does water now evaporate more slowly than it did before?



C

17.

A cupboard is placed in front of a heater. Air can move through a gap under the cupboard.



Which row describes the temperature and the direction of movement of the air in the gap?

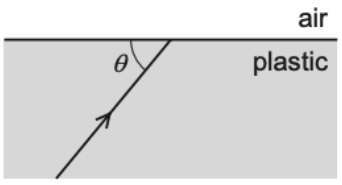
	air temperature	air direction
A	cool	away from the heater
B	cool	towards the heater
C	warm	away from the heater
D	warm	towards the heater

B

Waves

1.

Light in transparent plastic meets a boundary with air. Light is transmitted into the air only if the angle marked θ in the diagram is greater than 36°.



What is the refractive index of the plastic?

A 0.59 **B** 0.81 **C** 1.2 **D** 1.7

Answer: C

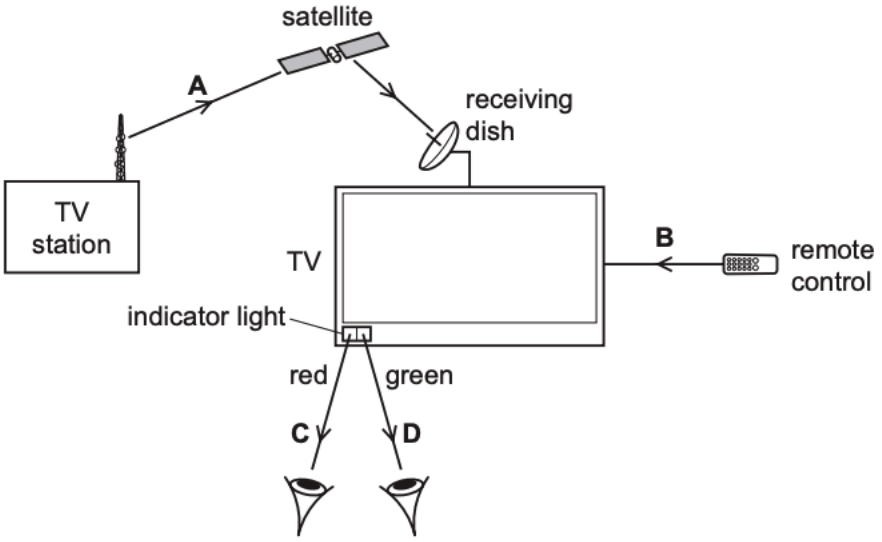
2.

A television (TV) station transmits a signal to a television receiving dish.

The television has an on / off indicator light.

The television is switched on by a remote control which changes the indicator light from red to green.

Which electromagnetic wave used in these actions has the longest wavelength?



Answer: A

3.

Visible light has wavelengths in the range 4.0×10^{-7} m to 7.0×10^{-7} m.

What is the range of the frequencies of visible light?

A 0.12 Hz to 0.21 Hz

B 120 Hz to 210 Hz

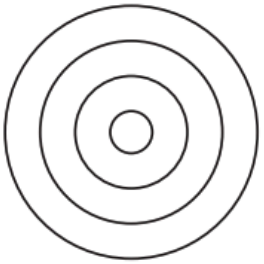
C 4.3×10^{11} Hz to 7.5×10^{11} Hz

D 4.3×10^{14} Hz to 7.5×10^{14} Hz

Answer: D

4.

A drop of water from a tap falls onto the surface of some water of constant depth.



view from above

Water waves spread out on the surface of the water.

Which statement is correct?

A The waves are longitudinal and travel at the same speed in all directions.

B The waves are longitudinal and travel more quickly in one direction than in others.

C The waves are transverse and travel at the same speed in all directions.

D The waves are transverse and travel more quickly in one direction than in others.

Answer: C

5.

A student writes four statements matching a communication system to the region of the electromagnetic spectrum that it uses to transmit signals.

Which statement is correct?

A Wireless internet uses visible wavelengths.

B Mobile phones use X-rays.

C Cable television uses infrared wavelengths.

D Bluetooth uses ultraviolet wavelengths.

Answer: C

6.

Which piece of equipment is designed to produce a type of electromagnetic wave?

A electric fire

B electric generator

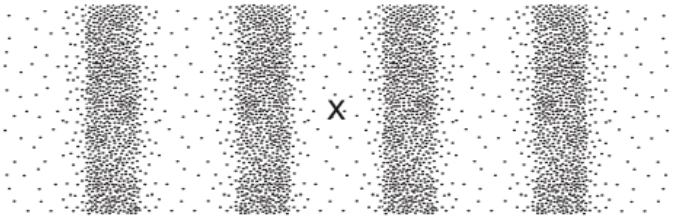
C electric motor

D electromagnet

Answer: A

7.

The diagram shows the air molecules in part of a sound wave at a particular moment in time.



Which statement is **not** correct?

A Earlier, there was compression at X.

B Later, there will be a rarefaction at X.

C This part of the wave is travelling horizontally across the page.

D This part of the wave is travelling towards the top of the page.

Answer: D

8.

A sound wave travels from air into water.

Which row describes what happens to the frequency and the wavelength of the wave?

	frequency	wavelength
A	decreases	increases
B	decreases	stays the same
C	stays the same	decreases
D	stays the same	increases

Answer: D

9.

The angle between an incident ray and the surface of a plane mirror reflecting the ray is 70°.

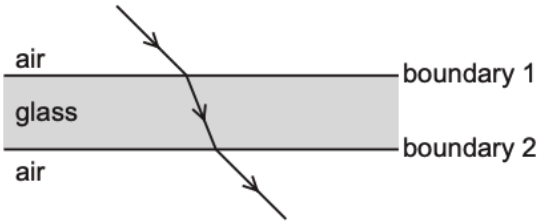
What is the angle of incidence?

A 20° **B** 40° **C** 70° **D** 140°

Answer: A

10.

A ray of light passes from air through a sheet of glass and out the other side, as shown.



Which two angles are equal to each other?

A angle of incidence at boundary 1 and angle of incidence at boundary 2

B angle of incidence at boundary 1 and angle of refraction at boundary 1

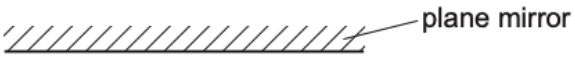
C angle of incidence at boundary 1 and angle of refraction at boundary 2

D angle of refraction at boundary 1 and angle of refraction at boundary 2

Answer: C

11.

A student uses one eye to look at images in a plane mirror.



Objects are placed on the line XY.

Which objects give rise to images that can be seen by the eye at E?

A P, Q, R, S, T and U

B Q, R, S and T only

C P and U only

D R and S only

Answer: B

12.

A tank contains water. Ripples are produced on the surface of the water. Refraction is observed.

What causes the ripples to refract?

A The cold water in the tank is replaced by warm water.

B The ripples change speed as they move from deep to shallow water.

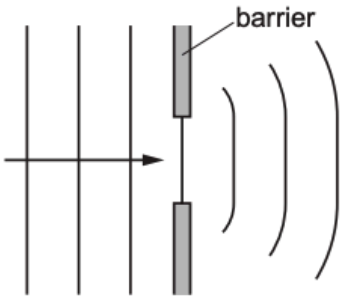
C The ripples hit the wall of the tank.

D The ripples pass through a narrow gap.

Answer: B

13.

The diagram shows wavefronts of a water wave passing through a gap in a barrier.



Which change will increase the diffraction of the wave as it passes through the gap?

A Increase the amplitude of the wave.

B Increase the width of the gap.

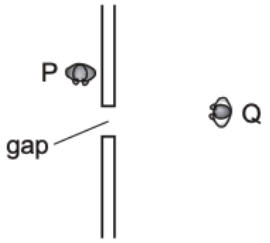
C Reduce the depth of water.

D Reduce the frequency of the wave.

Answer: D

14.

Two men, P and Q, stand close to a gap in a wall, as shown. Man P cannot see man Q but man P can hear man Q speaking.



Which statement explains this?

A Light waves do not diffract at all because they are electromagnetic waves.

B Light waves have a range of frequencies but sound has just one frequency.

C Sound waves are of a higher frequency than light waves.

D Sound waves diffract a lot because their wavelength is a similar size to the width of the gap.

D

15.

A student writes down some facts about two transverse waves.

Wave 1 has a frequency f and a velocity v.

Wave 2 has four times the frequency of wave 1 and is travelling at a velocity of $2v$.

What is the wavelength of wave 2 in terms of f and v?

A $\frac{2f}{v}$ **B** $8fv$ **C** $\frac{2v}{f}$ **D** $\frac{v}{2f}$

D

16.

Light travels from air into glass.

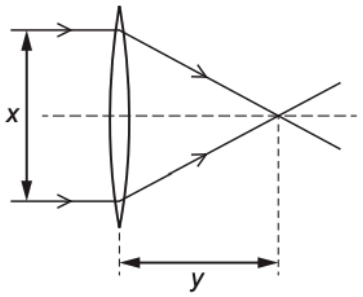
What is the relationship between the refractive index n of the glass, the angle of incidence i and the angle of refraction r?

A $n = \frac{i}{r}$ **B** $n = \frac{r}{i}$ **C** $n = \frac{\sin i}{\sin r}$ **D** $n = \frac{\sin r}{\sin i}$

C

17.

A student passes parallel rays of light through four different converging lenses. He measures the distance *x* and the distance *y* for each experiment.



Which lens has the longest focal length?

	x/cm	*y*/cm
A	4.6	2.0
B	5.1	3.1
C	5.9	2.3
D	6.1	2.4

B

18.

Which row gives typical values for the speed of sound in a solid and in a gas?

	speed of sound in a solid m/s	speed of sound in a gas m/s
A	3	30
B	30	3
C	300	3000
D	3000	300

D

19.

Light diffracts when it enters a telescope. This causes the image to blur slightly. The amount of diffraction depends on the diameter of the hole through which the light enters the telescope and the wavelength of the light.

Which combination for diameter and wavelength will result in the sharpest image (least blurring)?

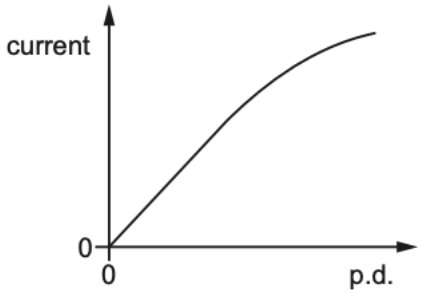
	diameter	wavelength
A	large	long
B	large	short
C	small	long
D	small	short

B

Electricity & Magnetism

1.

The graph shows the relationship between the current in a circuit component and the potential difference (p.d.) across it. The graph has a straight section and a curved section.



What happens to the resistance of the component in these two sections as the current increases?

	straight section	curved section
A	resistance increases	resistance decreases
B	resistance increases	resistance increases
C	no change in resistance	resistance decreases
D	no change in resistance	resistance increases

Answer: D

2.

A wire is moved across a magnetic field. This causes an induced current in the wire.

The induced current interacts with the magnetic field to produce a force on the wire.

In which direction is this force?

A in the direction of the current

B in the direction of movement of the wire

C in the opposite direction to the current

D in the opposite direction to the movement of the wire

Answer: D

3.

A 100% efficient step-down transformer has primary voltage V_p and primary current I_p.

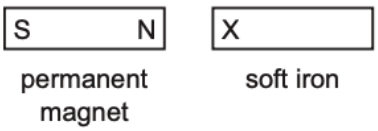
Which row compares the secondary voltage with V_p and the secondary current with I_p?

	secondary voltage	secondary current
A	greater than V_p	greater than I_p
B	greater than V_p	less than I_p
C	less than V_p	greater than I_p
D	less than V_p	less than I_p

Answer: C

4.

An unmagnetised piece of soft iron is placed close to a strong permanent magnet, as shown.



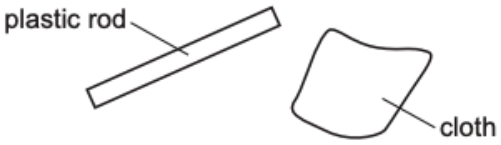
What is the induced polarity of end X of the soft iron and in which direction does the magnetic force act on the soft iron?

	polarity of end X	direction of force on the soft iron
A	N	to the left
B	N	to the right
C	S	to the left
D	S	to the right

Answer: C

5.

A plastic rod is rubbed with a cloth.

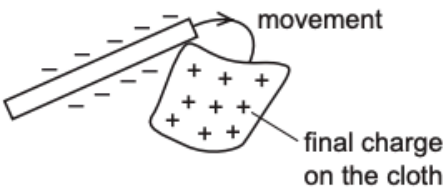


The rod and the cloth both become charged as electrons move between them.

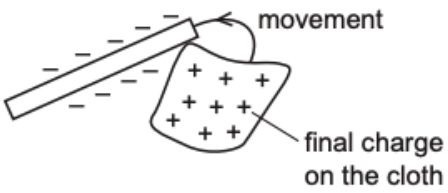
The rod becomes negatively charged.

Which diagram shows how the rod becomes negatively charged and shows the final charge on the cloth?

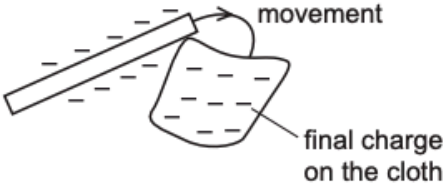
A



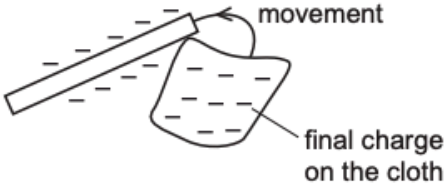
B



C



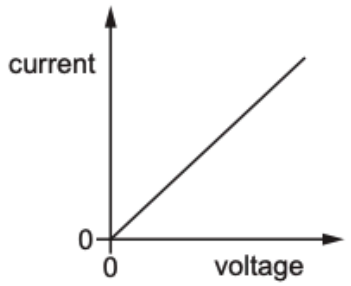
D



Answer: B

6.

The diagram shows the current–voltage graph for a metal wire.



What can be deduced from the graph?

A As voltage increases, the temperature of the wire increases.

B As voltage increases, the temperature of the wire decreases.

C As voltage increases, the resistance of the wire increases.

D As voltage increases, the resistance of the wire remains constant.

Answer: D

7.

A battery is connected to a circuit. It is switched on for 1.0 minute. During that time, there is a current of 0.40 A in the circuit and the battery supplies a total of 48 J of energy.

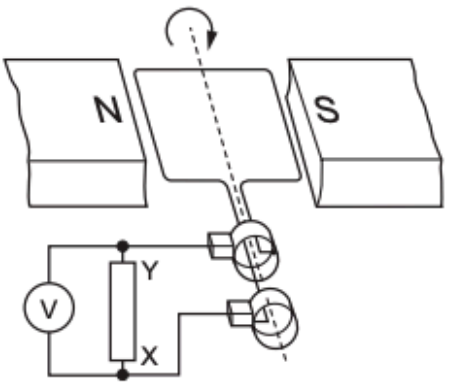
Which row gives the charge that passes and the electromotive force (e.m.f.) of the battery?

	charge that passes in 1.0 minute / C	e.m.f. of the battery / V
A	0.40	2.0
B	0.40	120
C	24	2.0
D	24	120

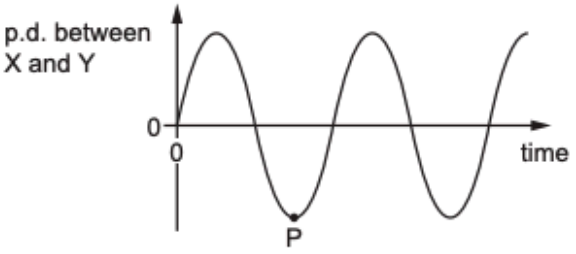
Answer: C

8.

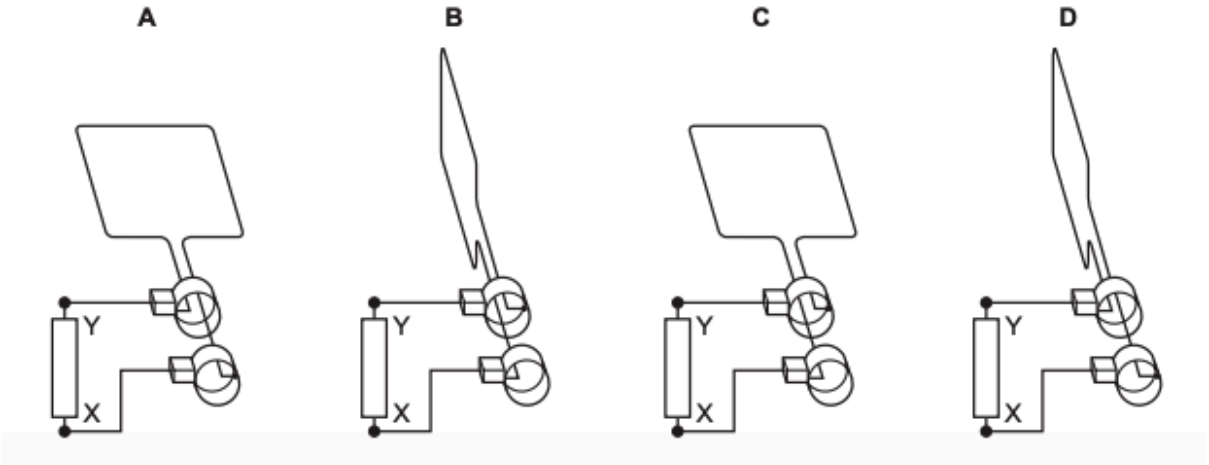
30 The diagram shows an a.c. generator.



The graph shows the potential difference (p.d.) between points X and Y plotted against time. A positive value of p.d. indicates that X is more positive than Y.



Which diagram shows the position of the coil at point P on the graph?



Answer: C

9.

Which statement about a transformer is correct?

A There is an alternating current in the iron core from the primary coil to the secondary coil.

B An alternating current in the iron core induces an alternating current in the secondary coil.

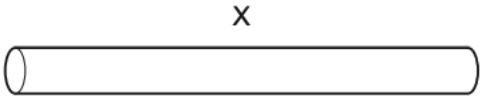
C An alternating current in the primary coil induces a direct current in the secondary coil.

D An alternating current in the primary coil induces an alternating voltage across the secondary coil.

Answer: D

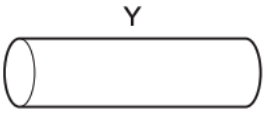
10.

A piece of metal wire X with a uniform diameter has resistance R.



A second piece of wire Y is made of the same metal and has a uniform diameter.

Y has double the cross-sectional area of X and half the length of X.



What is the resistance of Y?

A $\frac{R}{4}$ **B** $\frac{R}{2}$ **C** R **D** $4R$

Answer: A

11.

An electric fire is connected to a 240 V supply and transfers energy at a rate of 1.0 kW.

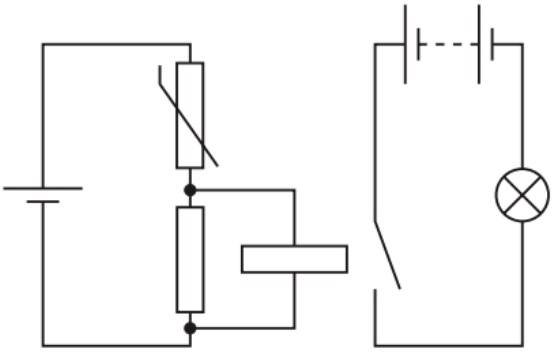
How much charge passes through the fire in 1.0 h?

A 42 C **B** 250 C **C** 1.5×10^4 C **D** 2.4×10^5 C

Answer: C

12.

The diagram shows a circuit that switches on a lamp when there is a change in the environment.



Which change in the environment causes the lamp to be switched on?

A a decrease in light intensity

B a decrease in temperature

C an increase in light intensity

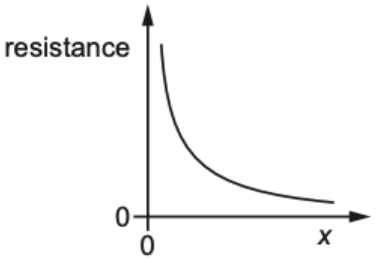
D an increase in temperature

Answer: D

13.

A student does an experiment to investigate the resistance of a metal wire.

The graph shows the results from the experiment.



What is plotted on the *x*-axis?

A diameter of the wire

B length of the wire

C temperature of the wire

D current in the wire

Answer: A

14.

A student is to demagnetise a bar magnet. She tries four different ways.

1 hammering the magnet

2 heating the magnet

3 passing direct current through the magnet

4 placing the magnet in water

Which methods will demagnetise the magnet?

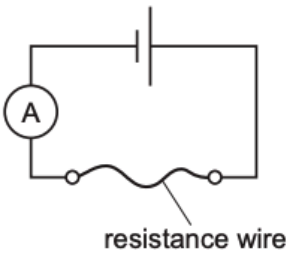
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 4 **D** 2 and 3 only

Answer: B

15.

A student is investigating a resistance wire.

She measures the current in a 50 cm length of resistance wire.



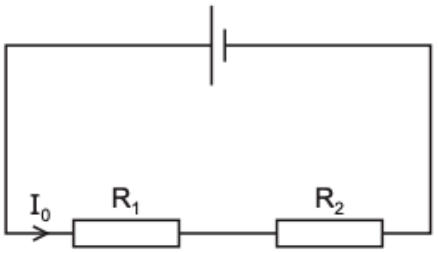
The student repeats the experiment using a 100 cm length of the same resistance wire.

What is the effect of this change on the current in the circuit and on the resistance of the wire?

	effect on current	effect on resistance
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

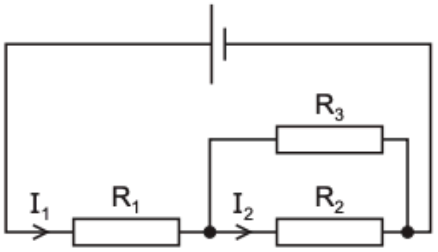
Answer: B

Two resistors, R_1 and R_2, are connected in series in a circuit, as shown.



The current in the resistors is I_0.

Another resistor, R_3, is then connected in parallel with R_2, as shown.



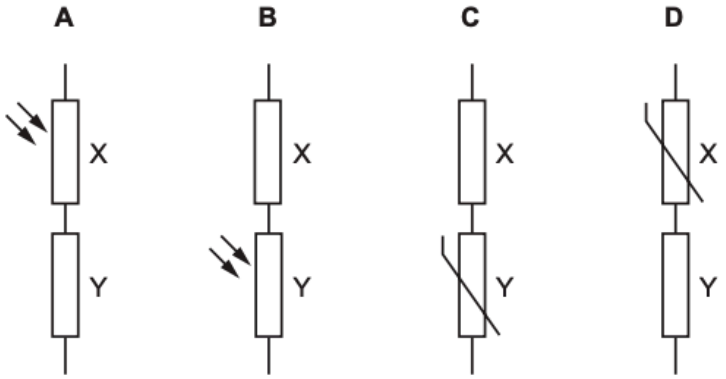
How do the currents I_1 and I_2 in the resistors R_1 and R_2 compare to current I_0?

16.

	current in R_1	current in R_2
A	$I_1 = I_0$	$I_2 < I_0$
B	$I_1 = I_0$	$I_2 = I_0$
C	$I_1 > I_0$	$I_2 = I_0$
D	$I_1 > I_0$	$I_2 < I_0$

Each potential divider is placed in a circuit with a power supply.

Which potential divider makes the potential difference (p.d.) across component Y increase when the light intensity increases?



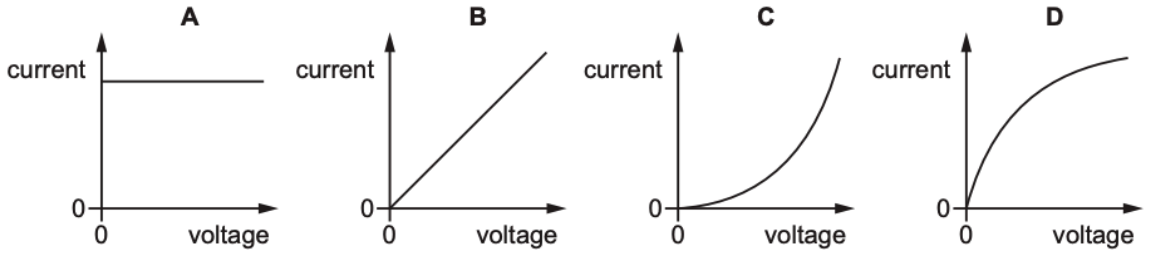
Answer: A

17.

Answer: D

18.

29 Which diagram shows a graph of current against voltage for a filament lamp?



Answer: D

19.

Diagram 1 is a circuit diagram showing an a.c. power supply connected to four diodes and a resistor.

Diagram 2 shows the output voltage from the power supply.

diagram 1

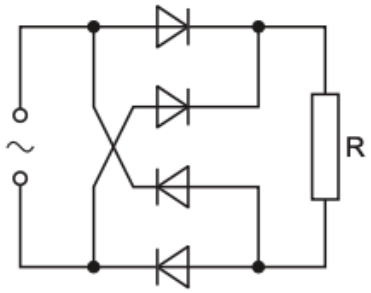
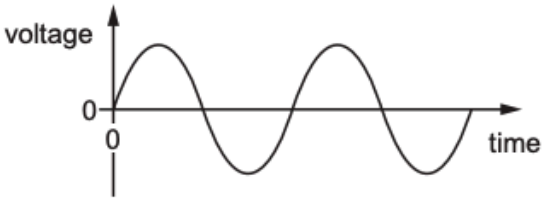
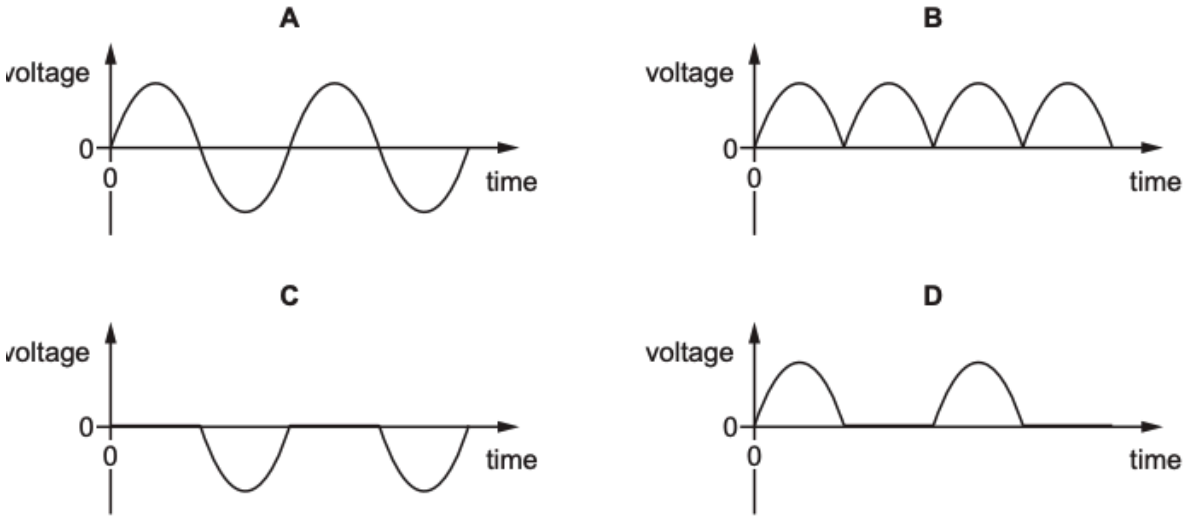


diagram 2



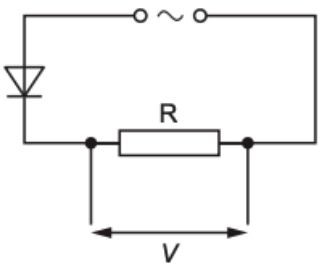
Which graph correctly shows the voltage–time curve across resistor R?



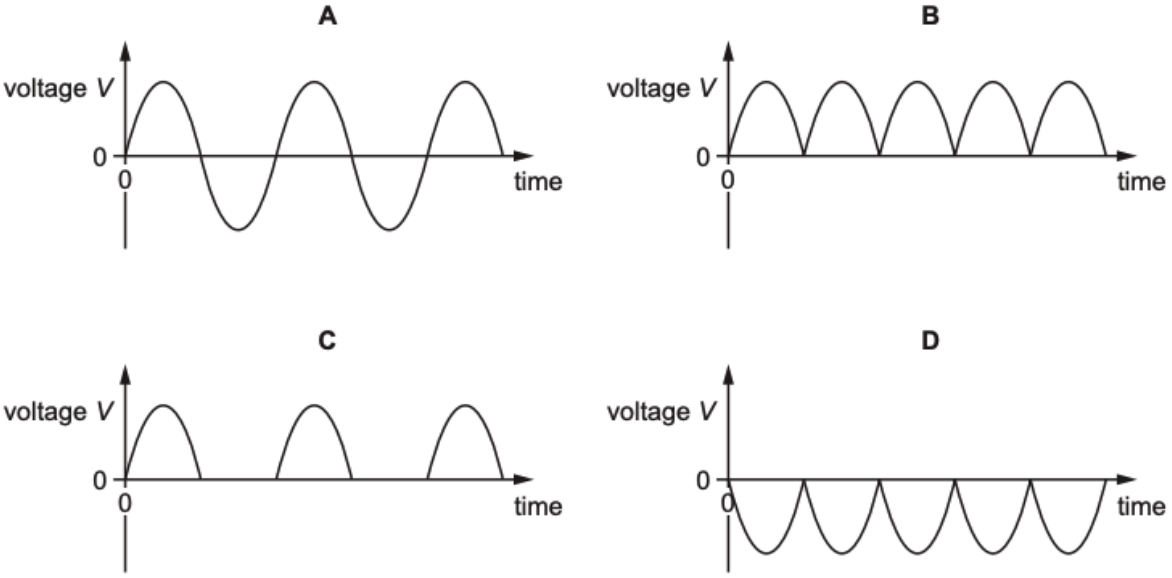
Answer: B

20.

30 An alternating current (a.c.) power supply is connected in series with a resistor R and a diode.



Which graph shows how the voltage *V* across the resistor R varies with time?



Answer: C

21.

A student makes four resistors using different pieces of wire. The wires have different diameters and lengths. All the pieces of wire are made of the same material.

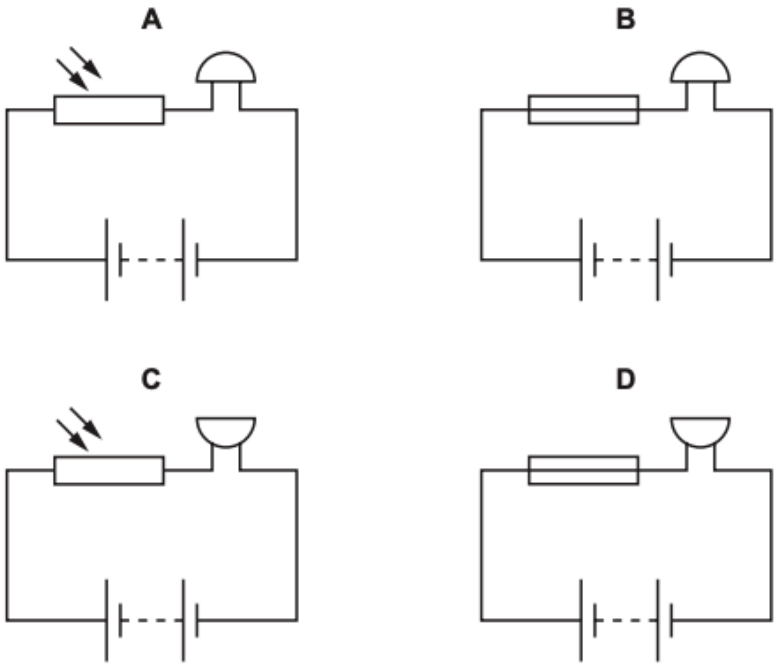
Which piece of wire will make the resistor with the largest resistance?

	diameter / mm	length / cm
A	0.8	10
B	0.8	17
C	2.0	10
D	2.0	17

Answer: B

22.

Which diagram shows a circuit containing a battery, a fuse and a buzzer?



Answer: D

23.

Which statement is **not** a method for magnetising an iron bar?

A Place the bar next to a magnet and hammer the bar.

B Place the bar inside a solenoid. Switch on an alternating current (a.c.) in the coil and gradually reduce the current.

C Place the bar inside a solenoid. Switch on a direct current (d.c.) in the coil and gradually reduce the current.

D Stroke the bar repeatedly with a magnet.

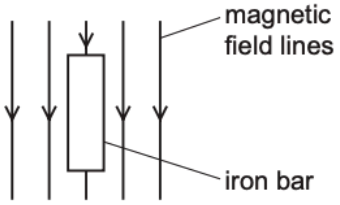
Answer: B

24.

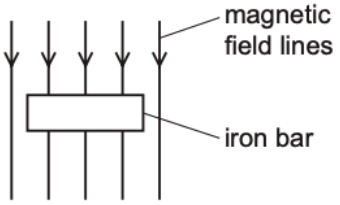
A student attempts to make a permanent magnet by hammering metal bars of the same size in the same magnetic field.

In which case is the strongest permanent magnet produced?

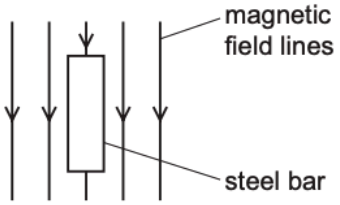
A



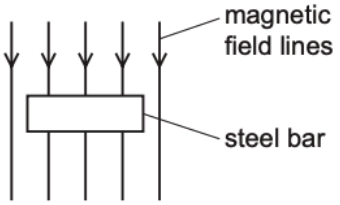
B



C



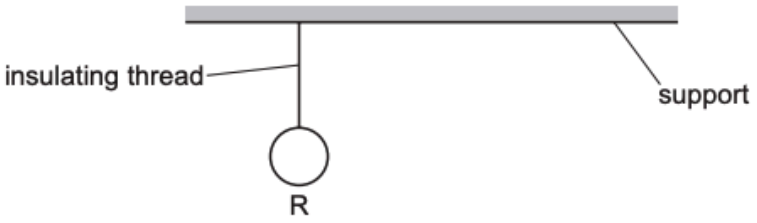
D



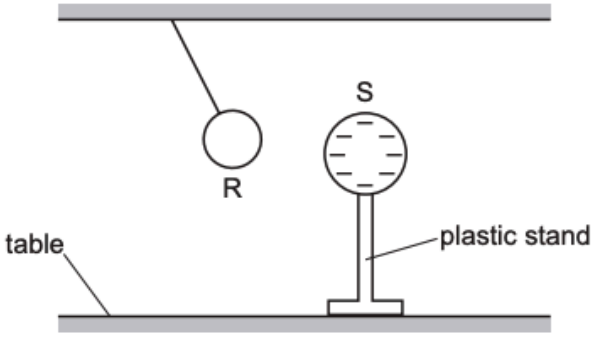
Answer: C

25.

A metal sphere R is suspended on an insulating thread.



Another sphere S is brought close to sphere R. Sphere S has a negative charge and is attached to a plastic stand. The diagram shows the spheres when they are close to each other.



Which charged state of R accounts for the behaviour in the diagram?

A negative only

B positive only

C negative or uncharged

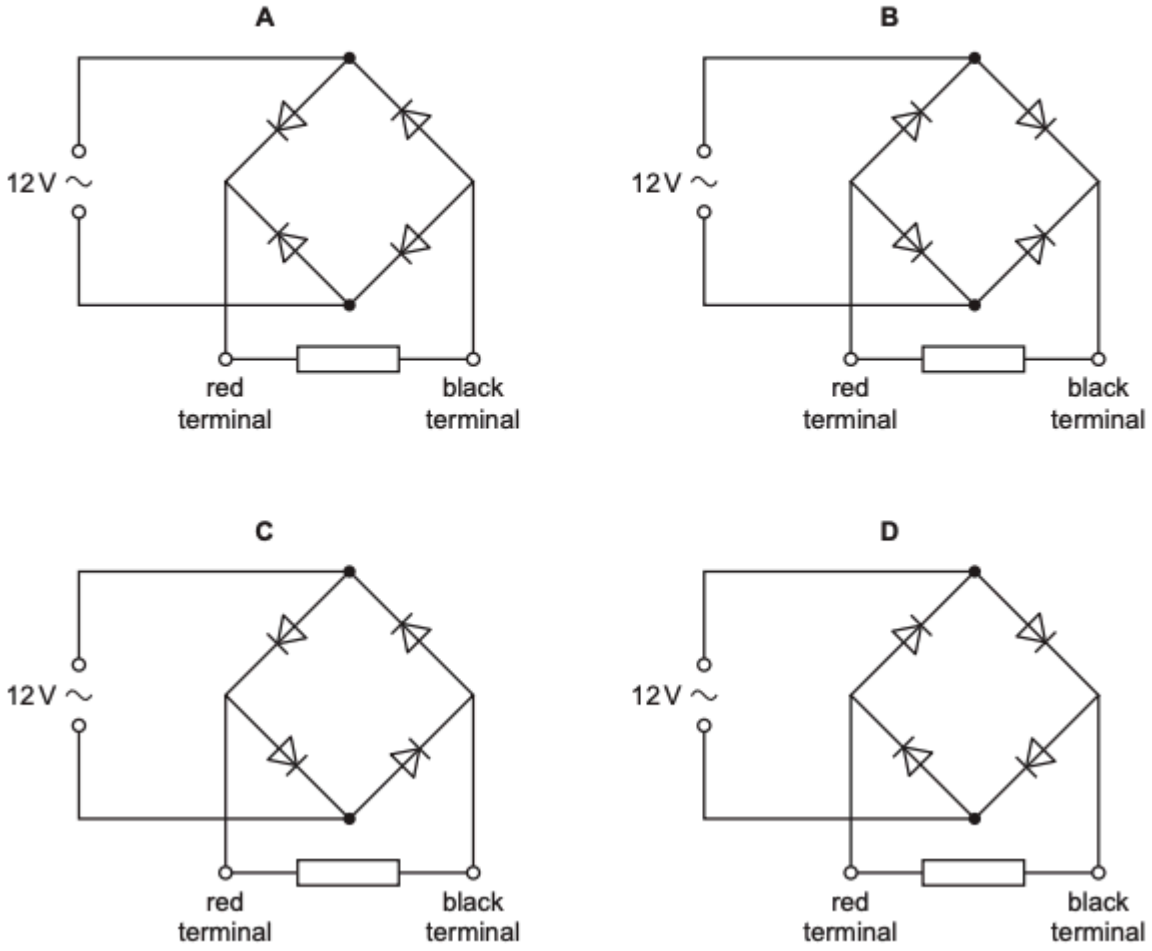
D positive or uncharged

Answer: D

26.

The four circuits shown each contain four diodes.

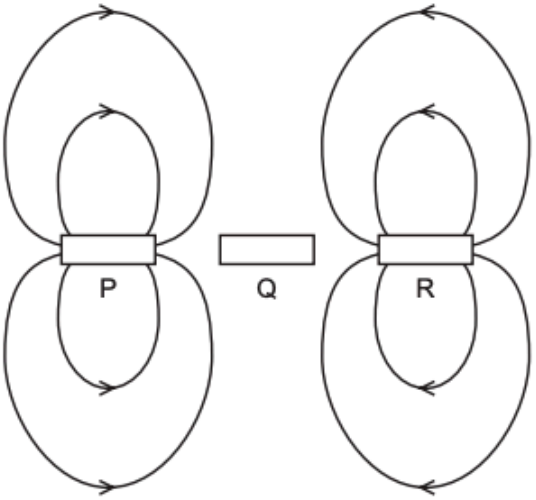
In which circuit is the direction of the current in the resistor always from the red terminal to the black terminal?



Answer: A

27.

The diagram shows the magnetic fields around three objects, P, Q and R, placed close to each other.



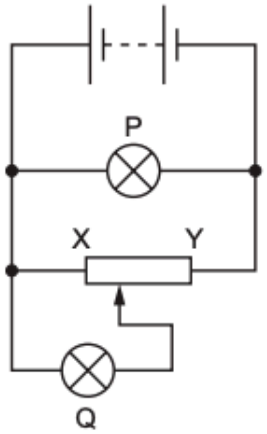
Which row shows the nature of each of the objects?

	P	Q	R
A	permanent magnet N S	copper rod	permanent magnet N S
B	permanent magnet N S	copper rod	permanent magnet S N
C	permanent magnet N S	iron rod	permanent magnet N S
D	permanent magnet N S	iron rod	permanent magnet S N

Answer: B

28.

The diagram shows a battery connected to a potential divider and to two lamps, P and Q.



The slider on the potential divider is moved from end X to end Y of the resistor.

Which row shows the effect on the brightness of each lamp?

	brightness of P	brightness of Q
A	brighter	brighter
B	brighter	dimmer
C	unchanged	brighter
D	unchanged	dimmer

Answer: C

29.

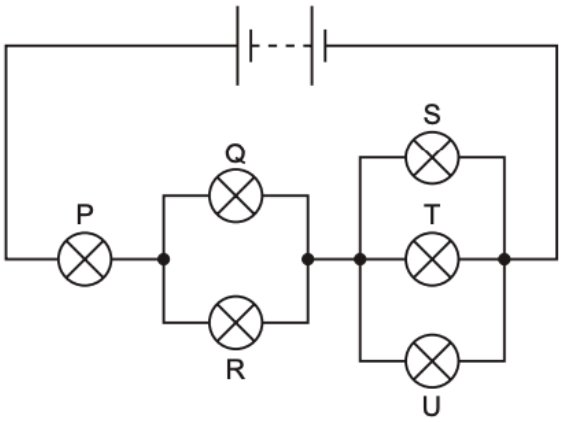
Which unit is equivalent to a volt (V)?

A A/Ω **B** J/C **C** J/s **D** W/C

Answer: B

30.

The diagram shows a circuit of six identical lamps connected to a battery.



Which lamps are brightest?

A P only

B Q and R only

C S, T and U only

D P, Q, R, S, T and U are equally bright

Answer: A

31.

A magnet is dropped vertically through a solenoid. This induces magnetic poles at both ends of the solenoid.

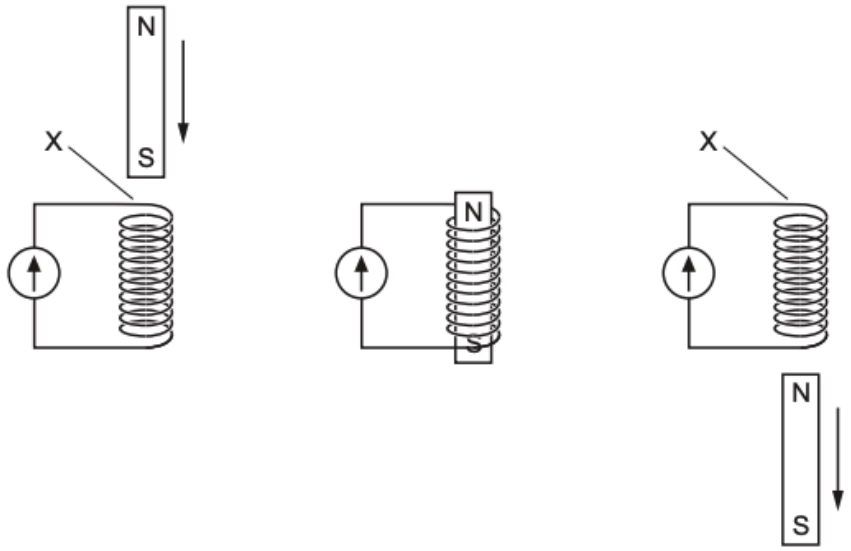


diagram 1 diagram 2 diagram 3

Which magnetic poles are induced at position X in diagram 1 and diagram 3?

	diagram 1	diagram 3
A	N pole	N pole
B	N pole	S pole
C	S pole	N pole
D	S pole	S pole

Answer: C

32.

Two separate circuits have different power supplies. Both power supplies provide the same magnitude current.

Power supply P has an electromotive force (e.m.f.) of 1.5 V and power supply Q has an e.m.f. of 3.0 V.

Which statements about Q are correct when compared with P?

1 Q supplies twice the charge per unit time.

2 Q supplies twice the energy per unit charge.

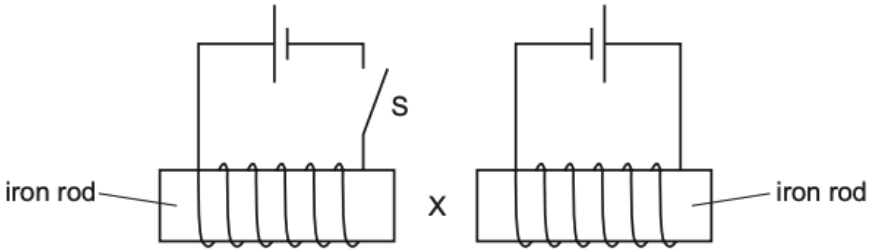
3 Q supplies twice the energy per unit time.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

Answer: D

33.

Two circuits are set up as shown. The iron rods are placed close together and are able to move.



What happens to the size of the gap at X when switch S is closed?

A It decreases.

B It decreases then increases.

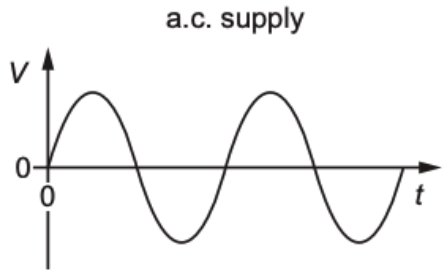
C It increases.

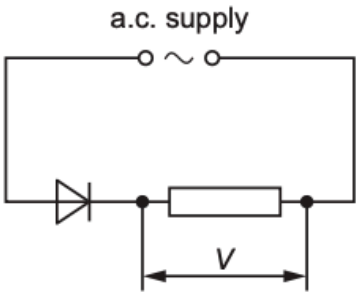
D It does not change.

Answer: C

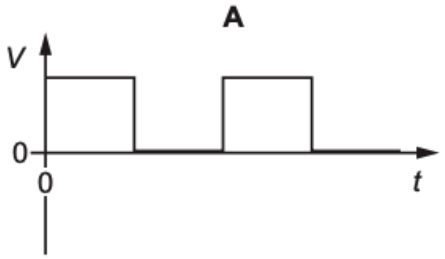
34.

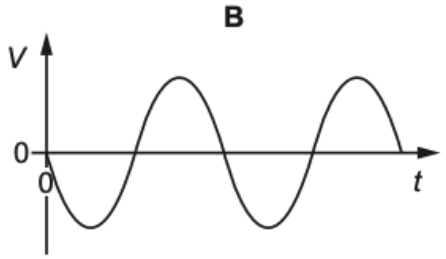
An alternating (a.c.) supply is connected to a diode and a resistor in series.

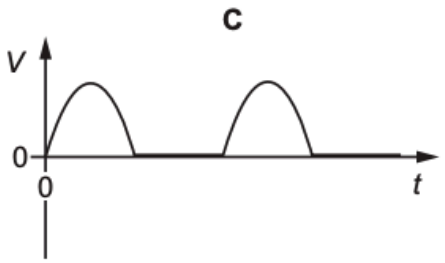


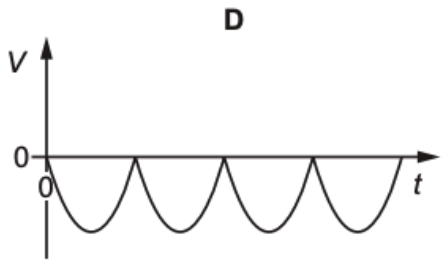


Which graph shows how the potential difference *V* across the resistor varies with time *t*?





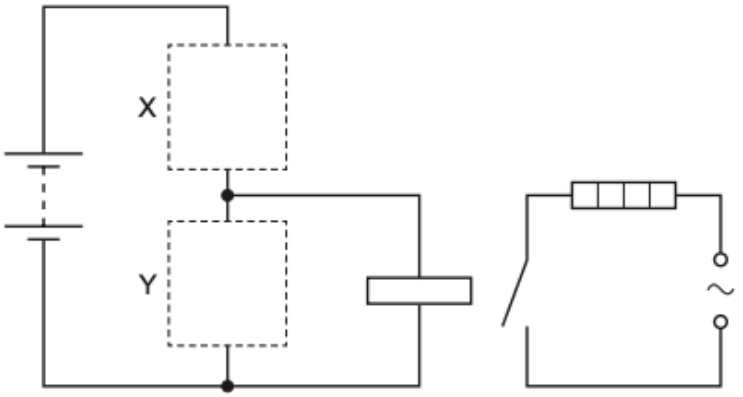




Answer: C

35.

The diagram shows a circuit used to switch on a heater when the temperature drops below a certain value.



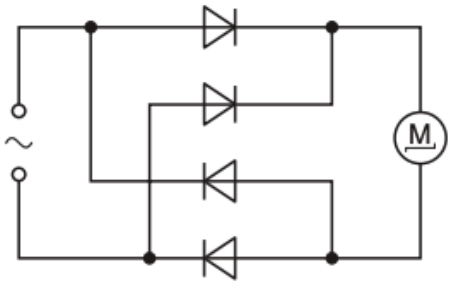
Which row shows the components that should be connected at X and at Y?

	X	Y
A		
B		
C		
D		

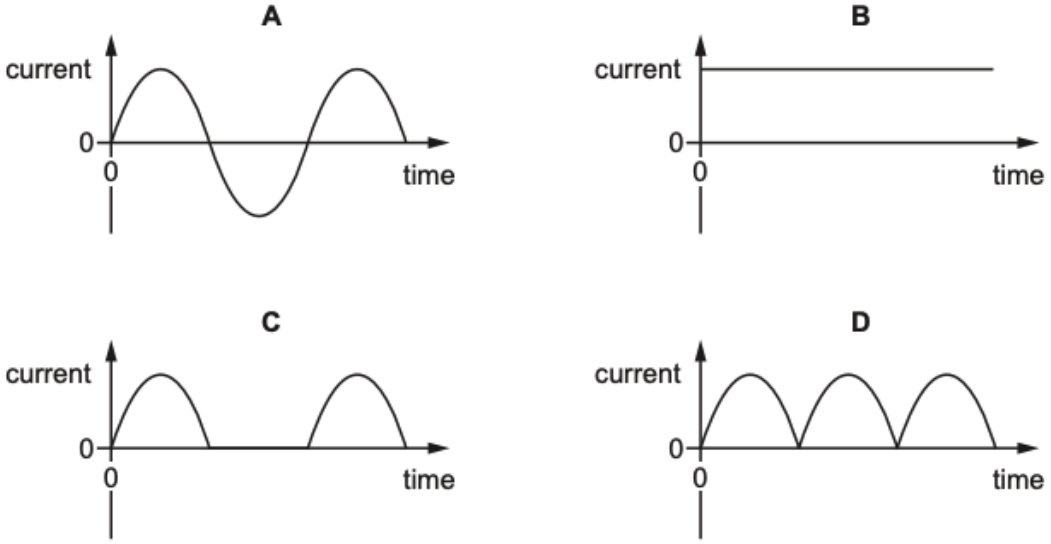
B

36.

The circuit diagram shows a circuit used to run a d.c. motor from an a.c. supply.



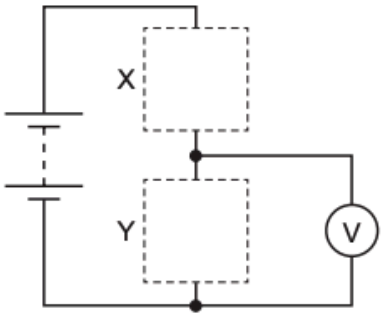
Which graph shows the current in the motor?



D

37.

The circuit shown can be completed by inserting components at X and at Y. The completed circuit is a potential divider in which the potential difference across component Y increases when the temperature increases.



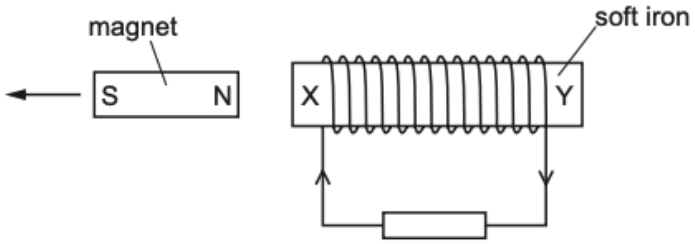
Which row shows the components X and Y?

	X	Y
A	light-dependent resistor	resistor
B	resistor	light-dependent resistor
C	resistor	thermistor
D	thermistor	resistor

D

38.

A piece of soft iron XY has a coil of wire wound round it.



The N pole of a bar magnet is pulled away from end X which causes an induced current in the coil.

The magnet is now turned round so that the N pole is on the left. It is taken to the other end of the soft iron and the N pole is pushed towards end Y. A new current is induced in the coil.

Which statement is correct?

A The new induced current is in the opposite direction and causes the soft iron to attract the N pole.

B The new induced current is in the opposite direction and causes the soft iron to repel the N pole.

C The new induced current is in the same direction and causes the soft iron to attract the N pole.

D The new induced current is in the same direction and causes the soft iron to repel the N pole.

D

39.

A resistance wire of length L melts and has to be replaced with a wire of the same material and the same resistance. The only wire available has twice the diameter of the broken wire.

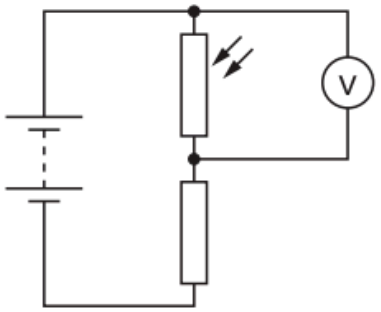
Which length of this wire should be used?

A $\frac{L}{4}$ **B** $\frac{L}{2}$ **C** $2L$ **D** $4L$

D

40.

The diagram shows a light-dependent resistor (LDR) connected in a potential divider circuit.



The brightness of the light falling on the LDR is increased.

Which row shows what happens to the resistance of the LDR and what happens to the reading on the voltmeter?

	resistance of LDR	reading on voltmeter
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

A

41.

A simple a.c. generator has a coil rotating in a magnetic field.

What happens to the peak electromotive force (e.m.f.) and to the frequency of the a.c. output when the coil is rotated faster?

	peak e.m.f.	frequency
A	greater	greater
B	greater	no change
C	no change	greater
D	no change	no change

A

Nuclear Physics

1.

The scattering of α-particles by a thin metal foil supports the nuclear model of an atom.

Why are α-particles used rather than neutrons?

A because they always travel more slowly

B because they are heavier

C because they are larger in diameter

D because they have a positive charge

Answer: D

2.

Several scientists are working in a laboratory. The scientists are experimenting with sources which emit ionising radiation. Each scientist is given a list of safety rules.

Three of the rules are shown.

1 Keep at least 2 m away from other people.

2 Do not stay longer than 4 hours per day in the laboratory.

3 Stay behind the lead-lined screen.

Which safety rules are for protection against the effects of ionising radiation?

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

Answer: D

3.

Fission and fusion are two types of nuclear process.

How does the total mass of the nuclides produced compare with the total mass of the original nuclide or nuclides in these nuclear processes?

	total mass of fission products compared to original nuclide	total mass of fusion products compared to original nuclides
A	same	same
B	more	less
C	less	more
D	less	less

Answer: D

4.

Which change occurs in the nucleus of a radioactive atom during β-emission?

A A neutron transforms into a proton and an electron.

B A neutron transforms into a proton only.

C A proton transforms into a neutron and an electron.

D A proton transforms into a neutron only.

Answer: A

5.

A radioactive isotope has a half-life of 8 days.

A detector close to a sample of this isotope gives a count rate of 200 counts per minute.

Without the source, the background count is 20 counts per minute.

What is the count rate due to the source after 8 days?

A 80 counts per minute

B 90 counts per minute

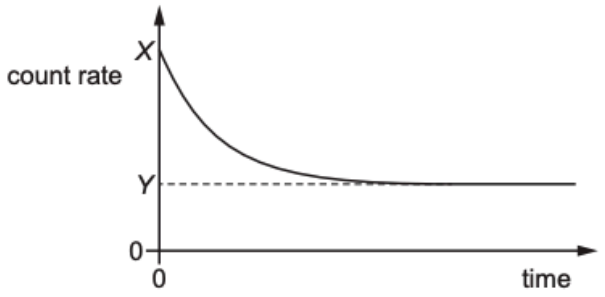
C 100 counts per minute

D 110 counts per minute

Answer: B

6.

The graph shows the measured count rate of radiation from a source containing a radioactive isotope. The detector is in a laboratory, with no shielding from background radiation.



What is the measured count rate after a time of one half-life?

A $\frac{X}{2}$ **B** $\frac{Y}{2}$ **C** $\frac{(X-Y)}{2}$ **D** $\frac{(X+Y)}{2}$

Answer: D

7.

A radioactive isotope of sodium has a half-life of 15 h.

The table gives data from an experiment to show how the rate of decay of the isotope varies with time.

The background count rate has not been subtracted from these data.

time / h	0	10	20	30
count rate / counts / s	400	260	170	115

What is the background radiation count rate?

A 12 counts / s

B 15 counts / s

C 20 counts / s

D 30 counts / s

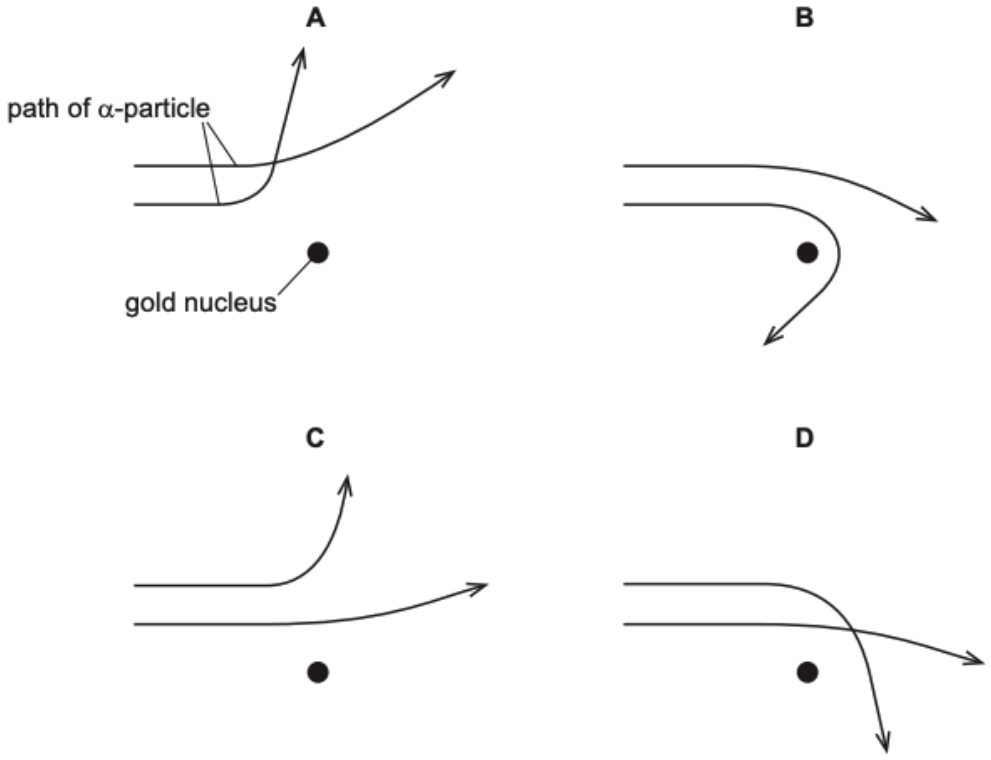
C

8.

The scattering of α-particles by a thin gold foil provides evidence for the nuclear model of the atom.

Two α-particles of the same energy are incident on a nucleus of gold.

Which diagram shows the correct paths followed by the α-particles as they pass close to the nucleus?



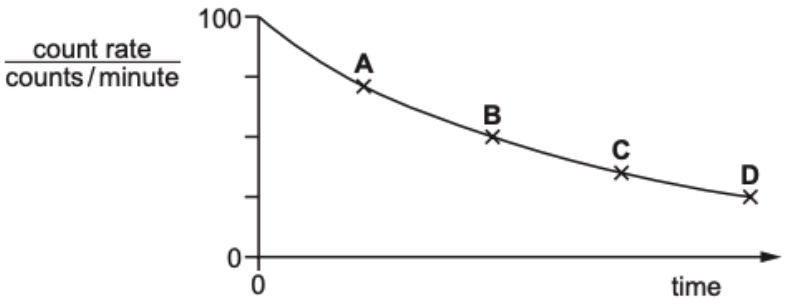
A

9.

The half-life of carbon-14 is 5700 years.

An object containing carbon-14 has a count rate of 100 counts / minute when it is first formed. The graph shows how the count rate decreases over time.

Which point on the graph corresponds to a time 11 400 years after the formation of the object?



D

Space Physics

1.

Two quantities define the Hubble constant H_0.

- the speed at which the galaxy is moving away from the Earth v
- the distance of the galaxy from the Earth d

What is the relationship between v and d and what is the current estimate for H_0?

	relationship	current estimate for H_0
A	v is proportional to d	$2.2 \times 10^{-18}\,s^{-1}$
B	v is proportional to $\frac{1}{d}$	$2.2 \times 10^{-18}\,s^{-1}$
C	v is proportional to d	$3.0 \times 10^{8}\,m/s$
D	v is proportional to $\frac{1}{d}$	$3.0 \times 10^{8}\,m/s$

Answer: A

2.

Which stages in the life cycle of a star are listed in the order that they occur?

A interstellar dust cloud → stable star → protostar

B protostar → red giant → stable star

C red giant → white dwarf → protostar

D stable star → red giant → white dwarf

Answer: D

3.

Which quantity can be determined using the brightness of a supernova in a distant galaxy?

A the speed at which the galaxy is moving away from the Earth

B the distance of the galaxy from the Earth

C the Hubble constant

D the age of the Universe

Answer: B

4.

An eclipse of the Sun happens when the Moon comes between the Earth and the Sun.

Which statement is correct?

A Infrared radiation from the Sun disappears before visible light and ultraviolet radiation.

B Ultraviolet radiation from the Sun disappears before visible light and infrared radiation.

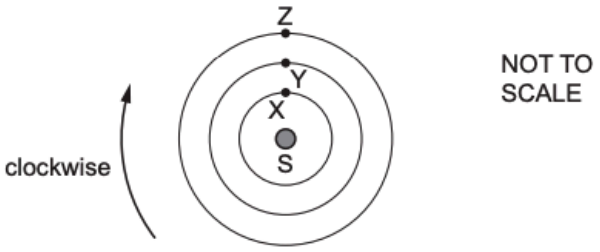
C Visible light from the Sun disappears before ultraviolet radiation and infrared radiation.

D Infrared radiation, ultraviolet radiation and visible light from the Sun all disappear at the same moment.

Answer: D

5.

38 The diagram shows a star S and the initial arrangement of three planets, X, Y and Z.



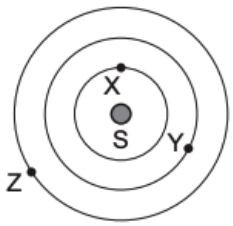
Each planet orbits clockwise in a circle about S.

The time for one orbit of Y is three times the time taken for one orbit of X.

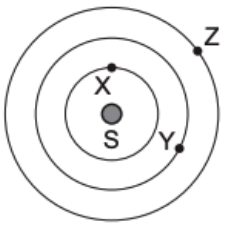
The time for one orbit of Z is twice the time taken for one orbit of Y.

Starting from the initial arrangement, which diagram shows the positions of the planets after X has made one complete orbit?

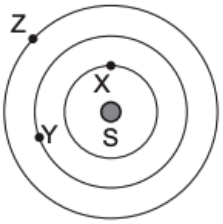
A



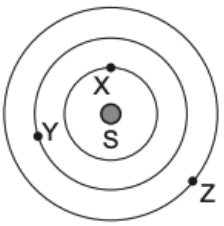
B



C



D



B

6.

The nearest star to the Sun is about four light-years away from the Earth.

A student makes three statements about the star.

1 Light from the star takes about four years to reach the Earth.

2 Light from the Sun takes about four years to travel to the star and back to the Earth.

3 The star is outside our galaxy.

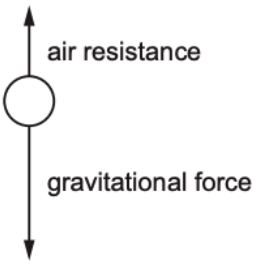
Which statements are correct?

A 1, 2 and 3 **B** 1 and 3 only **C** 1 only **D** 2 and 3 only

C

1.

A ball falls from rest through the air towards the ground. The diagram shows two forces acting on the ball.



As the ball falls, the air resistance increases.

Which statement is correct?

A The acceleration of the ball decreases.

B The acceleration of the ball increases.

C The speed of the ball decreases.

D The gravitational force on the ball decreases.

Answer: A

2.

A compressed spring projects a ball horizontally in a vacuum chamber.

On the Earth, the ball reaches the chamber floor 4.0 m in front of the spring.

An identical experiment is done on the Moon. The gravitational field strength is lower on the Moon than on the Earth.

The experimental results on the Moon are compared with those on the Earth.

Which statement is correct?

A The horizontal speed is greater on the Moon and the ball hits the floor 4.0 m in front of the spring.

B The horizontal speed is greater on the Moon and the ball hits the floor more than 4.0 m in front of the spring.

C The horizontal speed is the same on the Moon and the ball hits the floor 4.0 m in front of the spring.

D The horizontal speed is the same on the Moon and the ball hits the floor more than 4.0 m in front of the spring.

Answer: D

3.

Diagram 1 shows a piece of flexible material that contains many pockets of air. Diagram 2 shows the same piece of flexible material after it has been compressed so that its volume decreases.

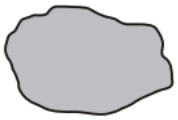


diagram 1
(before compression)

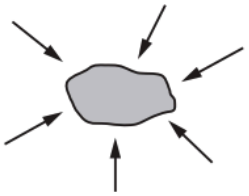


diagram 2
(after compression)

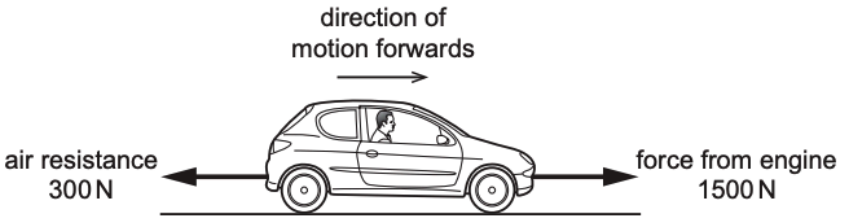
What happens to the mass and to the weight of the flexible material when it is compressed?

	mass	weight
A	increases	increases
B	increases	no change
C	no change	increases
D	no change	no change

Answer: D

4.

A car travels along a horizontal road at constant speed. Three horizontal forces act on the car. The diagram shows two of these forces.



What is the size and the direction of the third horizontal force acting on the car?

A 1200 N backwards

B 1200 N forwards

C 1800 N backwards

D 1800 N forwards

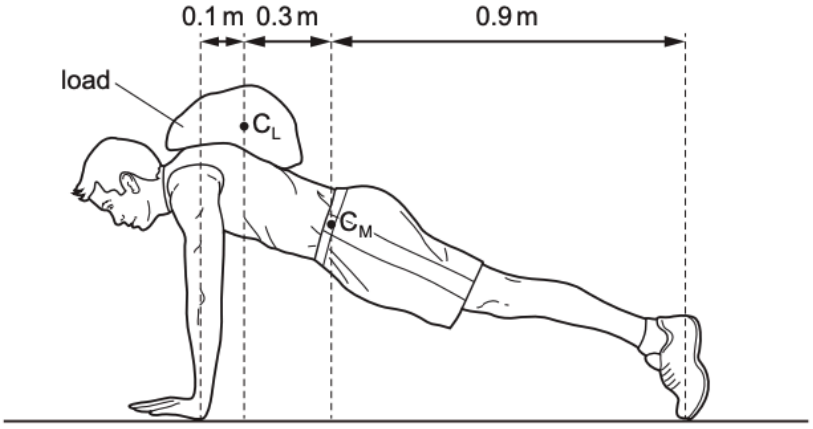
Answer: A

Because the car is moving at <u>constant speed.</u> This means that there is no resultant force acting on it. Therefore, there should be a 1200 N force acting backwards to balance the 1200 N force acting forward.

5.

An athlete with mass 70 kg trains by performing press-ups with a load on his back. The diagram shows the perpendicular distances involved.

The centre of mass of the athlete is C_M and the centre of mass of the load he is carrying is C_L.



The mass of the load is 6.0 kg.

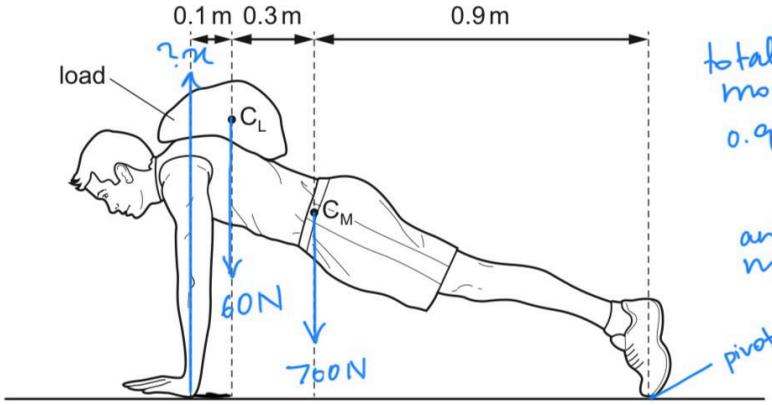
What is the upward force exerted by his two arms?

A 54 N **B** 76 N **C** 540 N **D** 760 N

Answer: C

An athlete with mass 70 kg trains by performing press-ups with a load on his back. The diagram shows the perpendicular distances involved.

The centre of mass of the athlete is C_M and the centre of mass of the load he is carrying is C_L.



total clockwise moment =
$0.9 \times 700 + 1.2 \times 60$
$= 702$ Nm
anticlockwise moment $= 702$ Nm $=$
$1.3x$
$\Rightarrow x = \frac{702}{1.3}$
$= 540$ N

The mass of the load is 6.0 kg.

6.

An air pistol fires a pellet forwards.

What is the motion of the air pistol?

A The air pistol moves backwards with speed greater than the pellet.

B The air pistol moves backwards with speed less than the pellet.

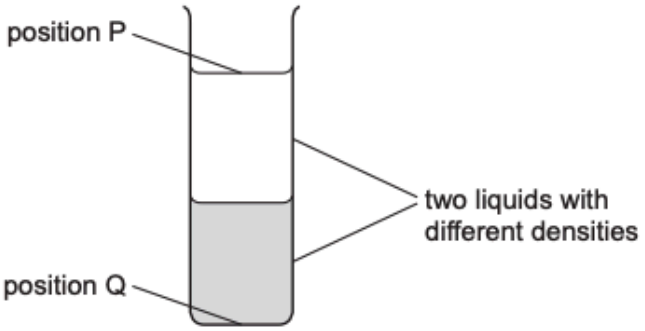
C The air pistol moves forward with speed greater than the pellet.

D The air pistol moves forward with speed less than the pellet.

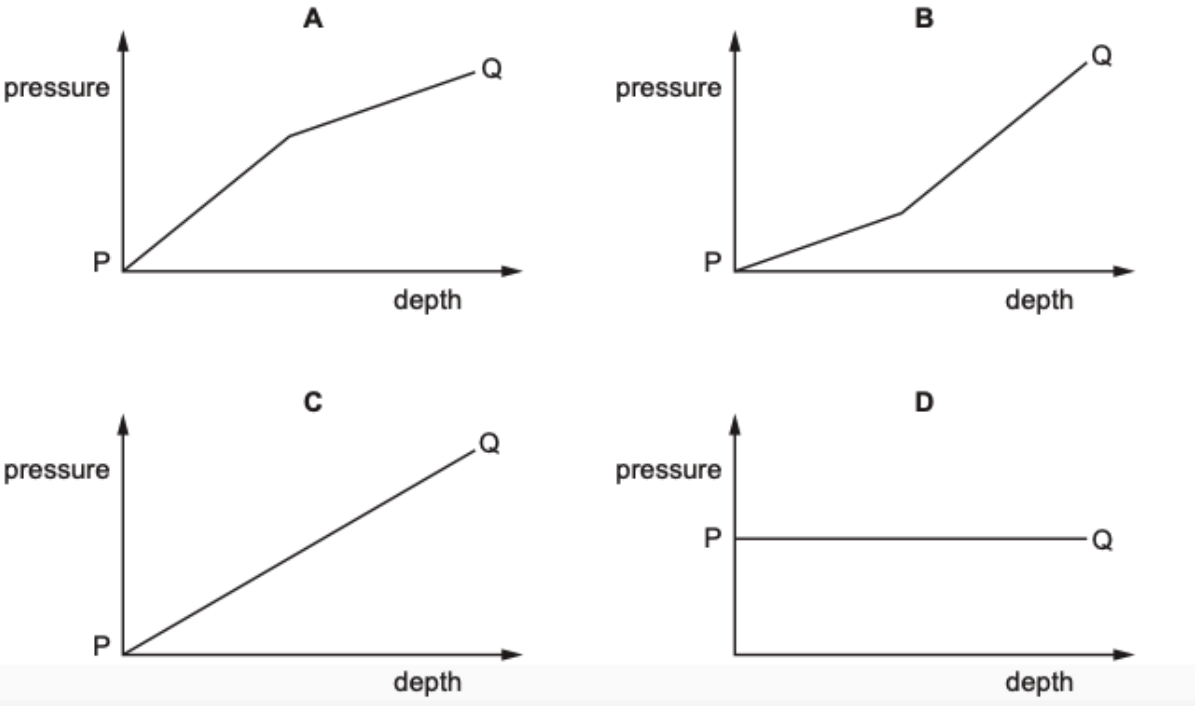
Answer: B

7.

A tall cylinder is partly filled with two liquids which do not mix. The two liquids have different densities. A student measures the pressure due to the liquids at different depths.



Which graph shows how the liquid pressure varies between positions P and Q?



Answer: B

NOTE: Fixed points in a liquid-in-glass thermometer = m.p & b.p of water = 0℃ & 100℃

8.

The specific heat capacities of aluminium, iron, ethanol and water are given.

substance	specific heat capacity J/kg °C
aluminium	900
iron	450
ethanol	2400
water	4200

1 kg of each metal is put into 5 kg of each liquid.

The starting temperature of each metal is 60 °C. The starting temperature of each liquid is 10 °C.

Which example has the highest final temperature?

	metal	liquid
A	aluminium	ethanol
B	iron	ethanol
C	aluminium	water
D	iron	water

Answer: A

9.

A teacher shows his class a polystyrene cup. The cup is made from thick plastic with lots of tiny air bubbles in it.

He asks the class why the cup is so good at keeping a hot drink warm. Three suggestions are made.

1 It contains air which is a poor thermal conductor.

2 The air is trapped in tiny bubbles so very little convection is possible.

3 The plastic is a poor thermal conductor.

Which suggestions are correct?

A 1 and 2 only **B** 1 and 3 only **C** 2 and 3 only **D** 1, 2 and 3

Answer: D

10.

Four students **A**, **B**, **C** and **D**, investigate the diffraction of water waves through a gap.

Each student uses a different gap size and a different wavelength for the water waves.

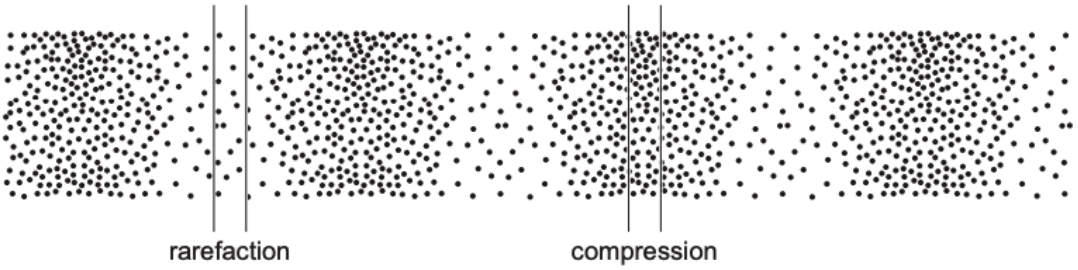
Which student produces the waves which have the most diffraction?

	gap size / cm	wavelength / cm
A	2.0	1.8
B	3.0	2.1
C	4.0	2.0
D	5.0	0.9

Answer: A

11.

The diagram shows compressions and rarefactions in air as a sound wave moves from left to right.



A quieter sound of the same frequency is made.

What will happen to the number of particles in a region of rarefaction and in a region of compression?

	number of particles in region of rarefaction	number of particles in region of compression
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

Answer: C

12.

When Rutherford bombarded thin gold foil with α-particles, he found that some α-particles were deflected through large angles.

Which statement explains this deflection?

A Most of the atom consists of empty space.

B All of the positive charge and most of the mass of the gold atom are concentrated in a small volume.

C Positive charge in the gold atom is spread evenly throughout the atom.

D All of the negative charge is concentrated at its centre.

Answer: B

13.

Which statement correctly describes the effects of placing a heavy load in a car?

A It is easier to accelerate the car and easier to bring the car to rest.

B It is easier to accelerate the car but more difficult to bring the car to rest.

C It is more difficult to accelerate the car and more difficult to bring the car to rest.

D It is more difficult to accelerate the car but easier to bring the car to rest.

Answer: C

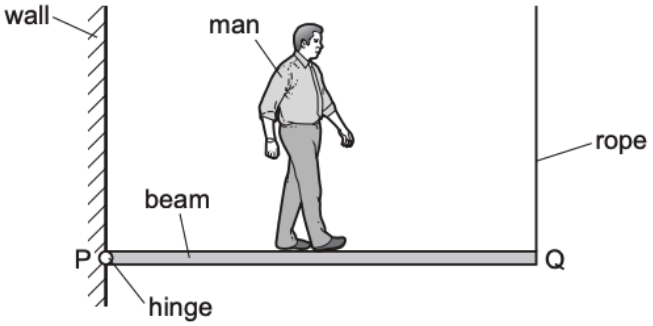
F = ma. Therefore, greater the mass, greater the force required to maintain the same acceleration.

14.

The diagram shows a wooden beam PQ, of negligible weight, which is attached to a wall by a hinge at P and kept in a horizontal position by a vertical rope attached at Q.

The beam is 3.0 m in length.

A man of weight 800 N walks along the beam from P to Q.



What is the distance of the man from P when the tension in the rope at Q becomes equal to 500 N?

A 0.53 m **B** 1.1 m **C** 1.9 m **D** 2.5 m

Answer: C

The diagram shows a wooden beam PQ, of negligible weight, which is attached to a wall by a hinge at P and kept in a horizontal position by a vertical rope attached at Q.

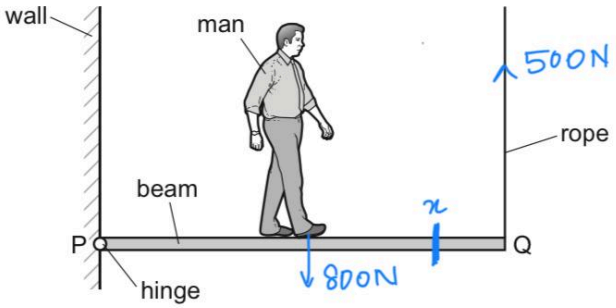
The beam is 3.0 m in length.

A man of weight 800 N walks along the beam from P to Q.

$800x = 500 \times 3$

$\Rightarrow x = \frac{1500}{800}$

$= 1.875 = 1.9$



15.

An object of mass 1.2 kg is moving with a velocity of 2.0 m/s when it is acted on by a force of 4.0 N. The velocity of the object increases to 5.0 m/s.

For what period of time does the force act on the object?

A 0.90 s **B** 1.1 s **C** 1.5 s **D** 3.6 s

Answer: A

$F = ma \Rightarrow 4 = 1.2 \times a$

$a = \frac{10}{3}$

$\frac{10}{3} = \frac{5-2}{t}$

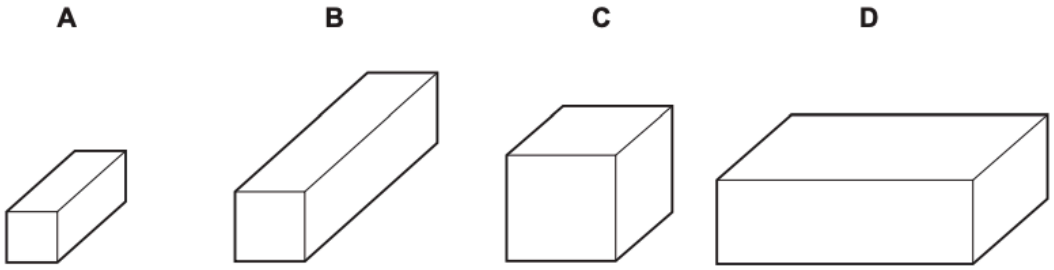
$\Rightarrow t = \frac{5-2}{10 \div 3} = 0.9$

16.

The diagrams show four blocks of steel. The blocks are all drawn to the same scale.

The same quantity of thermal energy is given to each block.

Which block shows the greatest rise in temperature?

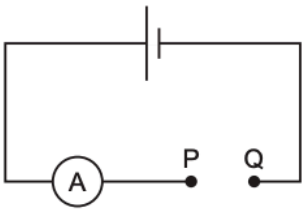


Answer: A

Smaller surface area to volume ratio allows an object to heat up faster.

17.

The diagram shows an incomplete circuit. The temperature and light levels around the circuit remain unchanged.



Four electrical components are connected in turn across PQ. The cell is reversed and the four electrical components are connected again in turn across PQ.

For which component is there a significant change in the magnitude of the current?

A diode

B light-dependent resistor

C resistor

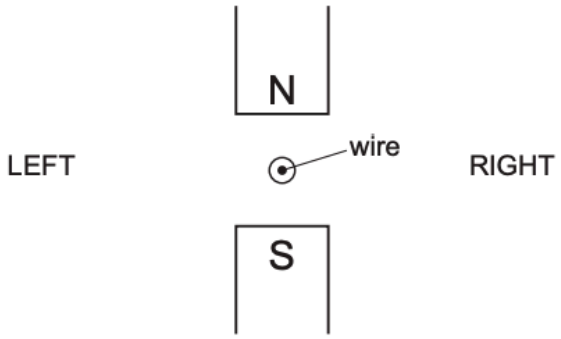
D thermistor

Answer: A

18.

The diagram shows a wire between the poles of a magnet.

The wire is perpendicular to the page.



The wire is moved and a current is induced upwards, out of the paper.

In which direction is the wire moved?

A left to right

B right to left

C up the page

D down the page

Answer: B

19.

A 100% efficient transformer converts a 240 V input voltage to a 12 V output voltage. The output power of the transformer can be a maximum of 20 W.

The output is connected to two 0.30 A bulbs in parallel. One of the bulbs fails.

How does the current in the primary coil change?

A It decreases by 0.30 A.

B It decreases by 0.015 A.

C It increases by 0.15 A.

D It remains unchanged.

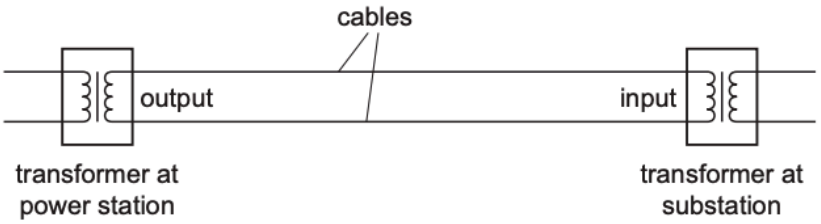
Answer: B

max output power = 20 W
actual output power = $VI = 12\,(0.3 + 0.3) = 7.2$ W
100% efficiency ∴ input power = output power = 7.2 W
current in primary = $\frac{P}{V} = \frac{7.2}{240} = 0.03$ A

if 1 lamp fails, output power = input power = $12 \times 0.3 = 3.6$ W
current in primary = $\frac{3.6}{240} = 0.015$
∴ reduces by 0.015

20.

Cables transmit electrical power from the output of the transformer at a power station to the input of the transformer at a substation.



The power at the output of the transformer at the power station is 400 MW.

Which situation delivers the most power to the input of the transformer at the substation?

	potential difference at power station transformer output / kV	diameter of cables
A	200	large
B	200	small
C	400	large
D	400	small

Answer: C

400 kV produces lower current; Large area reduces resistance. Therefore less energy is lost as heat/ thermal energy.

21.

A car of mass 500 kg is moving at 10 m/s. The engine does work on the car and the speed increases to 16 m/s.

How much work is done by the engine to increase the speed of the car?

A 3000 J **B** 9000 J **C** 39 000 J **D** 78 000 J

Answer: C

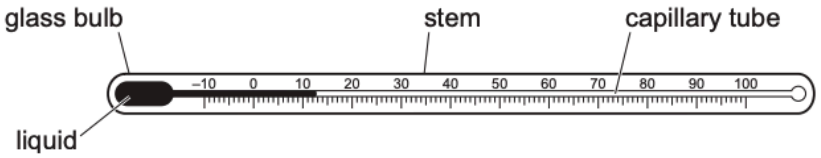
Initial KE = 25000 J

Final KE = 64000 J

Work done = final KE - intinnal KE = 39000 J

22.

The diagram shows a liquid-in-glass thermometer.



The design of this thermometer includes the following features.

1 a liquid which expands linearly when it is heated

2 a glass bulb which has a thick glass wall

3 a capillary tube with a very small diameter

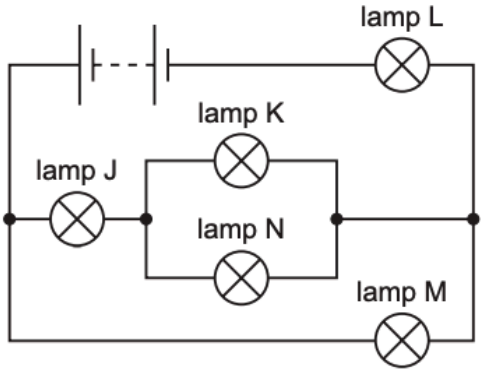
Which features increase the sensitivity of the thermometer?

A 1 only **B** 1 and 2 **C** 2 and 3 **D** 3 only

Answer: D

23.

The circuit shown contains five lamps J, K, L, M and N. All the lamps are glowing.



One lamp is removed and two other lamps go out.

Which lamp is removed?

A lamp J

B lamp K

C lamp L

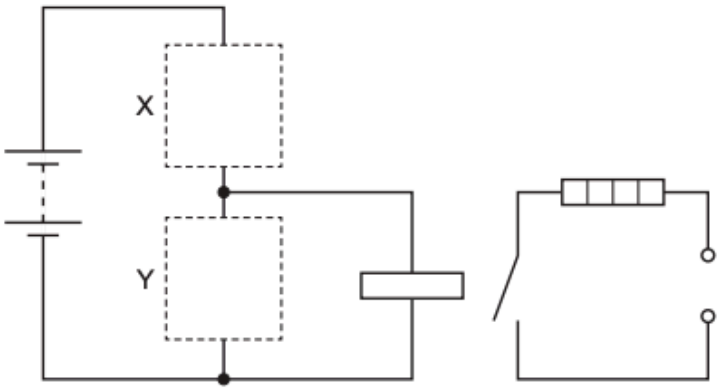
D lamp M

Answer: A

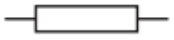
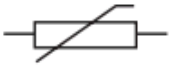
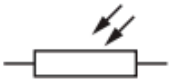
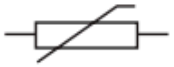
Note the question: 2 other lamps go out, not all!

24.

The diagram shows a circuit used to switch on a heater when the temperature drops below a certain value.



Which row shows the components that should be connected at X and at Y?

	X	Y
A		
B		
C		
D		

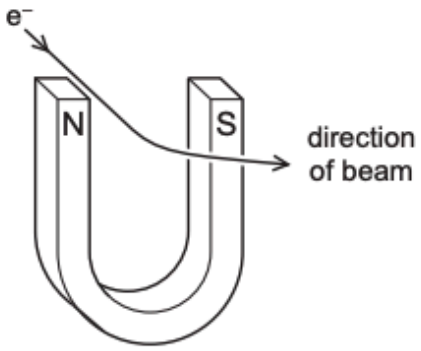
Answer: B

25.

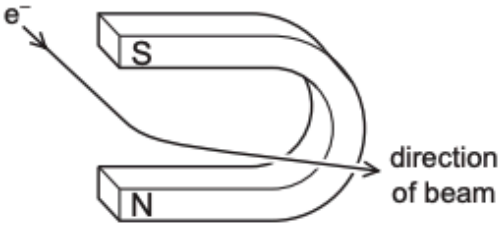
A beam of electrons is passed through the magnetic field of a magnet.

How must the magnet be positioned to deflect the beam in the direction shown?

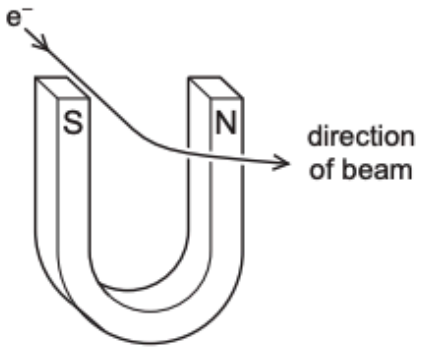
A



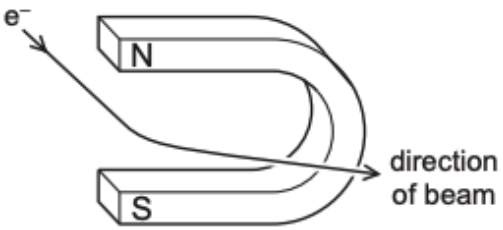
B



C



D



Answer: B

26.

Which moving object has a resultant force acting on it?

A a diver rising vertically through water at constant speed

B an aircraft circling an airport at constant speed

C a parachutist descending vertically at terminal velocity

D a train going up a straight slope at constant speed

Answer: B

27.

A ball falls vertically to the floor and rebounds vertically upwards.

Just before it hits the floor, its speed is 4.0 m/s.

As it rebounds, its speed is 3.0 m/s.

The mass of the ball is 0.50 kg.

What is the change in momentum of the ball?

A 0.50 kg m/s downwards

B 0.50 kg m/s upwards

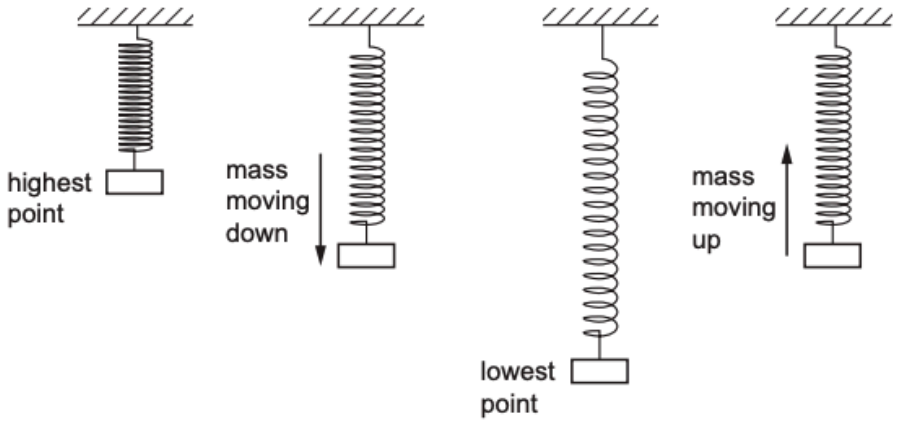
C 3.5 kg m/s downwards

D 3.5 kg m/s upwards

Answer: D
Initial momentum = -2 (downwards)
Final momentum = +1.5 (upwards)
Change in momentum = 1.5 - (-2) = +3.5 (upwards)
NOTE: When upwards/downwards OR forwards/backwards is mentioned, take one of them as +ve and the other as -ve.

28.

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

Answer: D

29.

A pipe full of water connects a water supply on a hill to a tap lower down the hill.

The length of the pipe is 500 m. The height of the supply above the tap is 100 m.

The density of the water is 1000 kg / m^3. The effect of atmospheric pressure is negligible.

What is the water pressure at the tap?

A 100 000 Pa

B 500 000 Pa

C 1 000 000 Pa

D 5 000 000 Pa

Answer: C

P = 100 x 1000 x 10 = 1,000,000

NOTE: The vertical height is always used for liquid pressure calculations

30.

When a molecule rebounds from a wall, a force is exerted on the wall.

What causes this force?

A the kinetic energy gained by the molecule

B the kinetic energy lost by the molecule

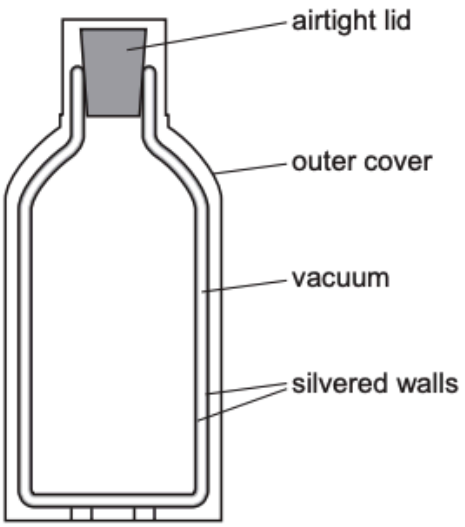
C the change of momentum of the molecule

D the change of speed of the molecule

Answer: C

31.

The diagram shows a vacuum flask used to keep a liquid warm.



Which methods of heat loss are reduced by the **vacuum** between the silvered walls?

A conduction only

B conduction and convection only

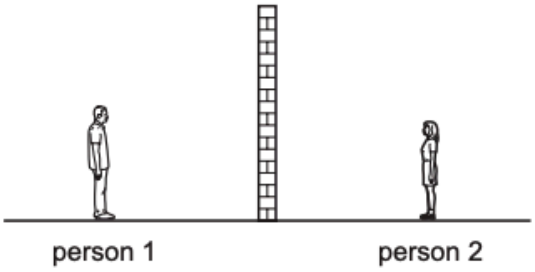
C convection and radiation only

D conduction, convection and radiation

Answer: B

32.

Two people are standing outdoors on either side of a high wall.



Person 1 can hear person 2 talking although he cannot see her.

Which statement explains this?

A The sound waves have diffracted around the wall.

B The sound waves have passed unaffected through the wall.

C The sound waves have reflected around the wall.

D The sound waves have refracted around the wall.

Answer: A

33.

The diagrams show a magnetised steel rod inside a solenoid connected to a potentiometer.

In diagram 1, the potentiometer is connected to a d.c. power supply.

In diagram 2, the potentiometer is connected to an a.c. power supply.

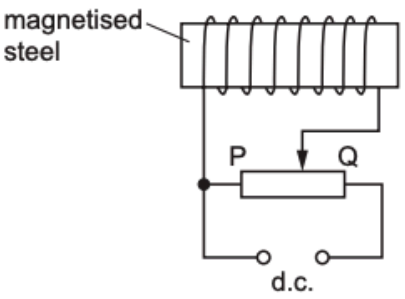


diagram 1

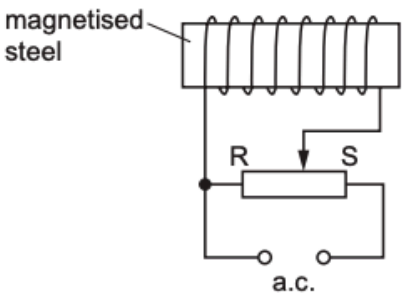


diagram 2

Which action would demagnetise the piece of steel?

A In diagram 1, move the potentiometer slide from P to Q.

B In diagram 1, move the potentiometer slide from Q to P.

C In diagram 2, move the potentiometer slide from R to S.

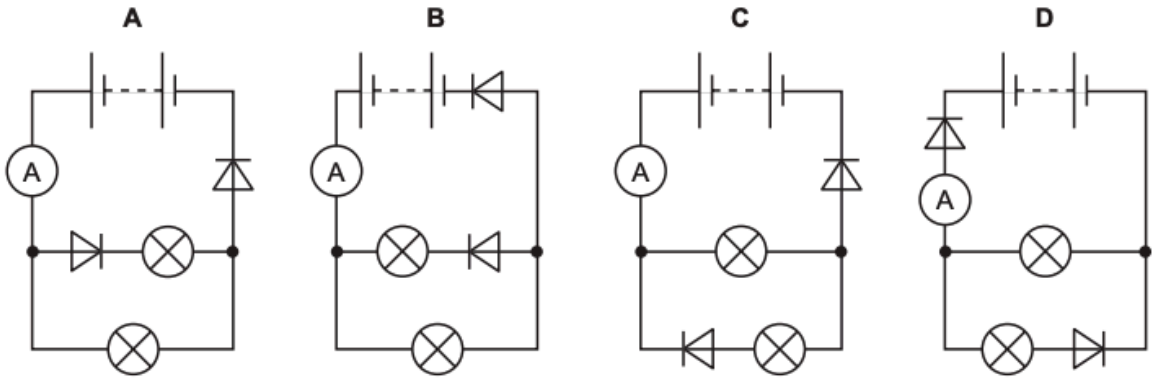
D In diagram 2, move the potentiometer slide from S to R.

Answer: D

34.

31 The lamps, the diodes and the batteries in the circuits are identical.

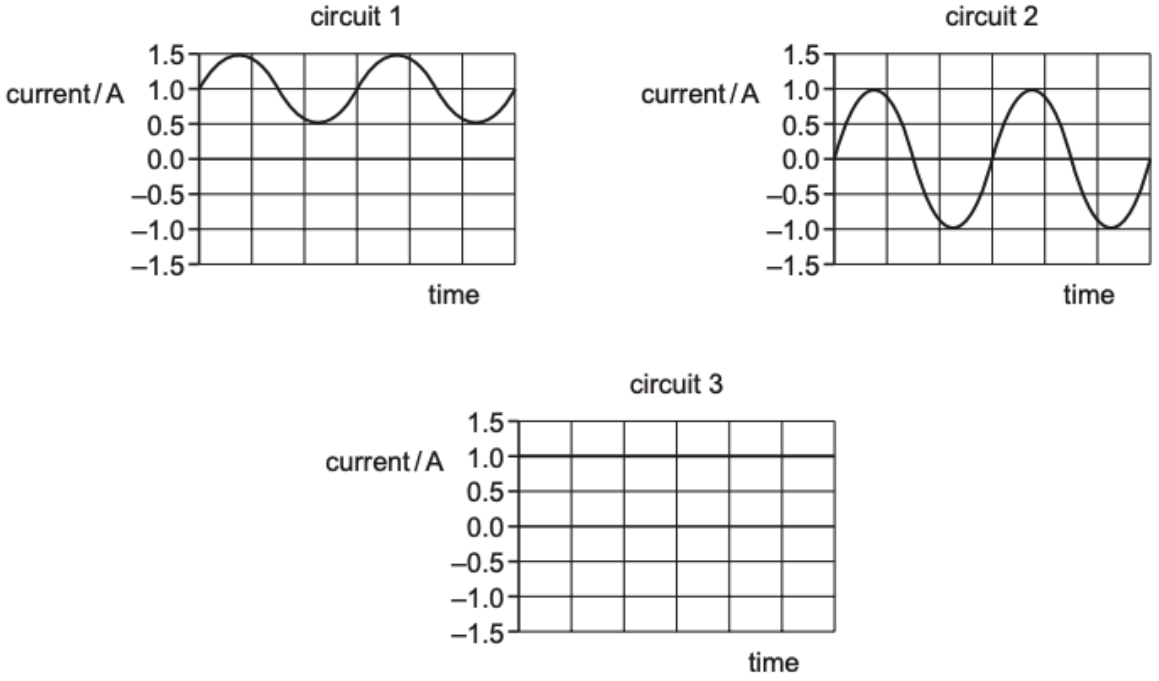
In which circuit does the ammeter give the greatest reading?



Answer: A

35.

The graphs show how the currents in three circuits vary with time.



In which circuits is there a direct current?

A 1 and 2 **B** 1 and 3 **C** 2 only **D** 3 only

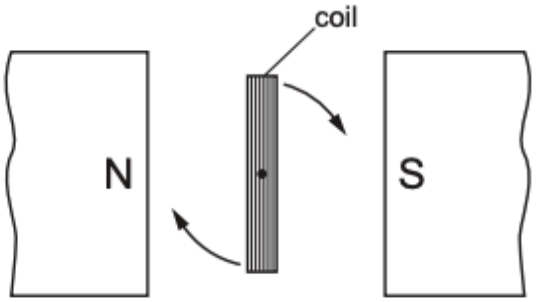
Answer: B

Circuit 1 is d.c, because the current is positive at all times. It never goes below 0, therefore it never changes direction.

36.

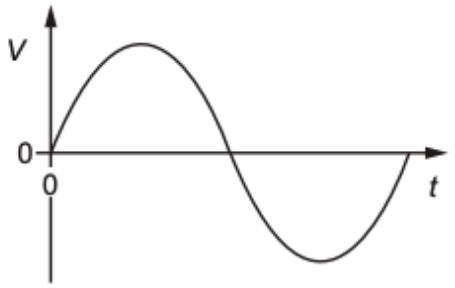
The coil of a simple a.c. generator rotates steadily in a uniform magnetic field.

The diagram shows the position of the coil at time $t = 0$.

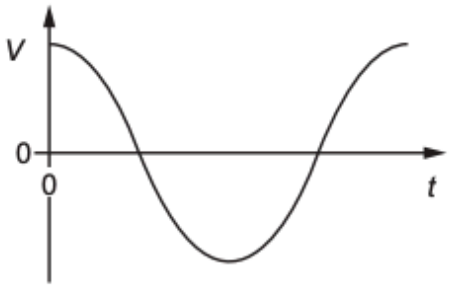


Which graph shows the output voltage for one revolution of the coil?

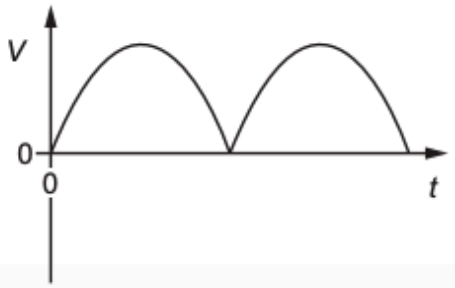
A



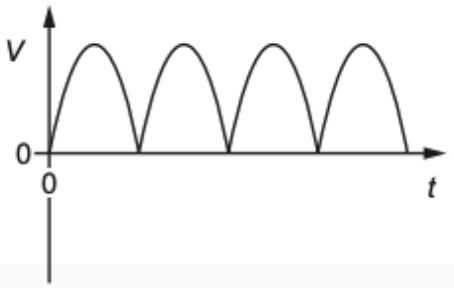
B



C



D



Answer: A