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| NAME: | CLASS: | INDEX NO: |
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QUEENSWAY SECONDARY SCHOOL  
PRELIMINARY EXAMINATION 2024  
SECONDARY 4 EXPRESS

Parent's Signature:

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**PHYSICS**

Paper 1 Multiple Choice

**6091/01**

**28 August 2024**

**1 hour**

Additional Materials: Multiple Choice Answer Sheet

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**READ THESE INSTRUCTIONS FIRST**

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, class and index number on the Answer Sheet in the spaces provided.

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 Answer Sheet.

**Read the instructions on the Answer Sheet very carefully.**

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 booklet.

The use of an approved scientific calculator is expected, where appropriate.

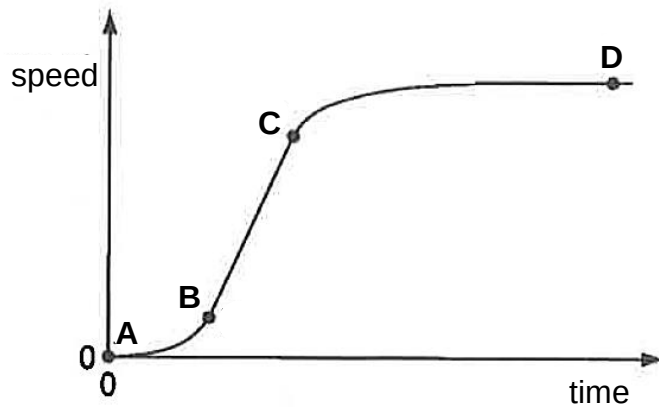
- 1 A voltage of 0.4 decivolt is applied across a resistor, resulting in a current of 20 nanoamperes.

Which of the following gives the voltage in volt and the current in ampere?

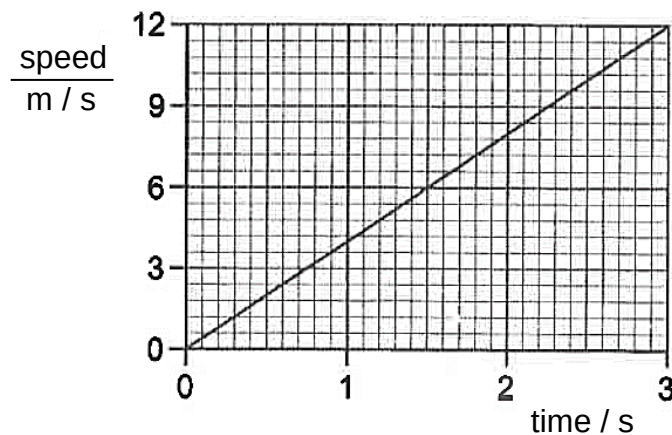
|          | voltage / V | current / A |
|----------|-------------|-------------|
| <b>A</b> | 0.004       | 0.00002     |
| <b>B</b> | 0.004       | 0.00000002  |
| <b>C</b> | 0.04        | 0.00002     |
| <b>D</b> | 0.04        | 0.00000002  |

- 2 The graph shows the speed of a weather balloon as it rises through the atmosphere.

At which point in the balloon's rise does the acceleration start to decrease?



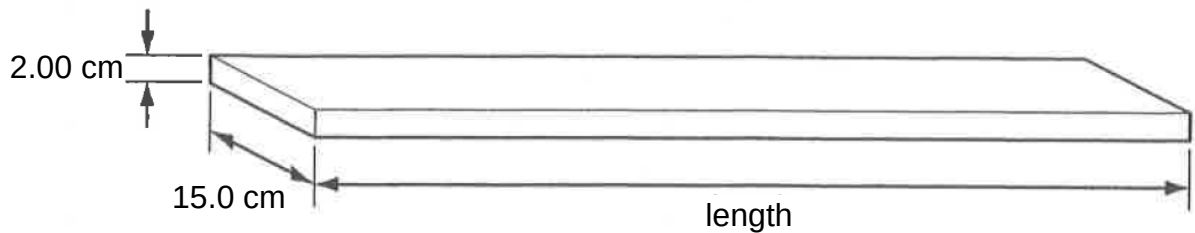
- 3 The graph shows the speed of a car as it moves from rest.



What is the average speed of the car during the first 3 s?

- A** 4 m/s                      **B** 6 m/s                      **C** 18 m/s                      **D** 36 m/s

- 4 Planks of wood delivered to a building site are all 15.0 cm wide and 2.00 cm thick but they have different lengths. They are made of wood with a density of  $1600 \text{ kg/m}^3$ .



The planks are lifted by a pulley system that cannot lift masses greater than 6.0 kg.

What is the length of the longest plank that can be lifted by this pulley system?

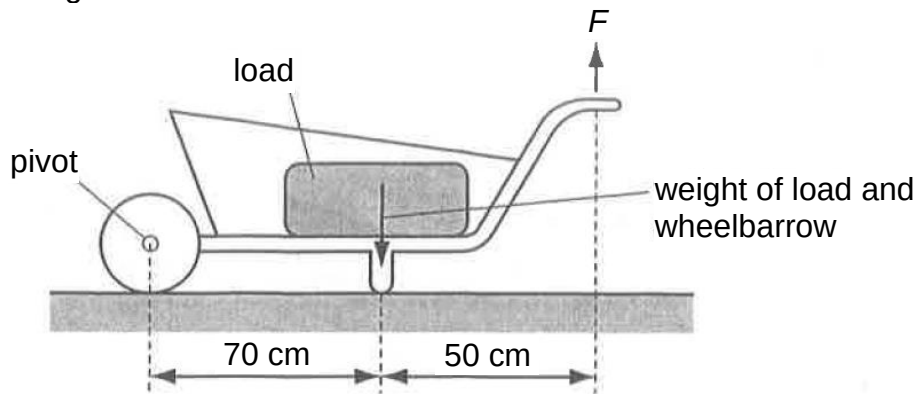
- A 125 cm                      B 320 cm                      C 500 cm                      D 1280 cm
- 5 The weight of a spacecraft is 2500 N on Earth and 950 N on Mercury. The gravitational field strength on Earth is  $10 \text{ N/kg}$ .
- What is the gravitational field strength on Mercury?
- A 3.80 N/kg                      B 2.63 N/kg                      C 0.38 N/kg                      D 0.26 N/kg
- 6 Two forces act on a car as shown.



If force  $F$  is equal to force  $R$ , which of the following is correct?

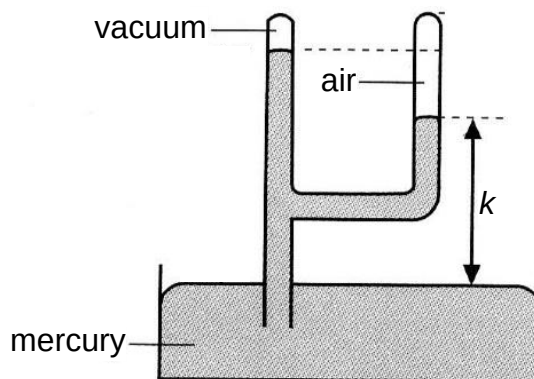
- A The car is moving with non-uniform acceleration.  
B The car is moving with uniform acceleration.  
C The car is moving with uniform velocity.  
D The car is not moving.

- 7 The total mass of the load and the wheelbarrow shown is 75 kg. The gravitational field strength is 10 N/kg.



What is the value of force  $F$  needed to just lift the loaded wheelbarrow?

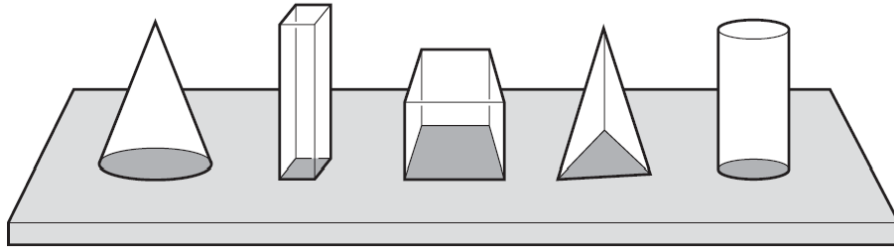
- A 440 N                      B 540 N                      C 750 N                      D 1050 N
- 8 The diagram shows a tube filled with mercury. The length of  $k$  is 320 mm. Atmospheric pressure is 760 mm Hg. The gravitational field strength is 10 N/kg and the density of mercury is  $13600 \text{ kg/m}^3$ .



What is the pressure in the air column on the right-hand side of the tube?

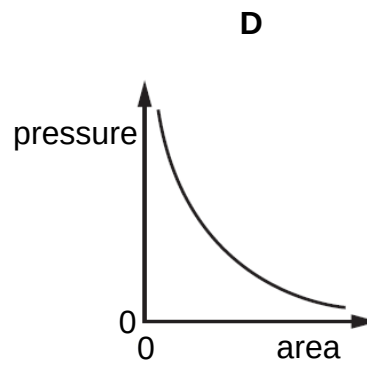
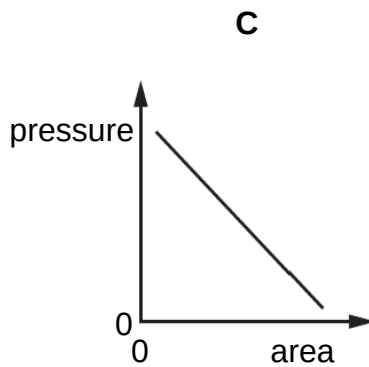
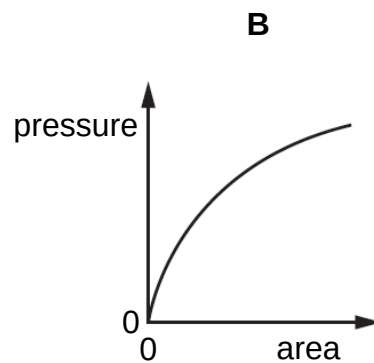
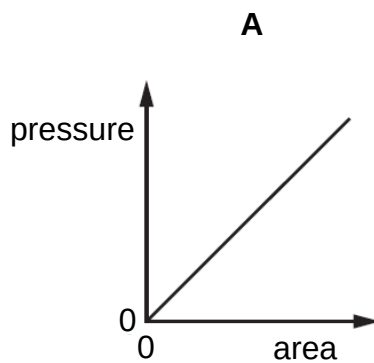
- A 10 300 Pa                      B 43 500 Pa                      C 59 800 Pa                      D 103 000 Pa

- 9 Five blocks have the same mass but different base areas. They all rest on a horizontal table.



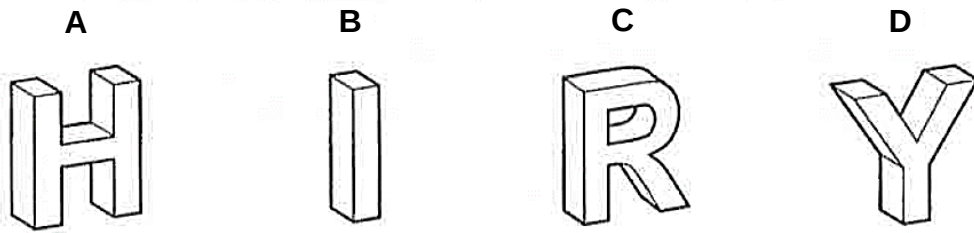
A graph is plotted to show the relationship between the pressure exerted on the table by the block and the base area of the block.

Which graph shows this relationship?

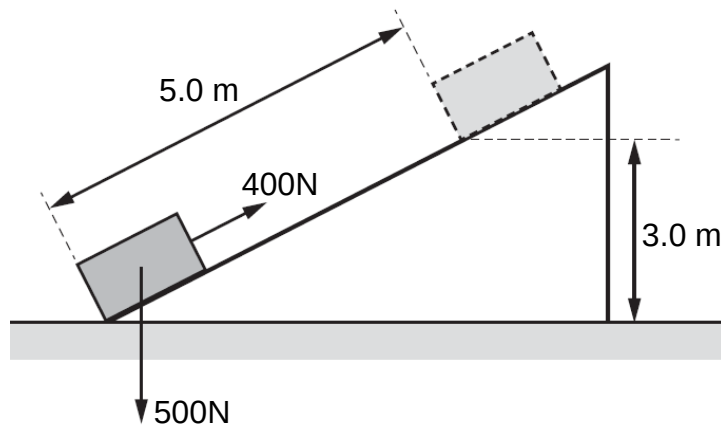


- 10** A child has a set of wooden 3-dimensional capital letters.

Which letter, H, I, R or Y, is the most stable when standing upright on a table?



- 11** Work is done when a force of 400 N pulls a crate of weight 500 N at a constant speed along a ramp, as shown.

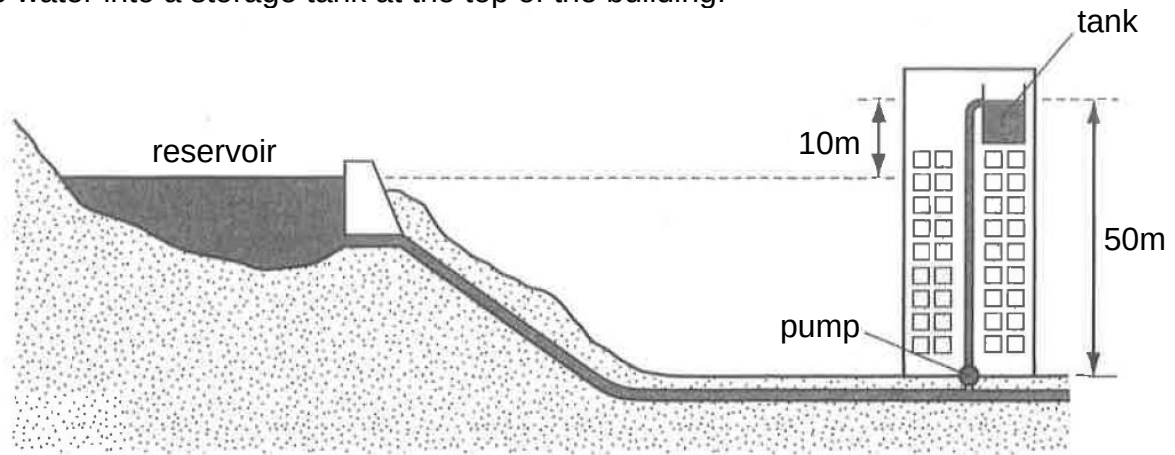


Part of the work done increases the gravitational potential energy  $E$  of the crate and the rest is work done  $W$  against friction.

What are the values of  $E$  and  $W$ ?

|          | $E / \text{J}$ | $W / \text{J}$ |
|----------|----------------|----------------|
| <b>A</b> | 1500           | 500            |
| <b>B</b> | 1500           | 2000           |
| <b>C</b> | 2000           | 2500           |
| <b>D</b> | 3500           | 500            |

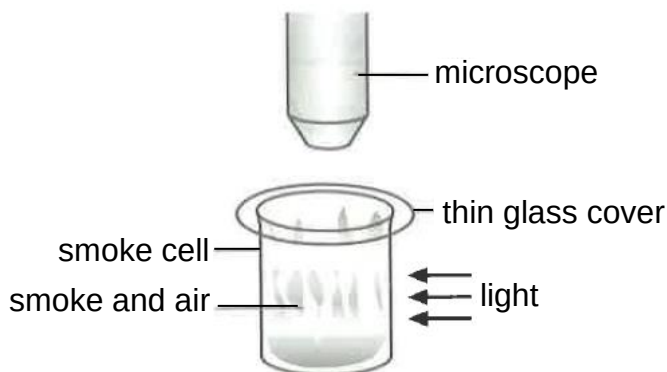
- 12** An apartment block receives water from a nearby reservoir. A pump is necessary to lift the water into a storage tank at the top of the building.



The gravitational field strength is  $10 \text{ N/kg}$ .

Given that the pump has an efficiency of 70%, how much input power does the pump require to lift each kilogram of water into the tank in  $0.6 \text{ s}$ ?

- A** 170 W                      **B** 240 W                      **C** 830 W                      **D** 1200 W
- 13** The diagram shows a setup used to observe the behaviour of smoke in air. When viewed through the microscope, bright specks of light are seen moving at random.



Which statement is correct?

- A** The random motion is due to collisions between the smoke molecules.  
**B** The specks move faster when the air is at a higher temperature.  
**C** The energy of the light causes the random motion.  
**D** The specks are the air molecules in random motion.

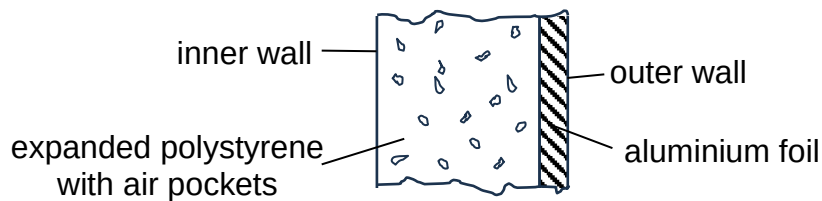
- 14** A sample of gas in a sealed container of fixed volume is heated.

Which of the following quantities will increase?

- 1 Average distance between the gas molecules.
- 2 Average kinetic energy of the gas molecules.
- 3 Average number of collisions per second made by the gas molecules with the container walls.

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

- 15** The walls of a refrigerator are insulated using both expanded polystyrene and aluminium foil.

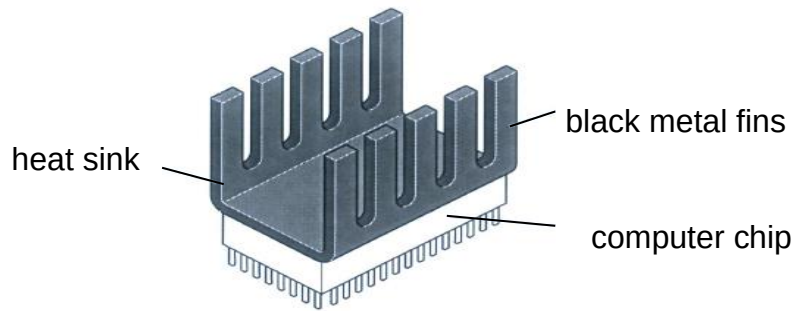


How is the transfer of thermal energy reduced?

- A** The aluminium foil is a good emitter of radiation.  
**B** The expanded polystyrene is a good emitter of radiation.  
**C** The expanded polystyrene and aluminium foil provide a bigger exposed surface area.  
**D** The air pockets in the expanded polystyrene are poor conductors of heat.



- 16 The diagram shows a computer chip fitted with a heat sink with black metal fins.

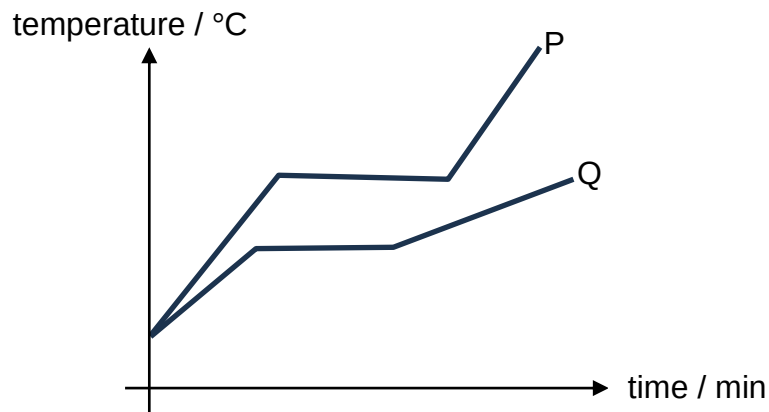


Which of the following explain how thermal energy is transferred easily from the computer chip to the surroundings?

- 1 The metal fins conduct heat from the computer chip to the surroundings.
- 2 The rate of heat transfer to the air by convection increases as a result of the metal fins.
- 3 The black metal fins are good reflectors of radiation.

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

- 17 Two solid substances, P and Q, are heated by identical heaters. The graphs below show how their temperatures vary with time.

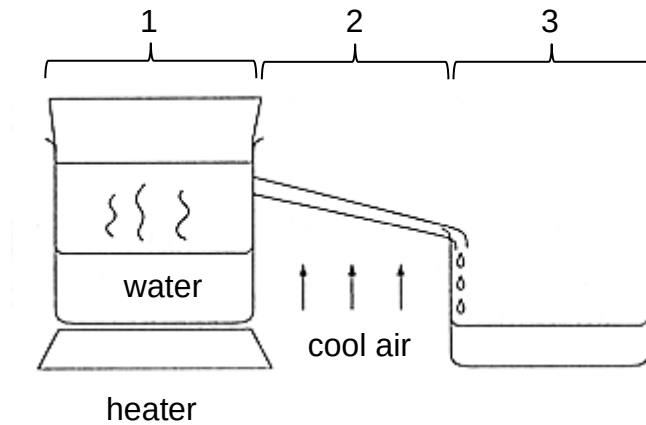


If P and Q have the same mass, which of the following statement(s) is/are correct?

- 1 Solid P has a higher specific heat capacity than solid Q.
- 2 The specific latent heat of fusion of P is lower than that of Q.
- 3 Liquid P has a lower specific heat capacity than liquid Q.

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

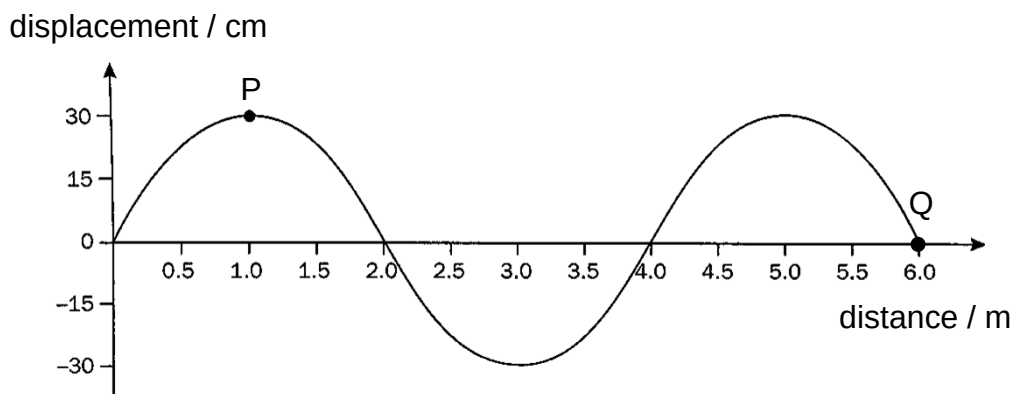
- 18** The diagram below shows a simple water distiller. Water is kept boiling in region 1, completely condensed in region 2 and collected in region 3.



In which region is latent heat of vaporisation absorbed or released by the water?

|          | absorbed | released |
|----------|----------|----------|
| <b>A</b> | 1        | 2        |
| <b>B</b> | 1        | 3        |
| <b>C</b> | 2        | 1        |
| <b>D</b> | 3        | 1        |

- 19** A transverse wave is represented by the graph below.



Given that the frequency of the wave is 5.0 Hz, how long does it take for the crest to travel from P to Q?

- A** 0.20 s                      **B** 0.25 s                      **C** 0.30 s                      **D** 0.50 s

**20** When the pitch of a musical note is increased, which of the following will decrease?

- A** loudness of the sound
- B** period of the sound wave
- C** frequency of the sound wave
- D** speed of the sound wave

**21** The diagram shows different regions of the electromagnetic spectrum.

|  |   |  |                  |  |            |  |
|--|---|--|------------------|--|------------|--|
|  | P |  | visible<br>light |  | microwaves |  |
|--|---|--|------------------|--|------------|--|

Which statement about P is correct?

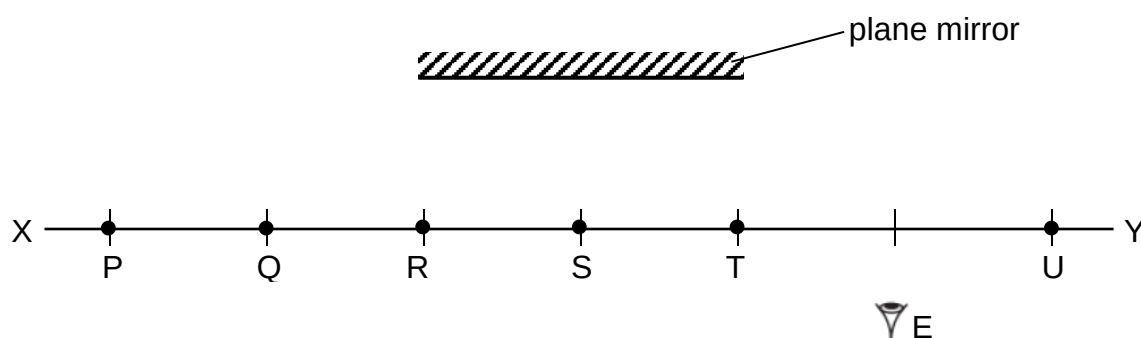
- A** P has a longer wavelength than microwaves.
- B** P has a higher speed in water than in air.
- C** P has a lower frequency than visible light.
- D** P is used to detect cracks in buildings.

**22** Which of the following statement(s) is/are true about all electromagnetic waves?

- 1 They always travel at the speed of light.
- 2 They can travel only through a vacuum.
- 3 Not all of them are transverse waves.

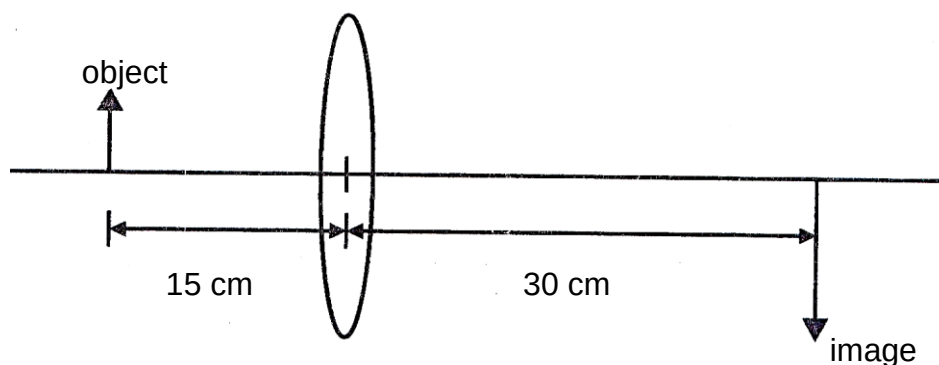
- A** Only 1 and 2
- B** Only 2 and 3
- C** All of the above
- D** None of the above

- 23** The diagram shows objects (P, Q, R, S, T and U) placed on the line XY in front of a plane mirror.



Which object(s) can be seen in the mirror by an observer positioned at E?

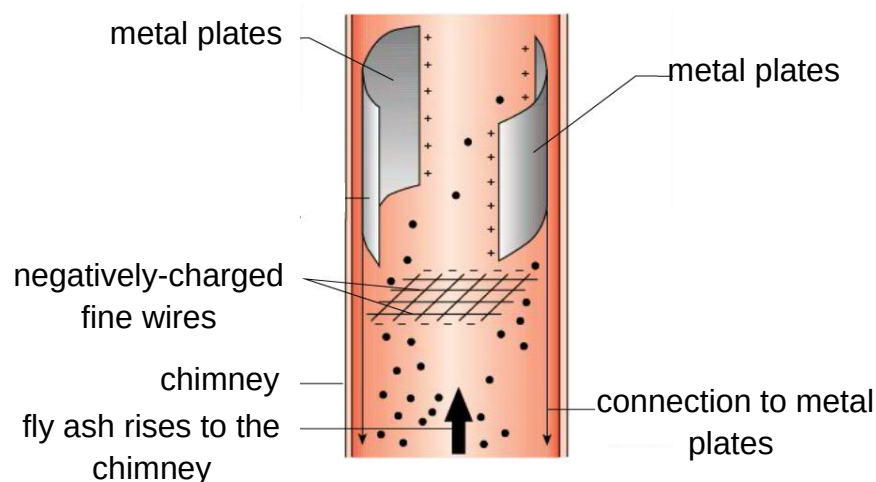
- A** Only T and U
  - B** Only R, S and T
  - C** Only P, Q, R and S
  - D** Only Q, R, S and T
- 24** When an object is placed 15 cm in front of a convex lens, the image is 30 cm behind the lens.



How would the size and distance of the image change when the object is moved slightly nearer to the lens?

|          | size of image | image distance |
|----------|---------------|----------------|
| <b>A</b> | decreases     | decreases      |
| <b>B</b> | decreases     | increases      |
| <b>C</b> | increases     | decreases      |
| <b>D</b> | increases     | increases      |

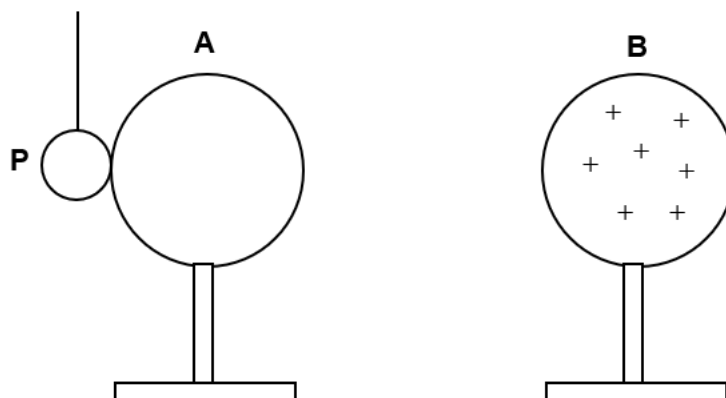
- 25 Electrostatic precipitators are installed in power stations to remove fly ash produced. Fly ash is a mixture of smoke and dust particles which can pollute the environment.



Which of the following **incorrectly** describes how the electrostatic precipitator removes fly ash?

- A On passing through the negatively-charged wires, the fly ash is charged negatively.
- B The fly ash is charged before passing through the metal plates.
- C The metal plates can be either both positively charged or both earthed to attract the fly ash.
- D The fly ash leaves the chimney with no charge.

- 26** A light metal sphere P is suspended by an insulating thread. P is in contact with an uncharged metal sphere A. Both spheres A and B are mounted on plastic stands. A positively charged metal sphere B is placed near to sphere A.



Sphere B is brought into contact with sphere A and then removed.

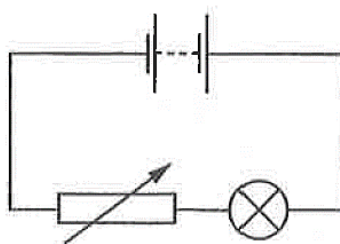
What happens to sphere P?

- A** P is attracted to A because P is negatively charged while A is positively charged.  
**B** P remains in contact with A because both P and A are uncharged.  
**C** P is repelled from A because both P and A are positively charged.  
**D** P is repelled from A because both P and A are negatively charged.
- 27** An electric heater is connected to a 240 V supply and converts 40 000 J of electrical energy.
- How much charge passes through the heater during this time?
- A** 0.0060 C      **B** 170 C      **C** 600 C      **D**  $9.6 \times 10^6$  C
- 28** A copper wire X has resistance  $R$ . Another copper wire Y has half the length and half the diameter of X.

What is the resistance of Y?

- A**  $\frac{1}{4}R$       **B**  $\frac{1}{2}R$       **C**  $R$       **D**  $2R$

- 29 The diagram shows a circuit where the brightness of a lamp can be changed using a rheostat.

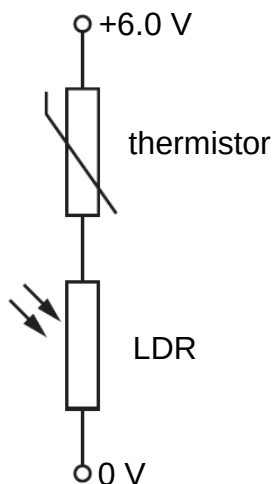


The brightness of the lamp is increased.

What happens to the voltage across the rheostat and the current in the lamp?

|          | voltage across the rheostat | current in the lamp |
|----------|-----------------------------|---------------------|
| <b>A</b> | decreases                   | decreases           |
| <b>B</b> | decreases                   | increases           |
| <b>C</b> | increases                   | decreases           |
| <b>D</b> | increases                   | increases           |

- 30 A thermistor and a light-dependent resistor (LDR) are connected in series. A potential difference (p.d.) of 6.0 V is applied across them as shown.



The thermistor has a resistance of  $6000\ \Omega$  in a cold room and  $1000\ \Omega$  in a warm room. The LDR has a resistance of  $2000\ \Omega$  in dim light and  $500\ \Omega$  in bright light.

When is the p.d. across the LDR equal to 2.0 V?

- A** in a cold room with bright light
- B** in a cold room with dim light
- C** in a warm room with bright light
- D** in a warm room with dim light

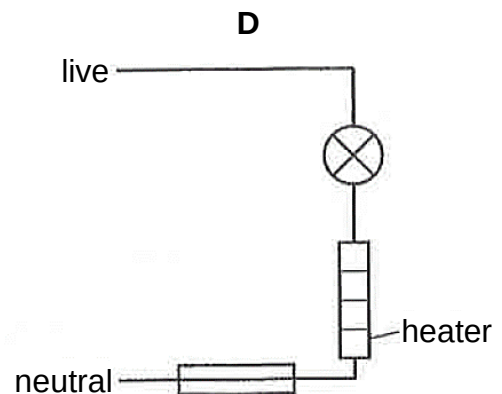
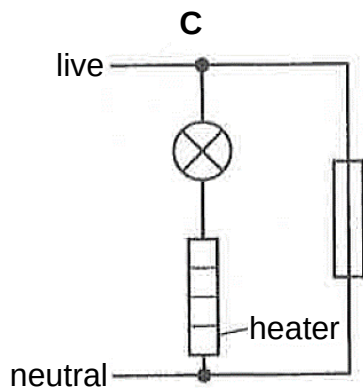
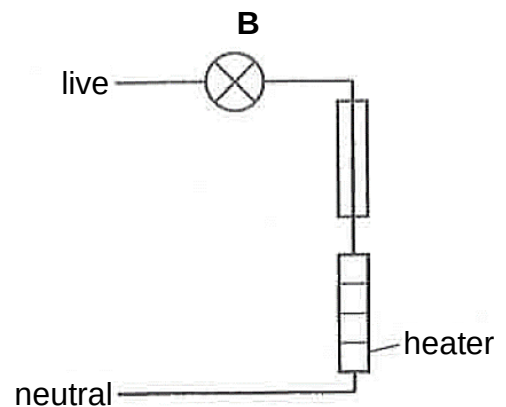
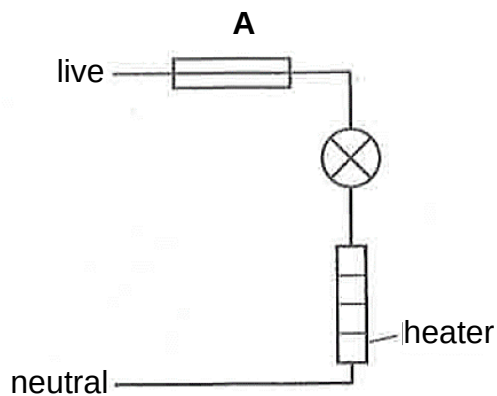
- 31** A man decides to replace five 100 W light bulbs with five 70 W bulbs. The bulbs are used for 4.0 hours each day and the cost of electrical energy is \$0.15 per kWh.

What is the weekly saving?

- A** \$0.13                      **B** \$0.63                      **C** \$1.47                      **D** \$18

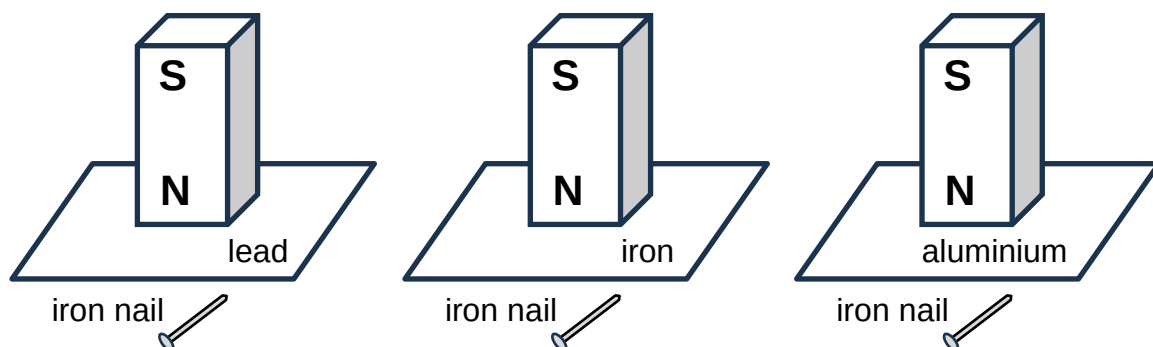
- 32** Each of the following diagrams shows a fuse, a lamp and a heater.

In which diagram is the fuse placed correctly?





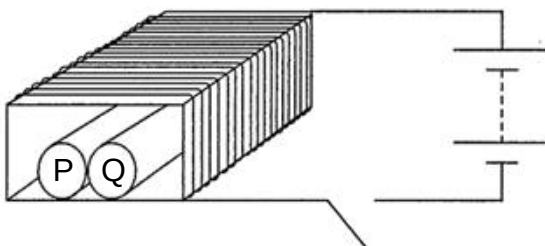
- 33** Three sheets made of different materials are each placed between a magnet and an iron nail.



Which of the following describes the magnetic force exerted on the nail for each material?

|          | lead       | iron       | aluminium  |
|----------|------------|------------|------------|
| <b>A</b> | attractive | attractive | attractive |
| <b>B</b> | attractive | no force   | attractive |
| <b>C</b> | no force   | attractive | no force   |
| <b>D</b> | no force   | no force   | no force   |

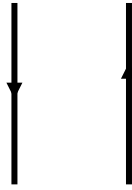
- 34** Two rods, P and Q, are placed inside a solenoid. P is made of iron, Q is made of steel.



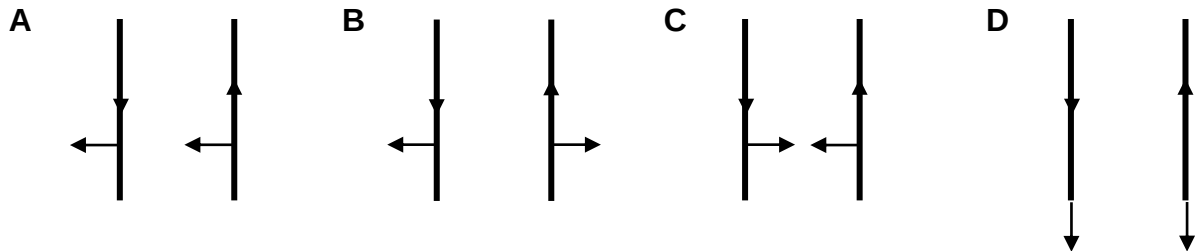
What will happen to the rods when the switch is first closed, and when the switch is open after being closed for several minutes?

|          | when switch is first closed       | when switch is open                  |
|----------|-----------------------------------|--------------------------------------|
| <b>A</b> | P and Q roll away from each other | P and Q remain apart from each other |
| <b>B</b> | P and Q roll away from each other | P and Q roll towards each other      |
| <b>C</b> | P and Q roll towards each other   | P and Q roll away from each other    |
| <b>D</b> | P and Q roll towards each other   | P and Q remain close to each other   |

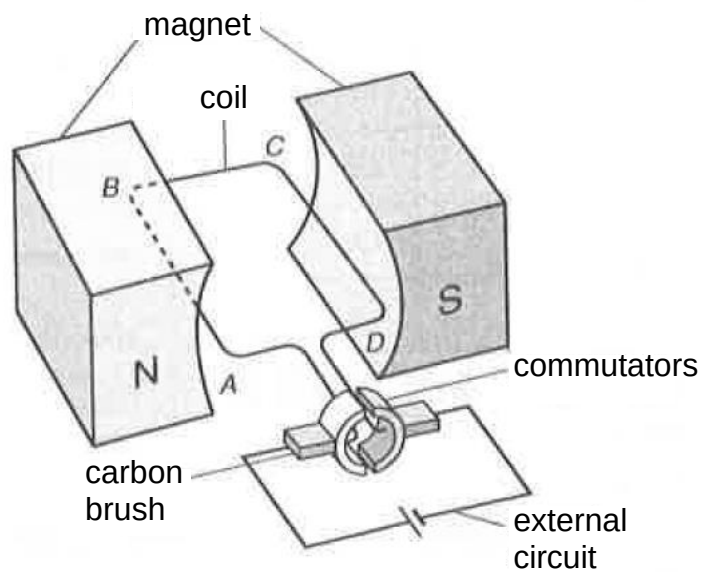
- 35 Two parallel wires carry equal currents in opposite directions.



Which diagram shows the forces acting on the wires due to the magnetic effect of these currents?



- 36 The diagram shows an electric motor.



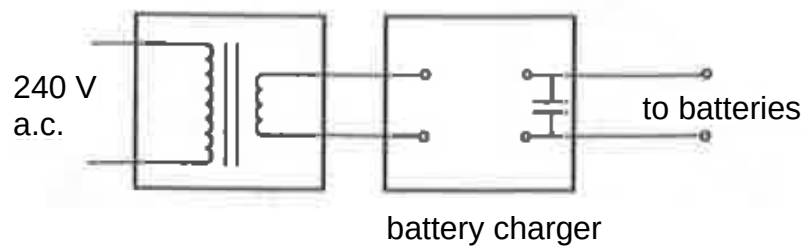
Which of the following will increase the speed of the motor?

- A Replacing the split ring commutators with slip ring commutators.
- B Replacing the battery with a.c. power supply.
- C Replacing the polarities of the magnets.
- D Winding the coil onto a soft iron core.

37 What is the purpose of using a soft iron core in a transformer?

- A To reduce resistance in the transformer.
- B To reduce eddy current in the transformer.
- C To prevent magnetic flux leakage.
- D To prevent the concentration of magnetic field lines.

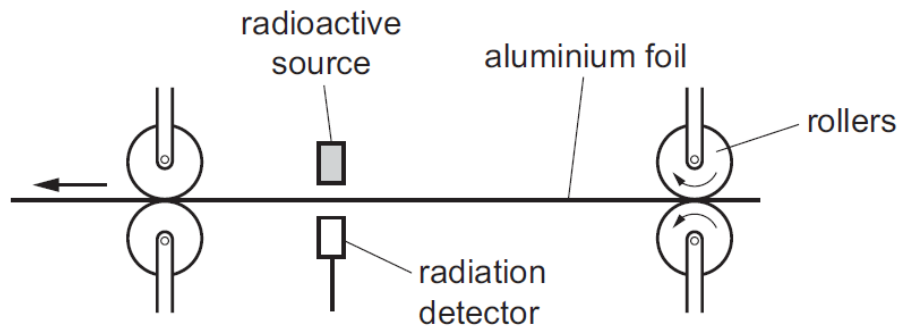
38 The diagram shows a battery charger, which uses a transformer, connected to a 240 V a.c. power supply. The efficiency of the transformer is 90 %.



What is the input current from the a.c. power supply when the output power of the battery charger is 270 W?

- A 0.80 A
- B 1.01 A
- C 1.13 A
- D 1.25 A

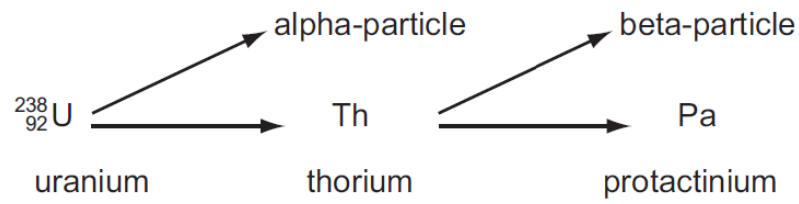
39 Thin aluminium foil is used in cooking. The diagram shows a system used to control the thickness of aluminium foil being made in a factory.



What is the most suitable radioactive source for the system?

|   | source | half-life of source |
|---|--------|---------------------|
| A | beta   | 1 hour              |
| B | beta   | 6 years             |
| C | gamma  | 1 hour              |
| D | gamma  | 6 years             |

- 40 The uranium nucleus  ${}_{92}^{238}\text{U}$  emits an alpha-particle to become thorium, which then emits a beta-particle to become protactinium.



What is the atomic number of protactinium?

- A** 95                      **B** 91                      **C** 90                      **D** 89

**END OF PAPER**