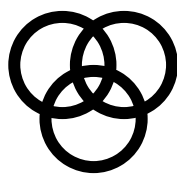


Name:

Register Number:

Class:

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南橋中學

NAN CHIAU HIGH SCHOOL  
PRELIMINARY EXAMINATION 2022  
SECONDARY FOUR EXPRESS

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**PHYSICS**

**6091/01**

Paper 1 Multiple Choice

**30 Aug 2022**  
**Tuesday**

**1 hour**

Candidates answer on the OTAS.

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**INSTRUCTIONS TO CANDIDATES**

Write your name, class and register number in the spaces provided at the top of this page.

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 OTAS.

Each correct answer will score one mark.

The total marks for this paper is 40.

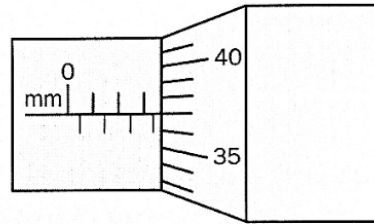
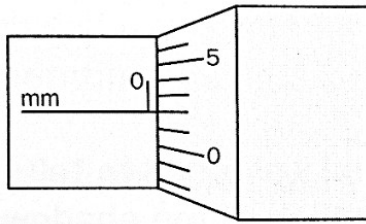
Take gravitational field strength of Earth =  $10 \text{ N kg}^{-1}$  and acceleration due to gravity =  $10 \text{ m s}^{-2}$ .

- 1 What is the order of magnitude of the mass of a typical motor car (without driver and passengers) in kg?

- A**  $1 \times 10$
- B**  $1 \times 10^2$
- C**  $1 \times 10^3$
- D**  $1 \times 10^4$

- 2** A micrometer screw gauge is used to measure the thickness of a coin.

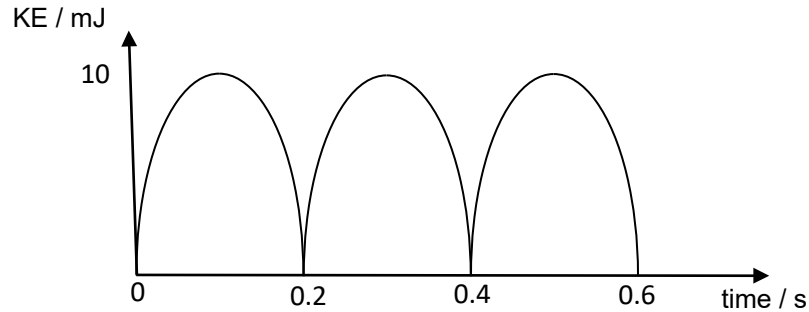
The diagrams show the scales of the micrometer when the jaws are closed with no coin and when the jaws are closed with the coin respectively.



What is the thickness of the coin?

- A** 3.35 mm      **B** 3.39 mm      **C** 3.85 mm      **D** 3.89 mm

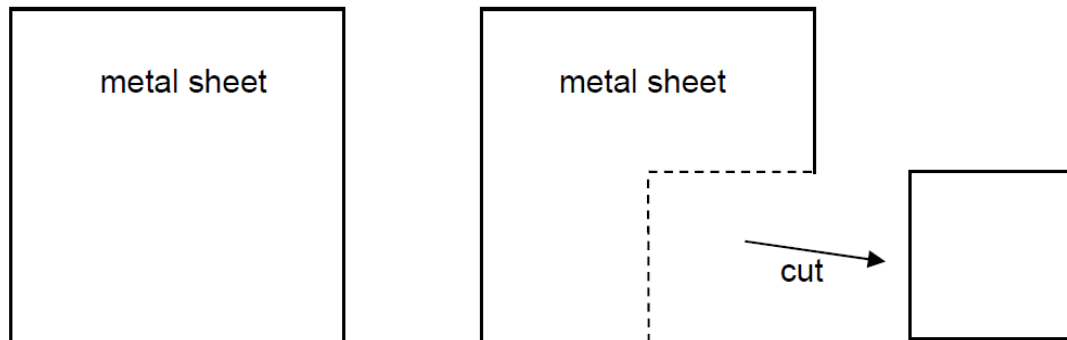
- 3** The diagram shows how the kinetic energy (KE) of the bob of an oscillating simple pendulum varies with time.



What is the period of the pendulum in second?

- A** 0.2                      **B** 0.4  
**C** 0.5                      **D** 0.6

- 4 An uniform flat piece of metal sheet has a density of  $8.0 \text{ g/cm}^3$ . One quarter of the metal sheet is cut out as shown.



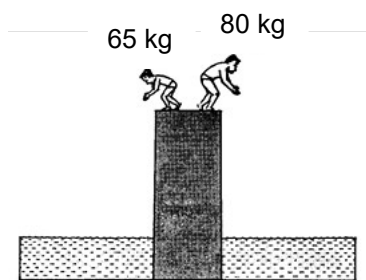
What is the density of the one-quarter metal sheet?

- A**  $2.0 \text{ g/cm}^3$       **B**  $4.0 \text{ g/cm}^3$       **C**  $8.0 \text{ g/cm}^3$       **D**  $32.0 \text{ g/cm}^3$
- 5 A car is moving in a straight line horizontally at a constant speed of  $20 \text{ m/s}$ . The car engine produces a constant power of  $28,000 \text{ W}$ . What is the frictional force acting on the car when the efficiency of the car engine is  $71 \%$ ?
- A**  $990 \text{ N}$       **B**  $2000 \text{ N}$       **C**  $20\,000 \text{ N}$       **D**  $400,000 \text{ N}$
- 6 A boy pushes a box  $10 \text{ m}$  along a rough, horizontal floor with a force of  $5.0 \text{ N}$ . The frictional force between the floor and the box is  $2.0 \text{ N}$ .

What is the work done against the friction, the work done by the boy and the energy gained by the box?

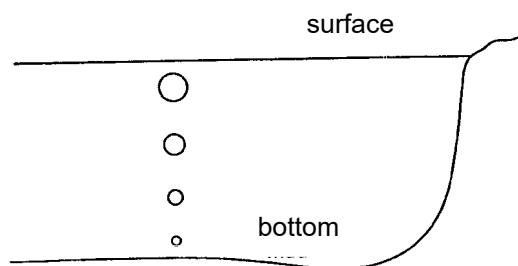
|          | work done against friction/ J | work done by boy/ J | energy gained by box/ J |
|----------|-------------------------------|---------------------|-------------------------|
| <b>A</b> | 20                            | 50                  | 30                      |
| <b>B</b> | 20                            | 50                  | 50                      |
| <b>C</b> | 30                            | 50                  | 50                      |
| <b>D</b> | 30                            | 50                  | 30                      |

- 7 The diagram shows two divers of different masses diving with the same initial speed from the same height into a pool. Air resistance is negligible.



Which physical quantity is different between the divers just before they hit the water?

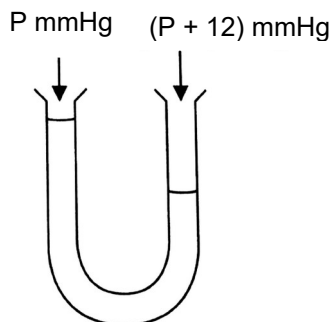
- A acceleration
  - B duration of free fall
  - C kinetic energy
  - D speed
- 8 A parachutist has opened his parachute and is falling to Earth at constant speed. What is the principal energy conversion taking place as he falls?
- A gravitational potential energy to kinetic energy
  - B gravitational potential energy to thermal energy
  - C kinetic energy to gravitational potential energy
  - D kinetic energy to thermal energy
- 9 Bubbles of gas rise from the bottom to the surface of a deep lake.



As the bubbles rise, their volumes increase. Why is this so?

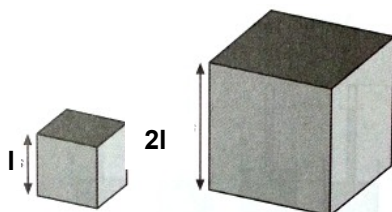
- A Atmospheric pressure on the bubbles decreases.
- B Atmospheric pressure on the bubbles increases.
- C Water pressure on the bubbles decreases.
- D Water pressure on the bubbles increases.

- 10 The diagram shows a mercury manometer. Pressures of  $(P + 12)$  mmHg and  $P$  mmHg are exerted at the right and left tubes respectively.



What will happen to the mercury level in the left tube when the pressure at the right tube decreases to  $(P + 6)$  mmHg?

- A increases by 3 mm
  - B increases by 6 mm
  - C decreases by 3 mm
  - D decreases by 6 mm
- 11 Two solid cubes are made from the same material. One cube has sides that are two times as long as the other.



When placed on one side, the small cube exerts a pressure  $p$  on the ground.

What is the pressure exerted by the large cube standing on one of its faces?

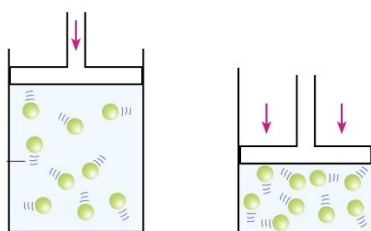
- A  $2p$
  - B  $4p$
  - C  $8p$
  - D  $13p$
- 12 A resistance thermometer has a resistance of  $45.0 \, \Omega$  at ice point and  $295 \, \Omega$  at steam point. What is its temperature when its resistance is  $148 \, \Omega$ ?
- A  $34.9 \, ^\circ\text{C}$
  - B  $41.2 \, ^\circ\text{C}$
  - C  $50.2 \, ^\circ\text{C}$
  - D  $59.2 \, ^\circ\text{C}$

- 13** When dust particles in air are observed in a microscope, they move in a random, zig-zag motion. The same dust particles are observed to move faster in the same random, zig-zag motion when room temperature is higher.

Why is it so?

- A** The dust particles gain kinetic energy and collide with the air molecules more vigorously and frequently.
- B** The air molecules gain kinetic energy and collide with the dust particles more vigorously and frequently.
- C** The increased temperature of the room creates a convection current that causes the dust particles to move faster.
- D** The increased temperature of the room causes chemical reactions to occur between the dust particles and air molecules.

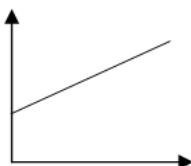
- 14** A fixed mass of helium gas is compressed to a smaller volume at constant temperature.



How do the following properties of the gas molecules change?

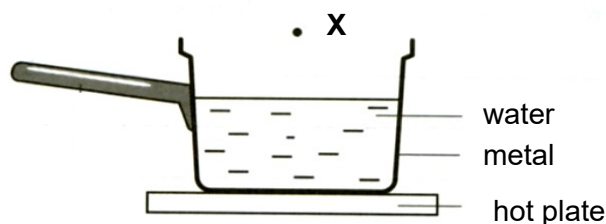
|          | average speed of the gas molecules | frequency of collisions with the walls of the container |
|----------|------------------------------------|---------------------------------------------------------|
| <b>A</b> | increases                          | increases                                               |
| <b>B</b> | increases                          | remains unchanged                                       |
| <b>C</b> | remains unchanged                  | increases                                               |
| <b>D</b> | remains unchanged                  | remains unchanged                                       |

- 15** The graph indicates properties of a fixed mass of ideal gas. Which of the following could describe what is plotted on the graph?



|          | horizontal axis | vertical axis | condition            |
|----------|-----------------|---------------|----------------------|
| <b>A</b> | temperature     | pressure      | constant volume      |
| <b>B</b> | temperature     | density       | constant pressure    |
| <b>C</b> | temperature     | volume        | constant density     |
| <b>D</b> | volume          | pressure      | constant temperature |

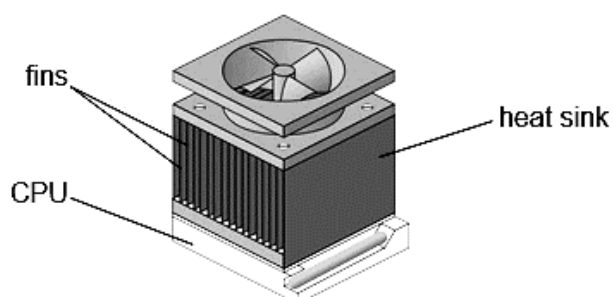
- 16 The diagram shows a metal saucepan filled with water and placed on a hot plate. After some time, the air at point **X** also becomes hot.



What are the main ways by which heat travels through the materials between the hot plate and point **X**?

|          | through base of the saucepan | through the water | through the air |
|----------|------------------------------|-------------------|-----------------|
| <b>A</b> | Conduction                   | Convection        | Radiation       |
| <b>B</b> | Conduction                   | Convection        | Convection      |
| <b>C</b> | Radiation                    | Convection        | Conduction      |
| <b>D</b> | Radiation                    | Conduction        | Convection      |

- 17 The figure below shows a heat sink placed on top of a central processing unit (CPU) chip in a computer. The heat sink is painted black and is designed to have many fins (layers with air spaces between them).



Heat is conducted from the CPU to the heat sink. The heat sink then transfers the heat to the surroundings.

Which statement about the heat sink is **not** correct?

- A** The fins is made of aluminium because aluminium is a good conductor of heat.
- B** The heat sink has many fins to increase the surface area for emission of radiant heat.
- C** The heat sink is painted black because black surfaces are good conductors of heat.
- D** The heat sink is painted black because black surfaces are good emitters of radiant heat.

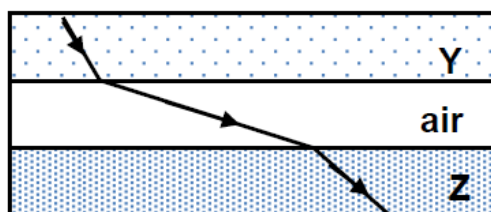
- 18 Water in a beaker is heated from 10 °C to 100 °C. The water starts boiling at 100 °C.

Which of the following is true for the internal potential energy (IPE) and the internal kinetic energy (IKE) of the water molecules during heating and boiling?

|          | heating from 10 °C to 100 °C | boiling at 100 °C      |
|----------|------------------------------|------------------------|
| <b>A</b> | IKE increases slightly       | IKE increases by a lot |
| <b>B</b> | IKE remains the same         | IKE remains the same   |
| <b>C</b> | IPE increase slightly        | IPE increases by a lot |
| <b>D</b> | IPE remains the same         | IPE remains the same   |

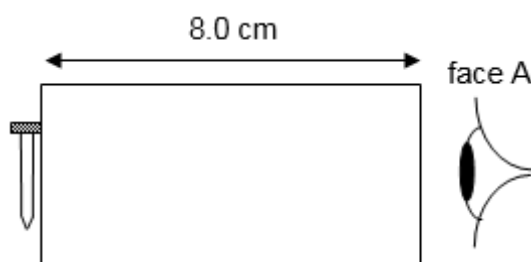
- 19 The diagram shows a light ray travelling from medium Y, through the air, to medium Z. The refractive indices of media Y and Z are denoted by  $n_y$  and  $n_z$  respectively.

Which relationship correctly describes the magnitude of  $n_y$  and  $n_z$ ?



- A**  $1 > n_z > n_y$                       **B**  $n_z > n_y > 1$   
**C**  $n_y > 1 > n_z$                       **D**  $n_y > n_z > 1$
- 20 A small nail is viewed through a rectangular glass block with parallel faces. The nail is 8.0 cm away from the face A of the glass block.

Which of the following describes how the image of the nail is seen by the observer?



- A** real and less than 8.0 cm away from face A  
**B** real and more than 8.0 cm away from face A  
**C** virtual and less than 8.0 cm away from face A  
**D** virtual and more than 8.0 cm away from face A
- 21 A dipper which is moving up and down, makes water waves in a ripple tank.

What happens when the frequency of the dipper is increased?

- A The wavelength of the wave decreases.
- B The wavelength of the wave increases.
- C The speed of the wave decreases.
- D The speed of the wave increases.

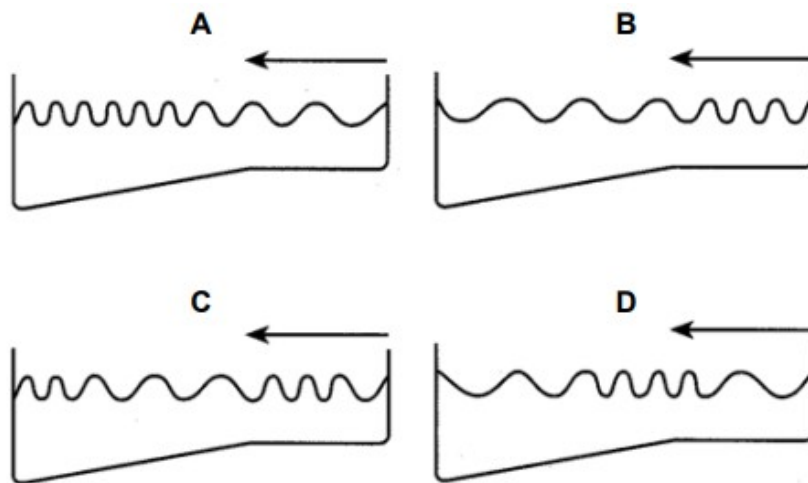
- 22** A wave generating machine produces a number of water waves per second. The generated wave travels 9.0 cm in 3.0 s and the distance between its 2 consecutive crests is 1.5 cm.

How many waves does the generator produce per second?

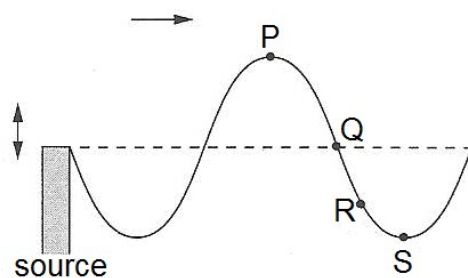
- |        |       |
|--------|-------|
| A 0.50 | B 2.0 |
| C 3.0  | D 4.5 |

- 23** A ripple tank contains water waves of constant frequency moving from right to left in varying depths.

Which diagram correctly represents the water waves as they travel from the shallow to the deeper region?



- 24** A source sets up a wave along a string. The wave is moving to the right.



Which of the following statements is **not** correct?

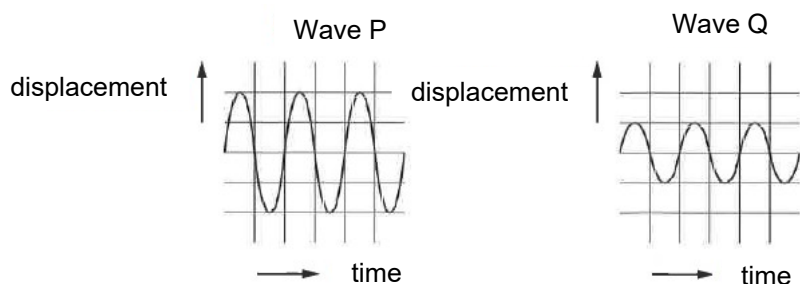
- A** Particle R is moving up.
- B** Particle Q is moving to the right.
- C** Particle P is momentarily at rest.
- D** Particle S is momentarily at rest.

- 25** The diagram shows a series of compressions and rarefactions of a sound wave in air. Given that the speed of sound is 300 m/s, what is the frequency of this sound wave?



- |                  |                  |
|------------------|------------------|
| <b>A</b> 25.0 Hz | <b>B</b> 50.0 Hz |
| <b>C</b> 100 Hz  | <b>D</b> 150 Hz  |

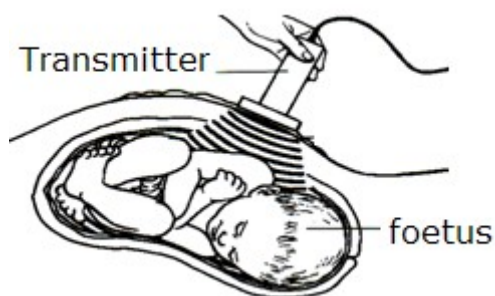
- 26** The diagrams show sound waves P and Q.



How do the frequency and loudness of wave P compare with the frequency and loudness of wave Q?

|          | frequency of P | loudness of P  |
|----------|----------------|----------------|
| <b>A</b> | higher than Q  | greater than Q |
| <b>B</b> | higher than Q  | same as Q      |
| <b>C</b> | same as Q      | greater than Q |
| <b>D</b> | same as Q      | same than Q    |

**27** The diagram shows how ultrasound is used to scan a human foetus.



What is the likely frequency of the ultrasound used?

- |                    |                    |
|--------------------|--------------------|
| <b>A</b> 4.0 Hz    | <b>B</b> 2 000 Hz  |
| <b>C</b> 20 000 Hz | <b>D</b> 40 000 Hz |

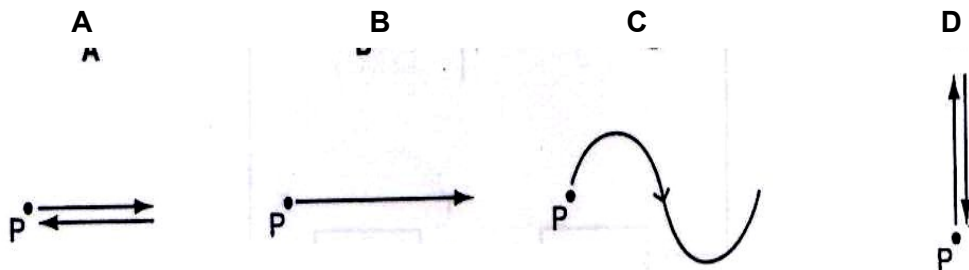
**28** The diagram shows a loudspeaker that is producing a continuous sound wave of frequency 100 Hz in air.

loudspeaker

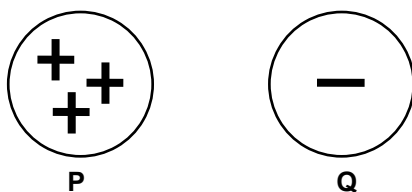


P

Which of the following diagrams shows how the sound wave causes an air molecule at P to move during 0.010 s?



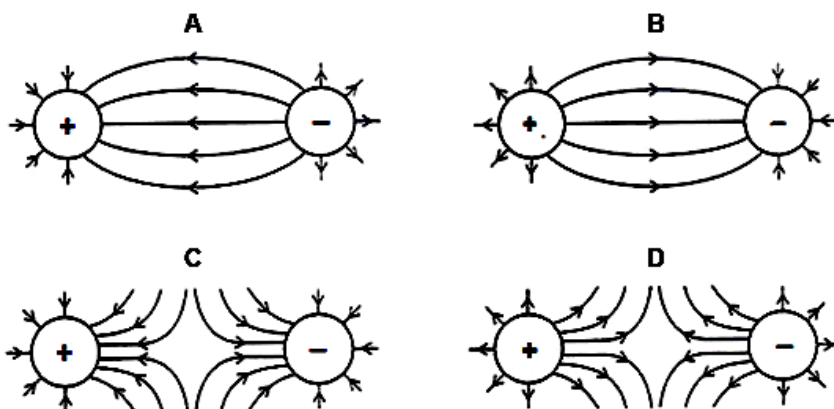
- 29 The diagram shows two identical isolated metallic spheres P and Q. Sphere P carries three *net* positive charges while sphere Q carries one *net* negative charge.



When sphere P touches sphere Q, which of the following describes the movement of the charge(s) correctly?

- A Only one negative charge moves from Q to P.
- B Only one positive charge moves from P to Q.
- C Two negative charges move from Q to P.
- D Two positive charges move from P to Q.

- 30 Which diagram correctly shows the electric field pattern between two charged spheres?

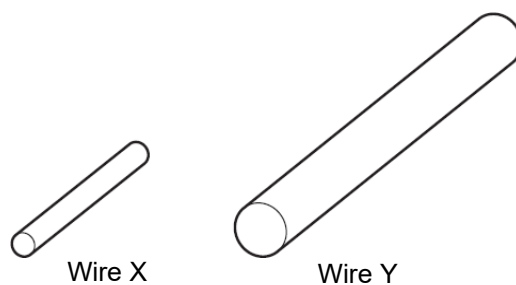


- 31 During a lightning strike that lasts  $2.0 \times 10^{-4}$  s, a total of  $3.5 \times 10^{21}$  electrons pass from the cloud to a tree. The size of the charge on an electron is  $1.6 \times 10^{-19}$  C.

What is the average current in the lightning strike?

- A  $8.0 \times 10^{-16}$  A                      B  $2.8 \times 10^6$  A  
C  $3.2 \times 10^{15}$  A                      D  $1.8 \times 10^{25}$  A

- 32 The diagram shows two resistance wires X and Y of the same material.



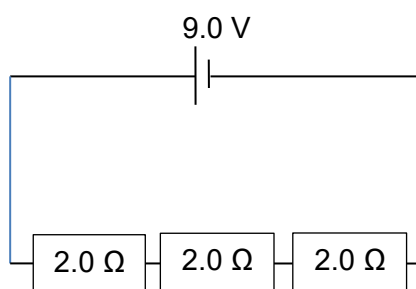
The cross-sectional area of wire Y is four times that of wire X. The length of wire Y is twice the length of wire X.

What is the ratio of the resistance of wire X to the resistance of wire Y?

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

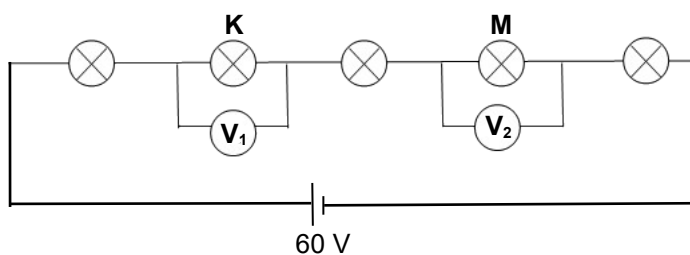
- 33 The diagram shows three identical resistors each of  $2.0\ \Omega$  resistance connected in series to a  $9.0\ \text{V}$  electric cell.

What is the total amount of energy dissipated in the circuit when  $2.0\ \text{C}$  of charge passes through the resistors?



- A**  $1.5\ \text{J}$                       **B**  $3.0\ \text{J}$                       **C**  $18\ \text{J}$                       **D**  $54\ \text{J}$

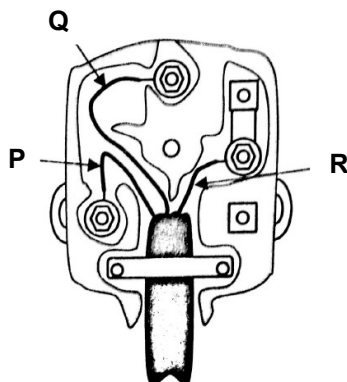
- 34 Five identical light bulbs are connected to a  $60\ \text{V}$  d.c. supply. Voltmeter  $V_1$  is connected in parallel with light bulb K and voltmeter  $V_2$  in parallel with light bulb M.



What will be the readings of the two voltmeters when light bulb M is short-circuited?

|          | $V_1 / \text{V}$ | $V_2 / \text{V}$ |
|----------|------------------|------------------|
| <b>A</b> | 0                | 60               |
| <b>B</b> | 12               | 0                |
| <b>C</b> | 12               | 12               |
| <b>D</b> | 15               | 0                |

- 35 A  $24\ \Omega$  resistor is connected to a 240 V mains. What are the magnitudes of the currents flowing in wires P, Q and R?



|   | P    | Q    | R    |
|---|------|------|------|
| A | 0    | 10 A | 10 A |
| B | 10 A | 0    | 10 A |
| C | 0    | 10 A | 0    |
| D | 0    | 0    | 10 A |

- 36 A lamp rated at 280 V, 10 W is connected across a 240 V household mains power supply. What happens when the circuit is switched on?

- A The lamp lights up with power less than 10 W.
- B The lamp lights up with power equal to 10 W.
- C The lamp lights up with power greater than 10 W.
- D The lamp blows.

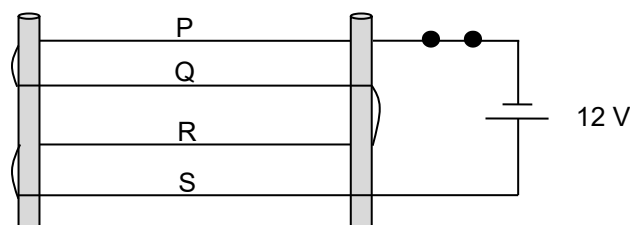
- 37 The metal casing of an electric heater is earthed. The live wire of the heater is connected to a correctly-rated fuse.

The cable to the heater becomes so worn out that the live wire makes electrical contact with the case.

What happens next?

- A The current flows to earth and the fuse is not affected.
- B The fuse melts and switches off the circuit.
- C The metal case becomes live and dangerous.
- D The metal case becomes very hot.

- 38** The cost of 1.0 kWh of electricity is 20 cents. What is the cost of electricity of using a 2000 W heater for 3 hours and 3 minutes?
- A**    61 cents                      **B**    122 cents  
**C**    163 cents                      **D**    2 120 cents
- 39** Four parallel lengths of bare wires, P, Q, R and S are created by wrapping a gold wire around two vertical wooden poles. The gold wire is connected to a switch and a 12 V d.c. battery.



When the switch is closed, which of the following is correct in terms of attraction and repulsion between wires P & Q and Q & R?

|          |         |         |
|----------|---------|---------|
|          | P & Q   | Q & R   |
| <b>A</b> | attract | attract |
| <b>B</b> | attract | repel   |
| <b>C</b> | repel   | attract |
| <b>D</b> | repel   | repel   |

- 40** Electric power cables transmit electrical energy over large distances using a high voltage, alternating current.

What are the advantages of using a high voltage and of using an alternating current?

|          |                                           |                                                |
|----------|-------------------------------------------|------------------------------------------------|
|          | advantage of using a high voltage         | advantage of using an alternating current      |
| <b>A</b> | a higher current is produced in the cable | the resistance of the cable is reduced         |
| <b>B</b> | a higher current is produced in the cable | the voltage can be changed using a transformer |
| <b>C</b> | a lower current is produced in the cable  | the resistance of the cable is reduced         |
| <b>D</b> | a lower current is produced in the cable  | the voltage can be changed using a transformer |

End of paper