CEDAR GIRLS' SECONDARY SCHOOL
Preliminary Examination 2024
Secondary Four

PHYSICS **6091/01**

Paper 1 **27 August 2024**

1 hour

Additional Materials: OMR Form

Candidates are to answer on the OMR Form.

READ THESE INSTRUCTIONS FIRST

Write your name, class, and index number in the spaces at the top of this page.
Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.

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 separate OMR form.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this paper.
The use of an approved scientific calculator is expected, where appropriate.

At the end of the examination, hand in OMR form separately.

The total number of marks for this paper is **40**.

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1 What is the order of magnitude of the diameter of the Earth?

A 1×10^3 m **B** 1×10^7 m **C** 1×10^9 m **D** 1×10^{12} m

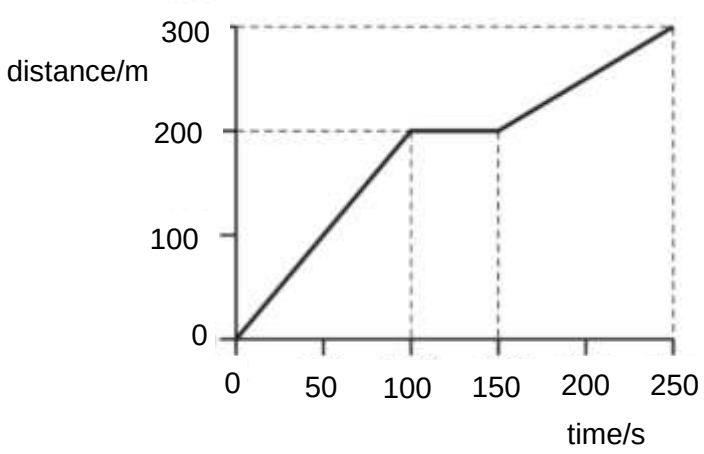
2 What is the unit of force expressed in SI base units?

A (kg m) / s^2 **B** kg / (m s) **C** kg / (m s^2) **D** (kg m) / s^{-2}

3 Which list contains only scalar quantities?

A acceleration, displacement, velocity
B distance, force, speed
C moment of force, length, time
D work done, mass, speed

4 A cyclist takes a ride lasting 250 s.
The distance-time graph shows the distance travelled by the cyclist



What is his average speed for the whole journey?

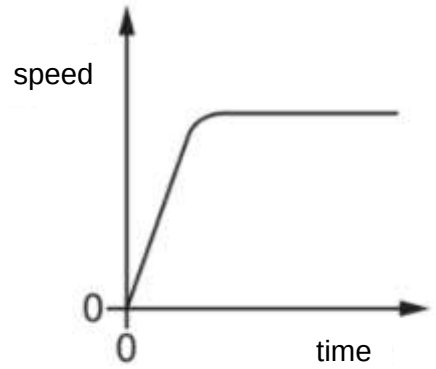
A 1.0 m/s **B** 1.2 m/s **C** 180 m/s **D** 200 m/s

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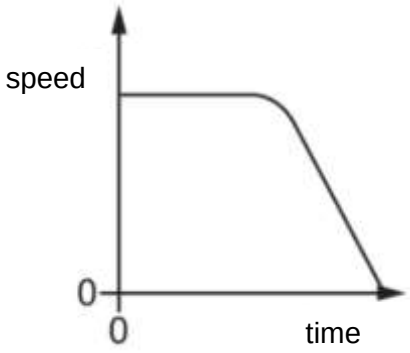
5 A ball starts from rest and rolls down a steep slope. The ball then rolls along rough horizontal ground.

Which graph describe the motion of the ball?

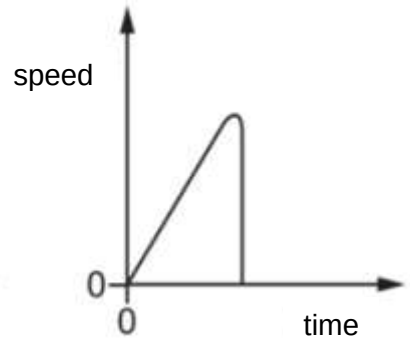
A



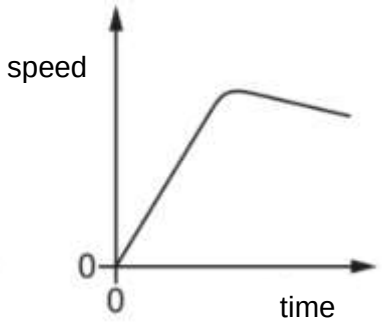
B



C

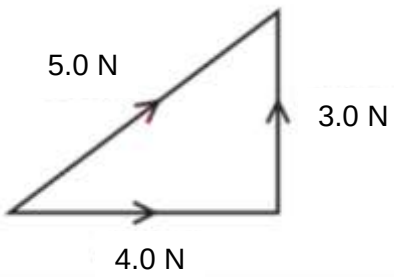


D

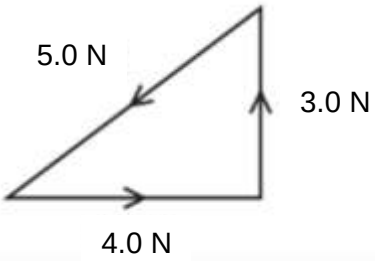


6 Which diagram shows the addition of the 4.0 N and the 3.0 N forces?

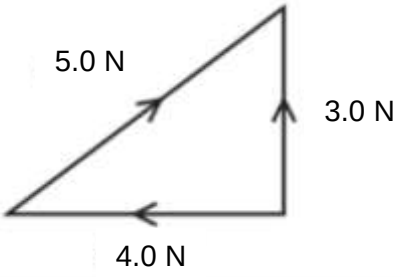
A



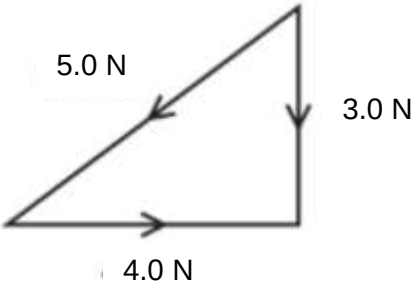
B



C



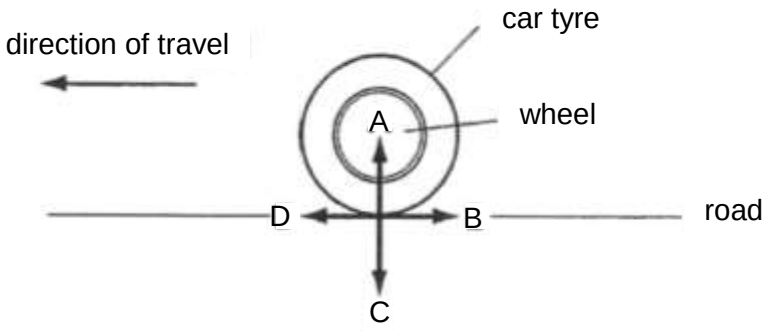
D



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7 A car is accelerating along a road in the direction shown. The wheel shown is connected to the engine.

In which direction is the force of friction exerted by the road on the car tyre?



8 The diagram shows a parachutist falling towards Earth.



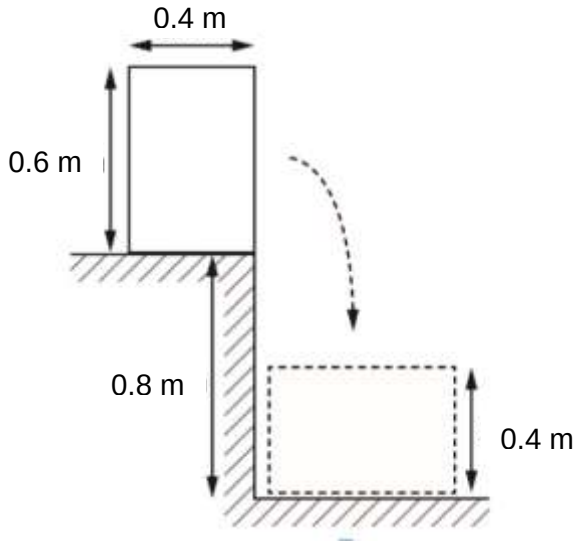
The lengths of the arrows represent the sizes of the forces on the parachutist and the parachute.

How is the parachutist moving at the instant shown?

A accelerating downwards
B constant speed
C decelerating downwards
D decelerating upwards

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9 A uniform solid block has weight 500 N, width 0.40 m and height 0.60 m. The block rests on the edge of a step of depth 0.80 m, as shown.



The block is knocked over the edge of the step and rotates through 90° before coming to rest with the 0.60 m edge horizontal.

What is the change in gravitational potential store of the block?

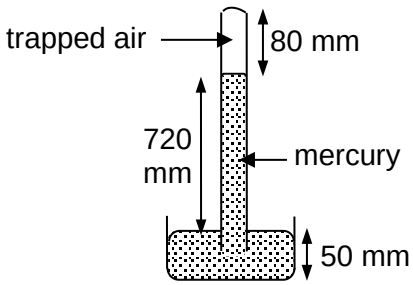
A 300 J **B** 400 J **C** 450 J **D** 550 J

10 A train of mass 40 000 kg is moving along a straight track. The velocity of the train decrease from 30 m/s to 25 m/s.

How much work done to slow the train down?

A 1.0×10^5 J **B** 5.0×10^5 J **C** 5.5×10^6 J **D** 1.1×10^6 J

11 The figure shows some air trapped above the mercury in an inverted glass tube.



If the atmospheric pressure is 750 mm Hg, the pressure exerted by the trapped air is

A 30 mm Hg.

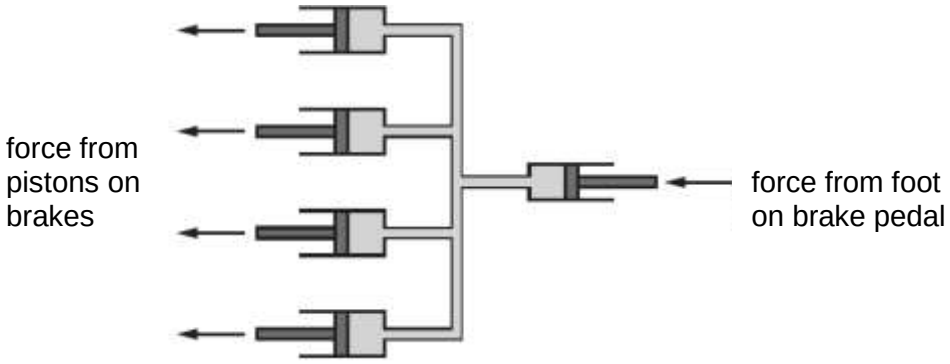
B 80 mm Hg.

C 720 mm Hg.

D 800 mm Hg.

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12 The pipes are filled with an incompressible liquid. When a force is applied to the brake pedal, the pressure in the liquid increases and applies a force to each of the four wheels.



The area of the piston connected to the brake pedal is 8 cm^2. The area of each piston connected to the brakes is 12 cm^2. A force of 800 N is applied by the foot to the brake pedal.

What is the force applied to each brake?

A 300 N **B** 530 N **C** 1200 N **D** 4800 N

13 Illuminated smoke particles, suspended in air, are viewed with a microscope. They are seen to move randomly.

This is because the smoke particles are

A bombarded continually by air molecules.

B moved about by convection currents.

C shaken by the vibration of the molecules within them.

D supplied with energy by the light illuminating them.

14 The pressure of a gas in a cylinder is the same at all points in the cylinder.
Which statement explains this?

A The molecules of the gas are all the same size.

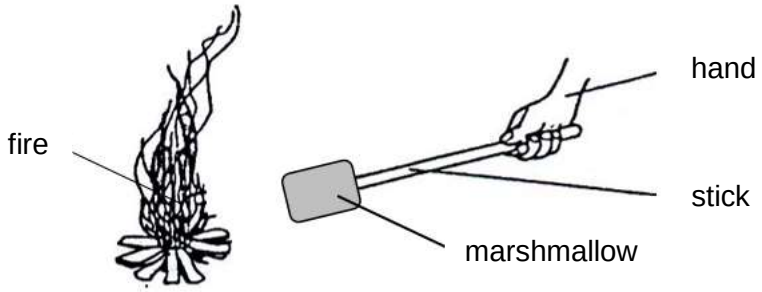
B The molecules of the gas attract one another.

C The molecules of the gas move at different speeds.

D There are many molecules, all moving at random.

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15 A boy places a marshmallow near the fire.



How is energy transferred from the fire to the marshmallow?

A By radiation only

B By convection only

C By conduction and convection

D By convection and radiation

16 When a person holds the door knob made of metal, the knob feels cold. This is because the knob

A has a high heat capacity

B has a high specific heat capacity

C is at a lower temperature than its surroundings

D conduct heat away from her hands faster

17 In car engines, a coolant is used to transport heat away from the engine to be dissipated to other parts of the car.

The liquid that is used as a coolant in motor car engines should have a

A low specific heat capacity.

B high specific heat capacity.

C constant heat capacity.

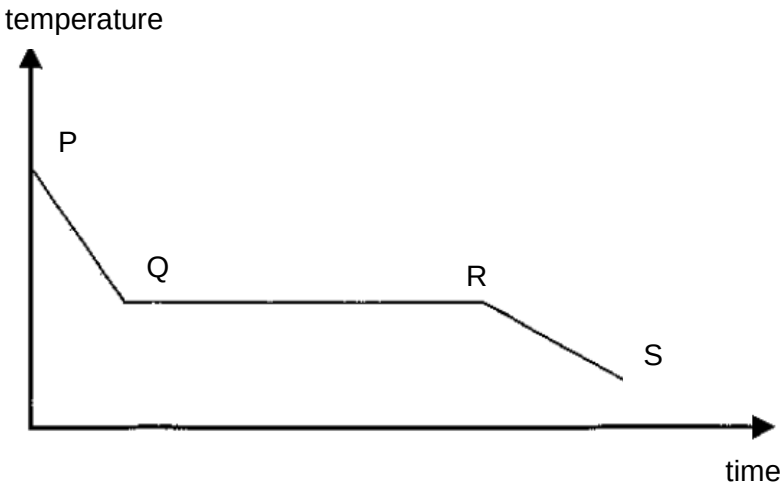
D low specific latent heat of vaporization.

18 A 500 g mass of copper is heated for 0.75 minutes by a heater which produces thermal energy at a constant rate of 80 J/s. The specific heat capacity of copper is 360 J / (kg ℃). What is the rise in temperature?

A 0.20 ℃ **B** 0.30 ℃ **C** 3.0 ℃ **D** 20.0 ℃

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19 Some wax in a test tube was heated and then allowed to cool. The temperature-time graph is shown below.



Which of the following statement is correct?

A Along PQ, molecules are losing internal energy.

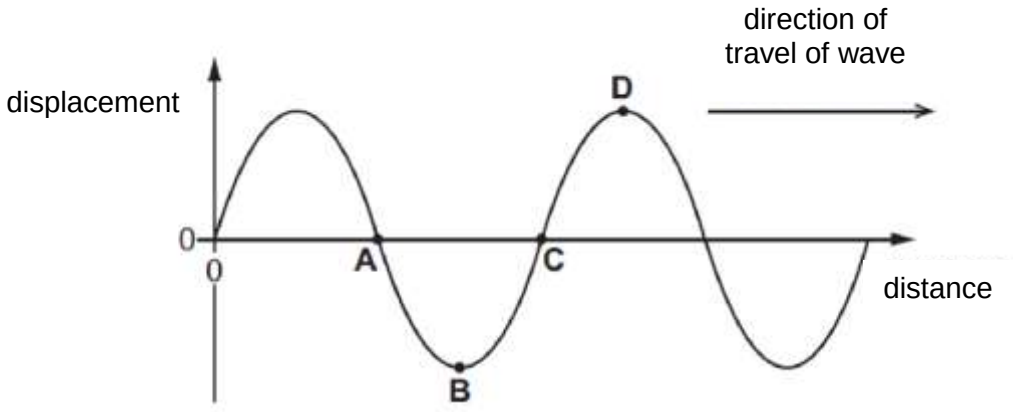
B Along QR, latent heat is given out and molecules are gaining potential energy.

C Along QR, molecules are losing kinetic energy.

D Along RS, latent heat is further lost

20 The graph shows the variation of the displacement of particles with distance along a transverse wave at an instant in time. The wave is moving to the right.

Which position along the wave corresponds to a point where particles in the wave are travelling the fastest upwards?



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21 Ultrasound has a number of uses in engineering and medicine.

What is ultrasound not used for?

A sonar
B medical scanning of soft tissue
C quality control
D sterilising medical equipment

22 The echo sounder of a ship transmits a pulse of sound which is reflected back to the ship by a shoal of fish directly below the transmitter. The time between the transmission and the reception of the pulse by the ship is 0.10 s. The speed of sound in sea water is 1200 m/s.

At what depth is the shoal of fish found?

A 60 m
B 120 m
C 600 m
D 1200 m

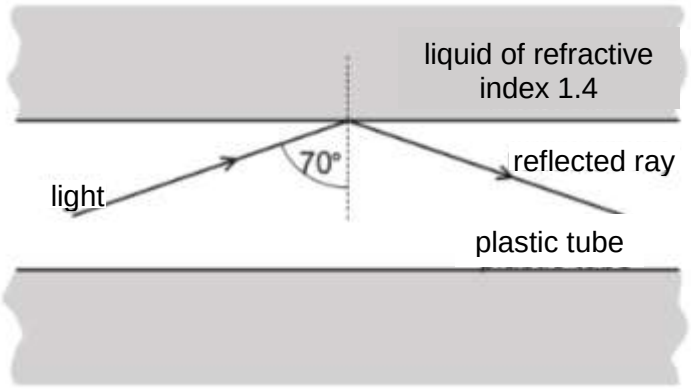
23 Ultraviolet radiation, radio waves and X-rays are part of the components of the electromagnetic spectrum.

Which of the following shows these components arranged in order of increasing frequency?

A radio waves, ultraviolet, X-rays
B radio waves, X-rays, ultraviolet
C X-rays, radio waves, ultraviolet
D X-rays, ultraviolet, radio waves

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24 A plastic tube is immersed in a liquid of refractive index 1.4. Light travelling in the plastic tube strikes the inside surface at an angle of incidence of 70°. The light undergoes total internal reflection.



What describes the values of the critical angle in the plastic and the refractive index of the plastic?

	critical angle in plastic	**refractive index of plastic**
A	greater than 70°	greater than 1.4
B	greater than 70°	less than 1.4
C	less than 70°	greater than 1.4
D	less than 70°	less than 1.4

25 Four processes are used to charge an isolated metal sphere.

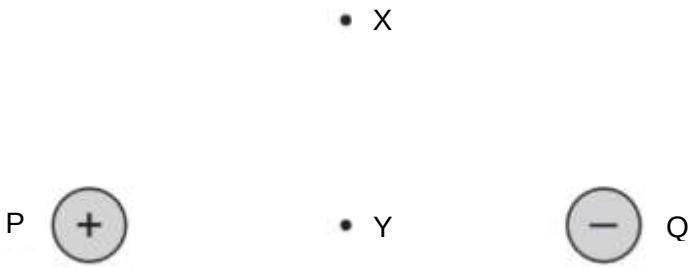
P The sphere is earthed by touching it.
Q The earth connection is removed from the sphere.
R A charged rod is brought close to the sphere.
S The charged rod is removed.

In which order should these processes be carried out to charge the sphere?

	First ----------> Last			
A	P	Q	R	S
B	P	R	S	Q
C	R	P	Q	S
D	R	S	P	Q

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26 An electric field is formed by two isolated, equal and opposite charges P and Q.



How does the field at X compare with the field at Y?

A It is stronger at X than at Y and is in the opposite direction.
B It is stronger at X than at Y and is in the same direction.
C It is weaker at X than at Y and is in the opposite direction.
D It is weaker at X than at Y and is in the same direction.

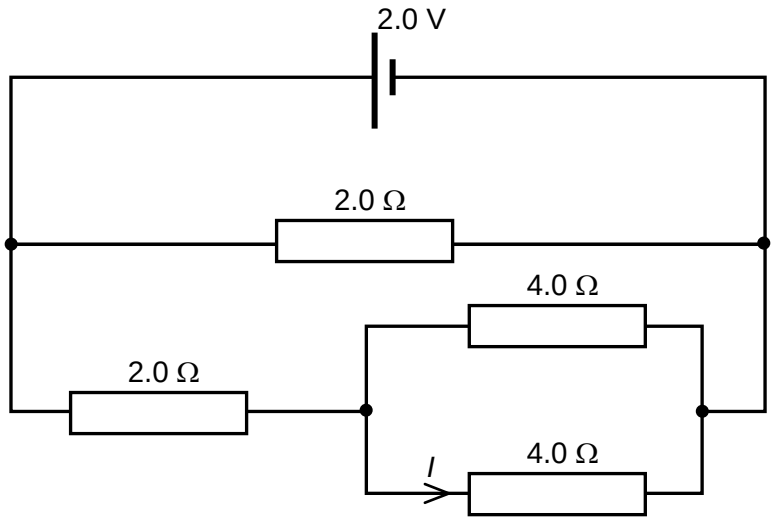
27 A student plots a graph of current, *I* against potential difference, V of a filament bulb. He obtains a curve passing through the origin.

What should the student observe to find out the change in the resistance of the filament?

A How the gradient of the tangent to the curve changes along the curve.
B How the inverse of the gradient of the tangent to the curve changes along the curve.
C How the ratio of V/*I* changes along the curve.
D How the ratio of *I*/V changes along the curve.

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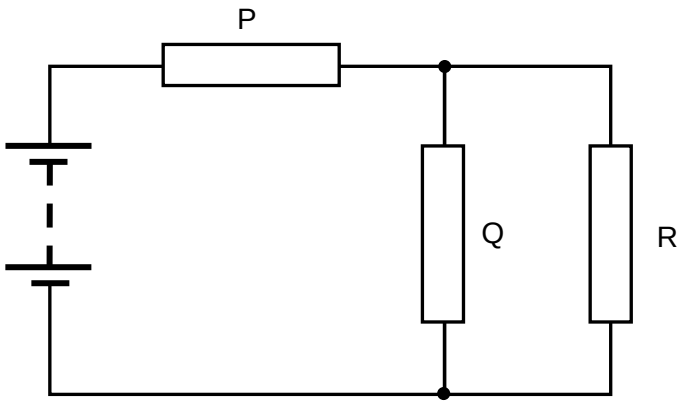
28 A cell of e.m.f. 2.0 V is connected to a network of resistors as shown.



What is the current *I* ?

A 0.25 A **B** 0.33 A **C** 0.50 A **D** 1.5 A

29 The resistors P, Q, and R in the circuit have equal resistance. The battery supplies a total power of 12 W.



What is the power dissipated in resistor R?

A 2.0 W **B** 3.0 W **C** 4.0 W **D** 6.0 W

30 A wire of length 0.50 m and cross-sectional area $1.0 \times 10^{-6}\ m^2$ has a resistance of 0.75 Ω.
Another wire of the same material has a length of 2.0 m and a cross-sectional area of $0.50 \times 10^{-6}\ m^2$.

What is the resistance of the longer wire?

A 0.094 Ω **B** 0.38 Ω **C** 1.5 Ω **D** 6.0 Ω

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31 The cost of 1.0 kWh of electricity is 80 cents. The table shows the power ratings of the electrical appliances.

electrical appliance	rating
television	135 W
air-conditioner	2.75 kW
lamp	100 W

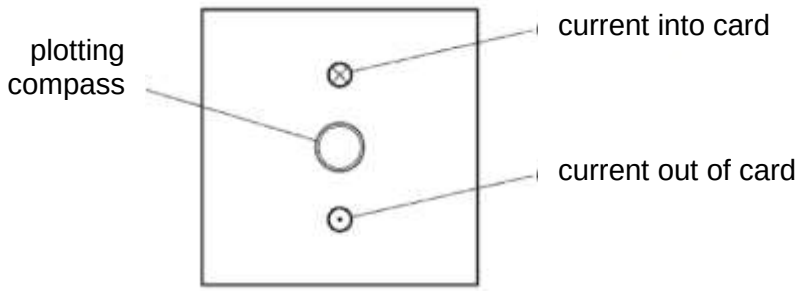
What is the total cost of operating the above electrical appliances for three hours?

A $7.16 **B** $12.24 **C** $73.40 **D** $429.80

32 It can be deduced that a piece of metal is already a magnet if

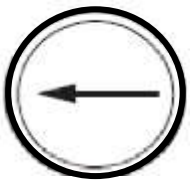
A both ends of a compass needle are attracted to it.
B a copper wire is attracted to it.
C one end of a compass needle is repelled by it
D a copper wire is repelled by it.

33 Two vertical wires pass at right-angles through a piece of card. There is a large current in each wire in the direction shown



A plotting compass is placed on the card.

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

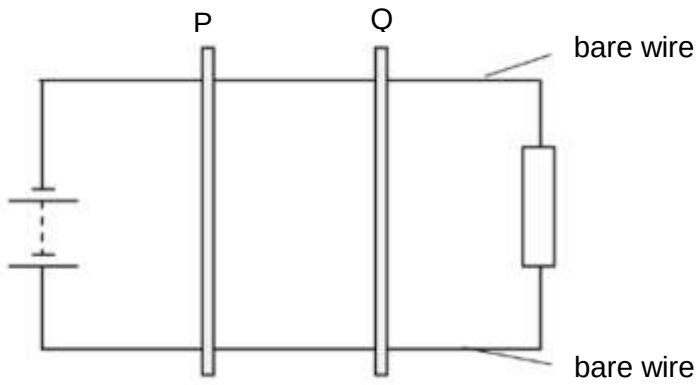
A 
B 
C 
D 

34 What is the main purpose of the split ring commutator in the direct current motor?

A to create a change in magnetic flux linkage in the coil
B to prevent the wires from entangling
C to reverse the direction of the current in the coil every 180°
D to reverse the magnetic field in the coil

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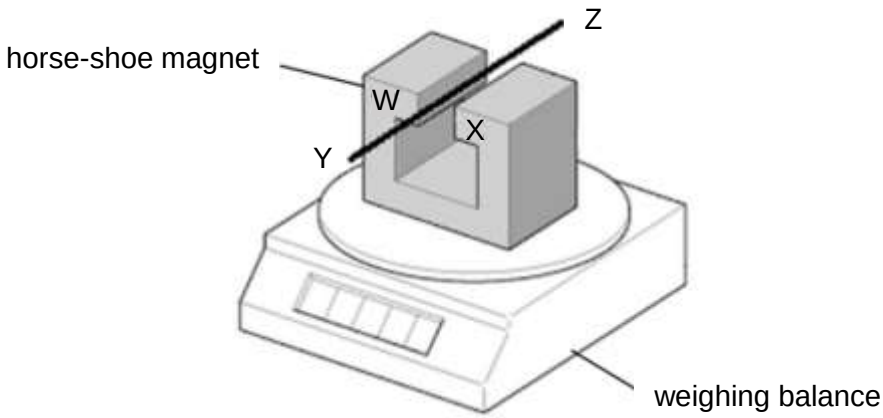
35 Copper rods P and Q are placed on top of the bare wires as shown.



What happens to both rods?

A Both rods attract each other.
B Both rods rotate anti-clockwise.
C Both rods rotate clockwise.
D Both rods repel each other.

36 The diagram shows a current-carrying conductor YZ between the poles W and X of a magnet. The weighing balance shows the mass of the horse-shoe magnet before a current starts to flow in the conductor YZ.

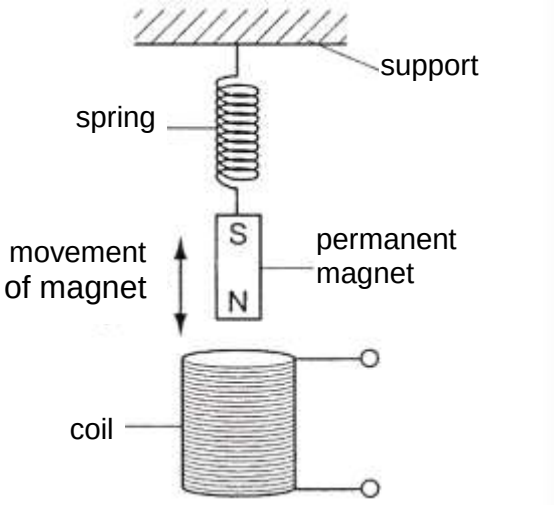


When a current flows in the conductor YZ, the weighing balance reads a mass that is greater than the mass of the horse-shoe magnet.
What should be the magnetic poles of W and X of the horse-shoe magnet and the potential of the terminals of conductor Y and Z?

	Pole W	**Pole X**	**Terminal Y**	**Terminal Z**
A	north	south	negative	positive
B	north	south	no current	no current
C	south	north	negative	positive
D	south	north	no current	no current

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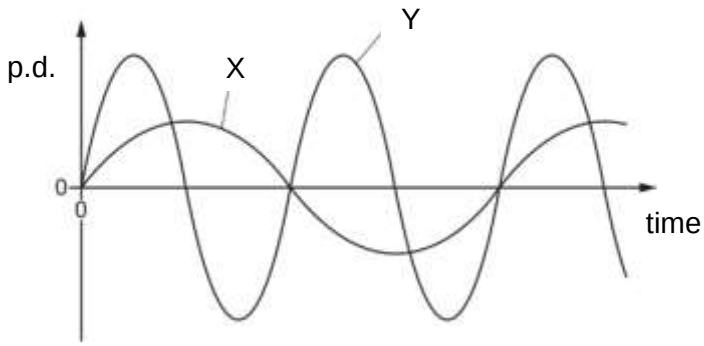
37 A permanent magnet moving up and down on the end of a spring induces e.m.f. in a coil.



Which factor, on its own, would decrease the maximum value of the induced e.m.f.?

A increasing the number of turns in the coil
B increase the strength of the magnet
C raising the coil
D raising the support of the spring

38 Graph X shows the output from an alternating current generator.



Which change can be made so that the generator produces graph Y?

A Decrease the magnetic field strength and decrease the speed of rotation only.
B Increase the magnetic field strength and decrease the number of turns of the coils only.
C Increase the number of turns of coils only.
D Increase the speed of rotation only.

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39 Which statement about gamma rays is correct?

A They are deflected by both electric and magnetic fields.
B They are deflected by magnetic fields but not by electric fields.
C They are deflected by electric fields but not by magnetic fields.
D They are not deflected either by electric fields or by magnetic fields.

40 Which equation represents the **β**-decay of lead-209?

A $^{209}_{82}\mathrm{Pb} + {}^{0}_{-1}\mathrm{e} \longrightarrow {}^{209}_{83}\mathrm{Bi}$

B $^{209}_{82}\mathrm{Pb} + {}^{0}_{-1}\mathrm{e} \longrightarrow {}^{209}_{81}\mathrm{Tl}$

C $^{209}_{82}\mathrm{Pb} \longrightarrow {}^{209}_{83}\mathrm{Bi} + {}^{0}_{-1}\mathrm{e}$

D $^{209}_{82}\mathrm{Pb} \longrightarrow {}^{209}_{81}\mathrm{Tl} + {}^{0}_{-1}\mathrm{e}$

End of Paper 1

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