Cambridge Assessment International Education

Cambridge O Level

PHYSICS **5054/12**

Paper 1 Multiple Choice **October/November 2021**

1 hour

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

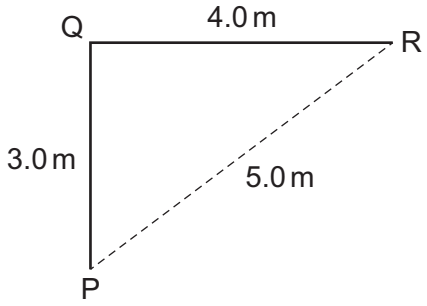
- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.

IB21 11_5054_12/3RP
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1 A boy starts at P and walks 3.0 m due north from P to Q and then 4.0 m due east from Q to R.



What is the shortest distance that he must now walk to have an overall displacement of zero?

A 3.0 m **B** 4.0 m **C** 5.0 m **D** 7.0 m

2 A student investigates the motion of a ball falling through the air.

Which quantity is a vector?

A the diameter of the ball

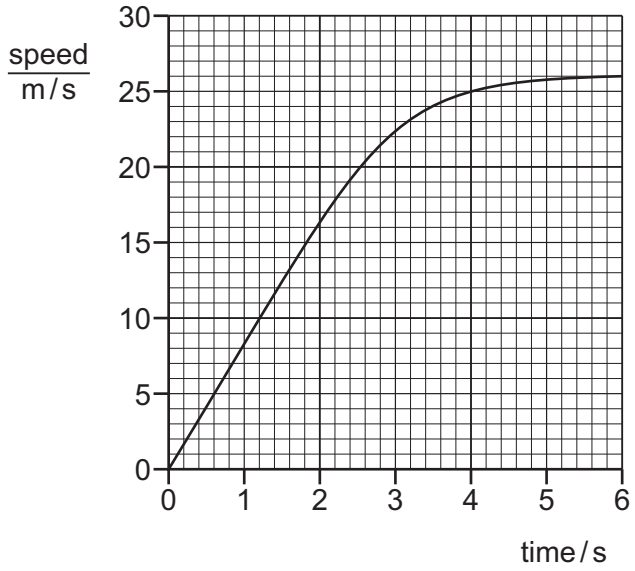
B the gravitational force on the ball

C the distance from which the ball is dropped

D the speed at which the ball hits the ground

3 A skier slides down a slope.

The diagram shows how his speed varies with time.



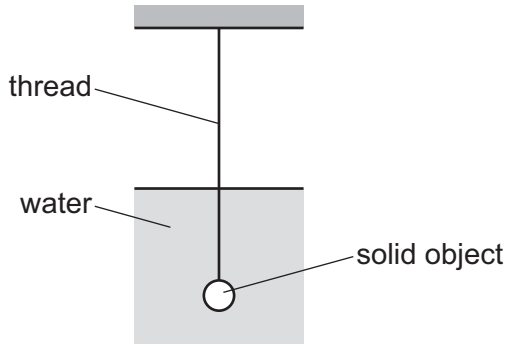
What is his average acceleration during the 6.0 s?

A 2.2 m/s^2 **B** 4.3 m/s^2 **C** 8.0 m/s^2 **D** 13.0 m/s^2

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4 A solid object, immersed in water, hangs from an elastic thread. Three forces act on the object: its weight *W*, the tension in the thread *T*, and a force *F* from the water.

The force *F* acts upwards.



Which equation is correct when the object is stationary?

A $F + W = 0$

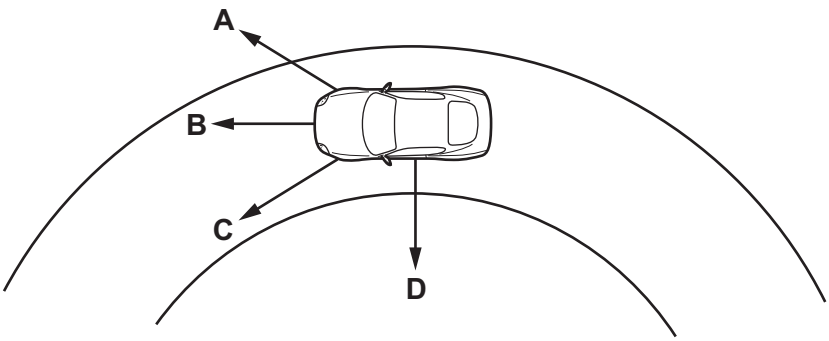
B $F - T = 0$

C $F - W - T = 0$

D $F - W + T = 0$

5 The diagram shows a car going around a circular track at constant speed.

Which arrow shows the direction of the resultant force on the car?



6 An object in a laboratory is used to determine the gravitational field strength *g*.

Which quantity is equal to *g*?

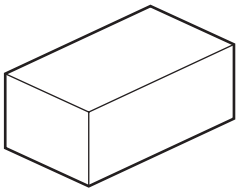
A the weight of the object

B the mass of the object

C the $\frac{\text{weight}}{\text{mass}}$ of the object

D the $\frac{\text{mass}}{\text{weight}}$ of the object

7 A student takes measurements to find the density of a regularly shaped block.



Which formula is used to calculate the density of the block?

A $\text{density} = \frac{\text{mass}}{\text{volume}}$

B $\text{density} = \frac{\text{volume}}{\text{mass}}$

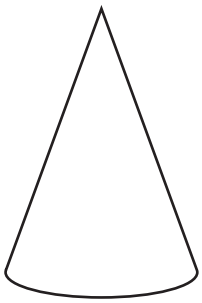
C $\text{density} = \frac{\text{weight}}{\text{area}}$

D $\text{density} = \frac{\text{weight}}{\text{volume}}$

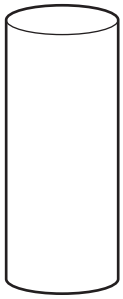
8 Four solid objects are made from the same material and have equal volumes.

Which object is the most stable?

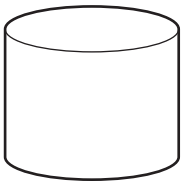
A



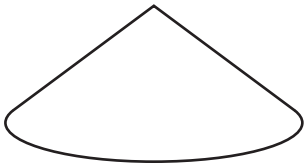
B



C



D



9 A metal wire is stretched by a force *F* up to the limit of proportionality.

Which statement describes what happens when *F* is increased slightly?

A The wire breaks.

B The wire continues to extend but not in direct proportion to *F*.

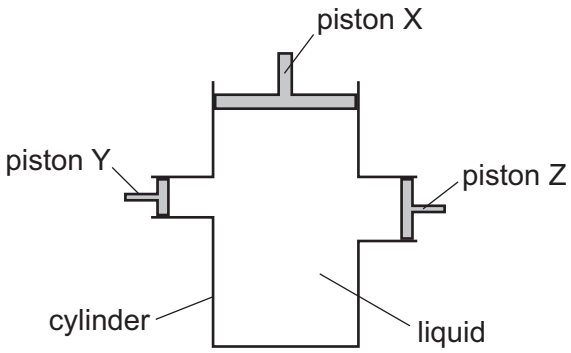
C The wire continues to extend in direct proportion to *F*.

D The wire does not extend any further.

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10 Piston X is pushed into a hydraulic cylinder. Piston X produces a pressure P_X in the liquid in the cylinder.

The diagram shows the cylinder viewed from above.



view from above

There are two other pistons, Y and Z, in the cylinder.

The pressures on piston Y and Z are P_Y and P_Z.

What is the relationship between P_X, P_Y and P_Z?

A $P_X = P_Y + P_Z$

B $P_X > P_Z > P_Y$

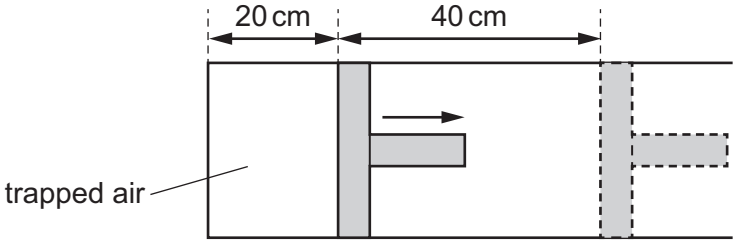
C $P_X < P_Z < P_Y$

D $P_X = P_Y = P_Z$

11 Air is trapped in a cylinder by a piston. The pressure of the air is p and the length of the air column is 20 cm.

The piston is moved outwards. The length of the air column increases by 40 cm.

The temperature of the air remains constant.



What is the new air pressure?

A $\frac{p}{2}$ **B** $\frac{p}{3}$ **C** $2p$ **D** $3p$

12 A 60 kg ice-skater, travelling initially at 3.0 m / s, glides across a horizontal icy surface. The skater brakes and comes to rest after 5.0 m.

The work done against the braking force is the change in the kinetic energy of the skater.

What is the braking force?

A 18 N **B** 27 N **C** 54 N **D** 108 N

13 Which equation is used to find the efficiency of an energy transfer?

A $\text{efficiency} = \dfrac{\text{useful energy output}}{\text{total energy input}}$

B $\text{efficiency} = \dfrac{\text{total energy input}}{\text{useful energy output}}$

C $\text{efficiency} = \dfrac{\text{energy converted to the required form}}{\text{total power input}}$

D efficiency = (energy converted to the required form) × (total energy input)

14 The diagram shows the inside of a refrigerator.



When the refrigerator is first switched on, what happens to the air near the cooling unit?

	the molecules of this air	the density of this air
A	become smaller	decreases
B	become smaller	increases
C	move closer together	decreases
D	move closer together	increases

15 What is the colour and what is the texture of a good absorber of infrared radiation?

A black and shiny

B black and dull

C white and shiny

D white and dull

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16 Which temperatures are used as the lower and upper fixed points for a mercury-in-glass thermometer?

	lower fixed point	upper fixed point
A	freezing point of mercury	boiling point of mercury
B	freezing point of water	boiling point of water
C	room temperature	boiling point of mercury
D	room temperature	boiling point of water

17 Two liquid-in-glass thermometers have identical dimensions.

One contains ethanol and the other an equal volume of mercury.

Ethanol expands more than mercury for the same temperature rise.

How do the sensitivity and range of the ethanol thermometer compare to those of the mercury thermometer?

	sensitivity of ethanol thermometer	range of ethanol thermometer
A	greater	greater
B	greater	smaller
C	smaller	greater
D	smaller	smaller

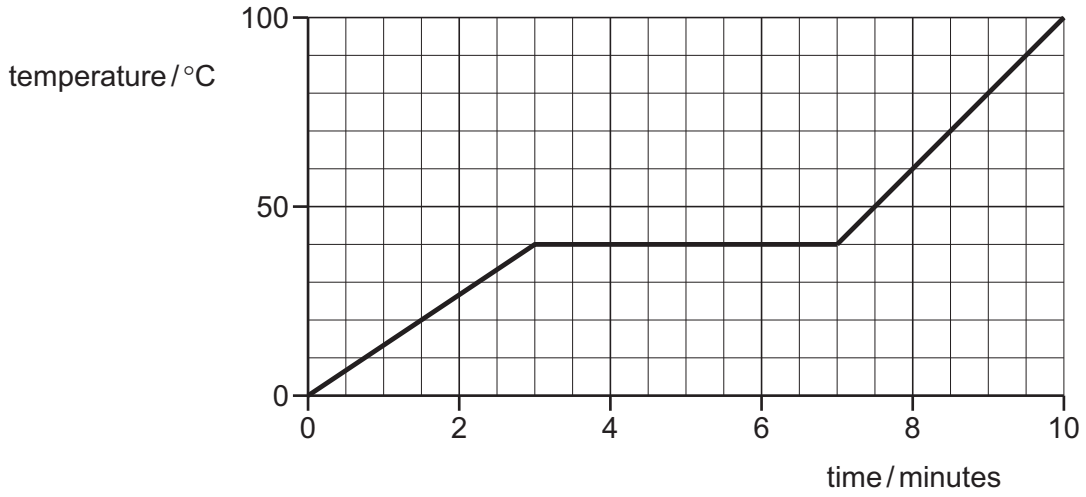
18 Solar panels are used to heat water with a mass of 500 kg.

The total area of the solar panels is 10 m^2 and the average power output from each square metre of the panels is 300 W. The specific heat capacity of water is 4200 J / (kg °C).

What is the increase in the water temperature after 8.0 hours? (Assume there is no heat loss.)

A 0.69 °C **B** 4.1 °C **C** 5.1 °C **D** 41 °C

19 The graph is the temperature–time graph for a sample of wax that is heated so that it melts.



The mass of the wax is 200 g.

Thermal energy is supplied to the wax at a constant rate of 12 000 J / minute.

What is the specific latent heat of fusion of the wax?

A 180 J / g **B** 240 J / g **C** 480 J / g **D** 600 J / g

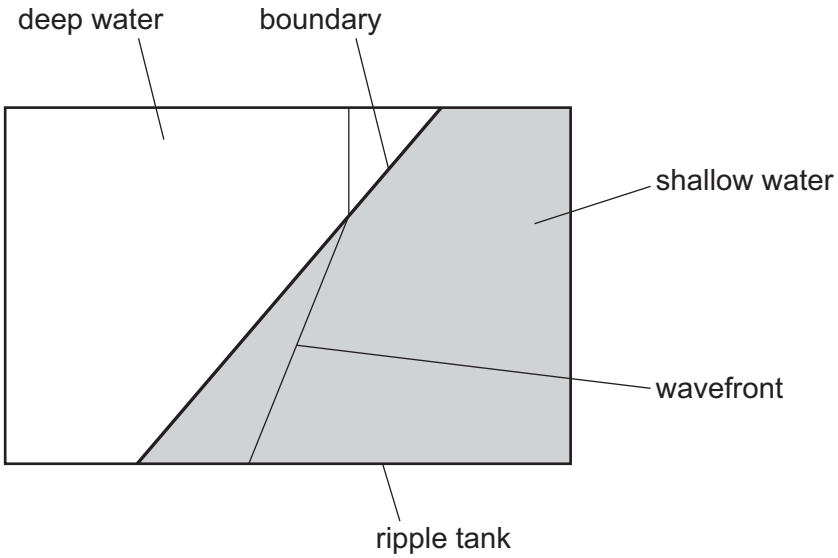
20 The temperatures of the water in four beakers are different and areas of the surfaces of the water are also different.

In which beaker is the rate of evaporation of the water greatest?

	temperature of water / °C	surface area of water / cm^2
A	20	50
B	20	100
C	25	50
D	25	100

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21 The diagram shows one wavefront of a wave as it travels from deep water to shallow water in a ripple tank.



What happens as the wavefront moves into the shallow water?

A The speed of the wavefront increases.

B The speed of the wavefront decreases.

C The wavelength of the wave remains constant.

D The wavelength of the wave increases.

22 Which example describes a transverse wave being refracted?

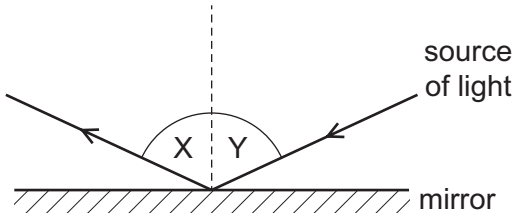
A infrared waves travelling in an optical fibre

B light waves from an object entering a magnifying glass

C ultrasound waves being used to clean jewellery

D water waves hitting a barrier

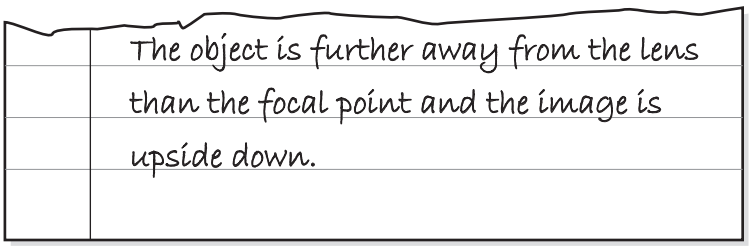
23 Light reflects from a plane mirror as shown.



Which row is always correct?

	symbol of angle X	relationship between X and Y
A	*i*	X = Y
B	*i*	X + Y = 90°
C	*r*	X = Y
D	*r*	X + Y = 90°

24 A piece of paper torn from an exercise book is shown.



Which process is being described?

A the formation of a virtual image by a diverging lens

B the formation of a virtual image by a converging lens

C the formation of a real image by a diverging lens

D the formation of a real image by a converging lens

25 A girl is long-sighted.

Which statement is correct?

A She sees close objects less clearly than a person with normal vision.

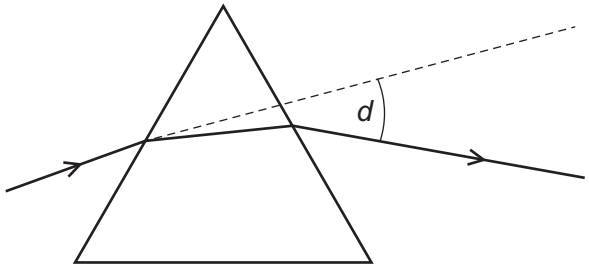
B She sees distant objects more clearly than a person with normal vision.

C The fault is corrected with a diverging lens.

D The image of a close object is formed in front of her retina.

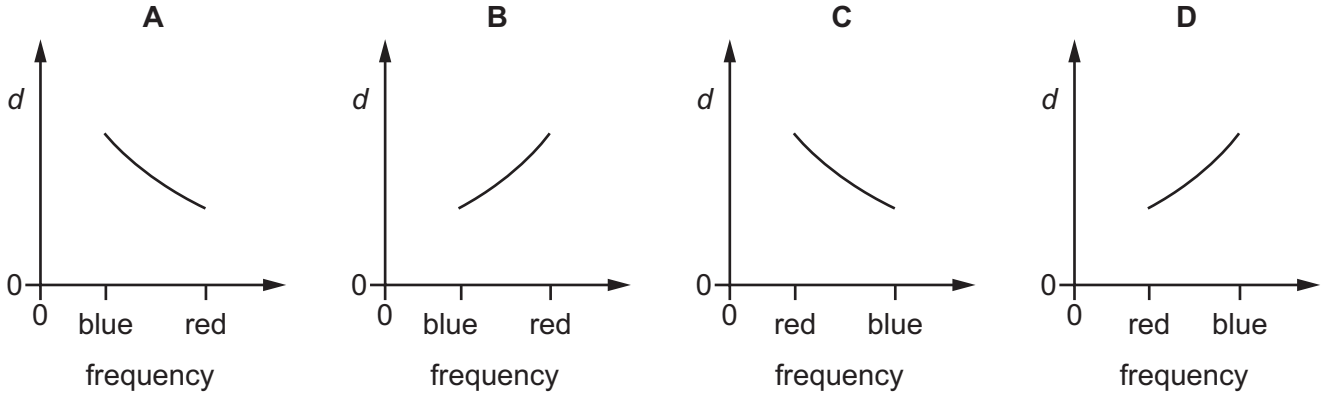
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26 Light rays are deviated by a prism.



The deviation angle *d* is measured for light rays of different frequency, including blue light and red light.

Which graph of *d* against frequency is correct?



27 A satellite orbits the Earth at a height of 300 km above the surface. The speed of electromagnetic waves is 3.0×10^8 m/s.

What is the minimum time taken for a radio signal transmitted from the Earth to reach the satellite?

A 1.0×10^{-6} s **B** 2.0×10^{-6} s **C** 1.0×10^{-3} s **D** 2.0×10^{-3} s

28 Which of the following is most closely associated with echoes?

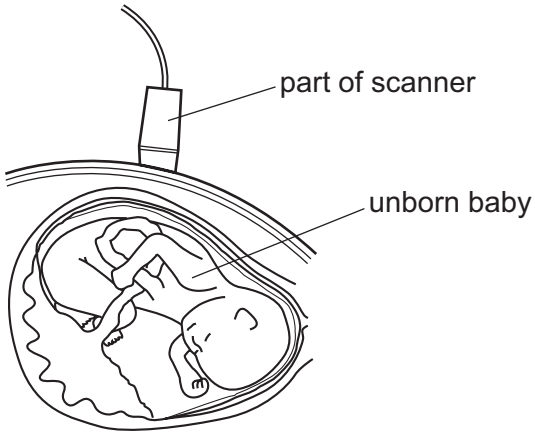
A focussing

B reflection

C refraction

D total internal reflection

29 An ultrasound scanner produces an image of an unborn baby.



What does the scanner use to form an image of the baby?

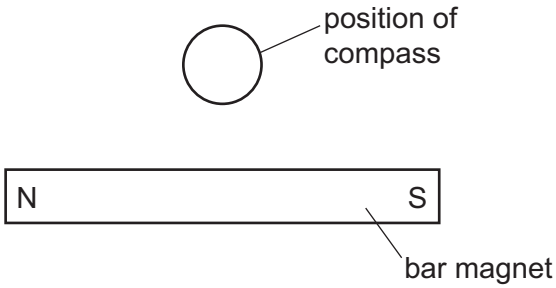
A ultrasound absorbed by the baby

B ultrasound emitted by the baby

C ultrasound reflected by the baby

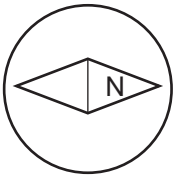
D ultrasound refracted by the baby

30 A small plotting compass is placed near to a bar magnet as shown.

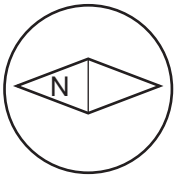


Which diagram shows the direction in which the compass needle points?

A



B



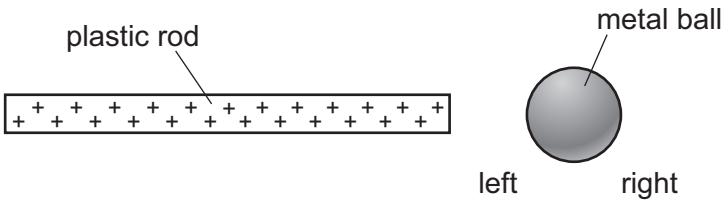
C



D



31 A positively charged plastic rod is held near but not touching an insulated and previously uncharged metal ball. No charge leaves the rod.

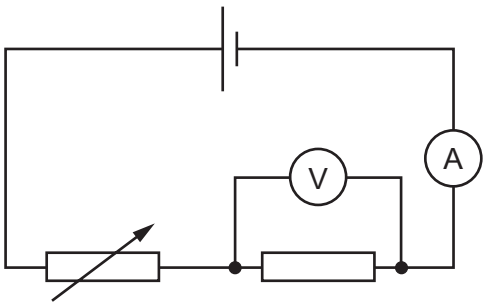


What are possible charges on the left-hand side and right-hand side of the ball?

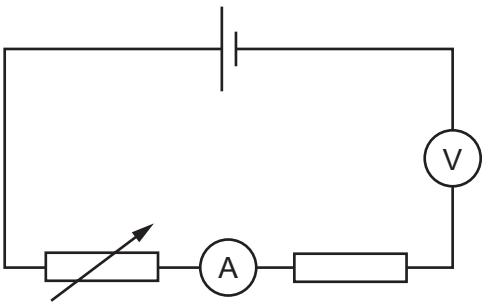
	charge on left-hand side of ball	charge on right-hand side of ball
A	-2.0×10^{-9} A	-1.0×10^{-9} A
B	-2.0×10^{-9} A	$+2.0 \times 10^{-9}$ A
C	-2.0×10^{-9} C	$+2.0 \times 10^{-9}$ C
D	$+2.0 \times 10^{-9}$ C	-2.0×10^{-9} C

32 Which circuit is connected to measure the current in the fixed resistor and the potential difference (p.d.) across the same resistor?

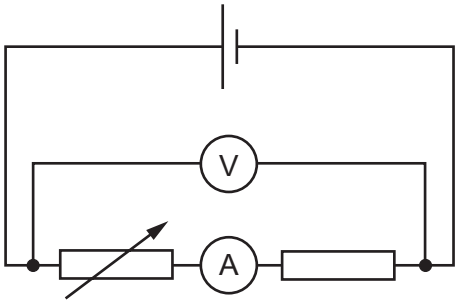
A



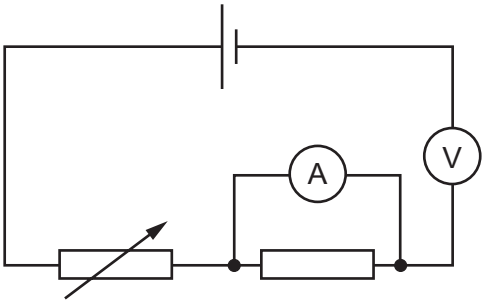
B



C



D



33 Quantity X and quantity Y have the same unit Z.

X is the energy dissipated by a battery in driving unit charge round the complete circuit.

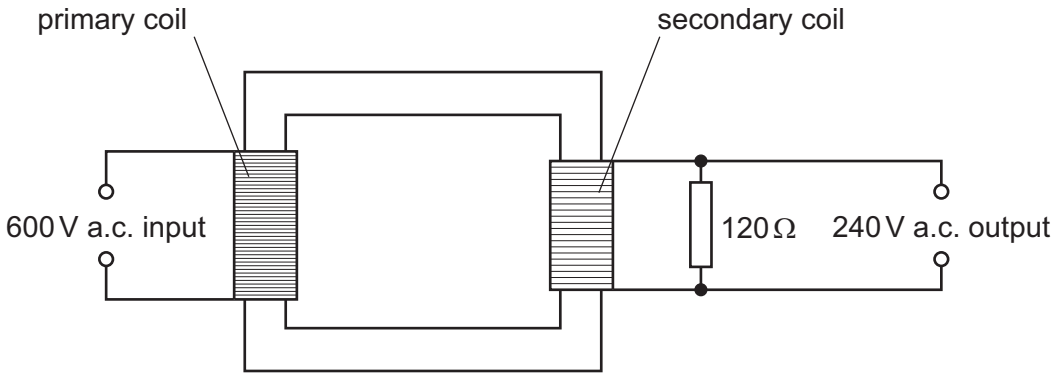
Y is the work done in a component in driving unit charge through the component.

What are X, Y and Z?

	X	Y	Z
A	electromotive force	potential difference	coulomb
B	electromotive force	potential difference	volt
C	potential difference	electromotive force	coulomb
D	potential difference	electromotive force	volt

34 A transformer with an efficiency of 100% has a primary voltage input of 600 V and a secondary voltage output of 240 V.

The secondary coil is attached to a resistor of resistance 120 Ω.



What is the power dissipated in the resistor and what is the current in the primary coil?

	power / W	current / A
A	120	0.20
B	120	5.0
C	480	0.80
D	480	1.3

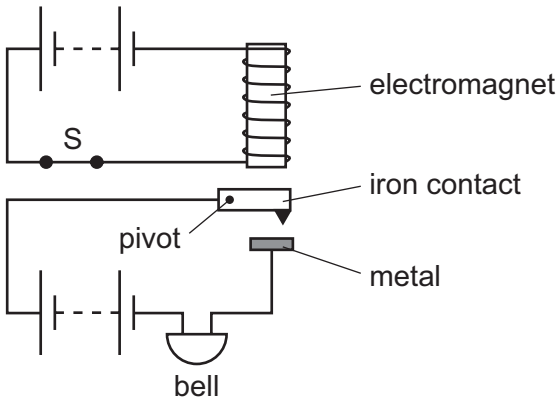
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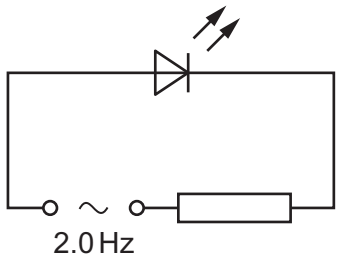
35 The diagram shows an alarm system in which the switch S is shown closed. The top circuit is arranged so that the electromagnet is positioned over the soft iron contact.



What happens when the switch S is opened?

	iron contact	bell
A	drops	rings
B	drops	stops ringing
C	moves up	rings
D	moves up	stops ringing

36 The diagram shows an LED connected in a circuit with a resistor and an a.c. power supply of frequency 2.0 Hz.



Which statement is correct?

A The LED does not light.

B The LED flashes on twice each second and off twice each second.

C The LED flashes on four times each second and off four times each second.

D The LED stays on all the time.

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37 Which statement about the production of electricity in a nuclear power station is correct?

A In the reactor, the main reaction occurs when protons hit uranium nuclei.

B The process taking place in the reactor is called nuclear fusion.

C The reactor produces energy to boil water and to produce steam.

D Carbon dioxide is the major waste product from the reactor.

38 A radioactive sample contains an isotope that emits alpha particles.

Which quantity stays constant?

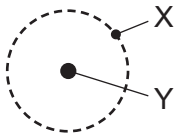
A the half-life of the isotope

B the mass of the sample

C the number of neutrons in the sample

D the rate of decay of the isotope

39 In the simple model of an atom, X orbits around Y.



What are X and Y?

	X	Y
A	electron	nucleus
B	neutron	electron
C	nucleus	proton
D	proton	neutron

40 How do the proton numbers (atomic numbers) and the nucleon numbers (mass numbers) of two different isotopes of the same element compare with each other?

	proton number	nucleon number
A	different	different
B	different	same
C	same	different
D	same	same

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