

1 Which list of SI units contains only base units?

- A. newton, kelvin, second, volt, mole
- B. kilogram, metre, second, ohm, mole
- C. kilogram, newton, metre, ampere, ohm
- D. kelvin, metre, mole, ampere, kilogram

2 Convert  $3400 \text{ N mm}^{-2}$  to  $\text{N m}^{-2}$

- A  $3.4 \times 10^{-1} \text{ N m}^{-2}$
- B  $3.4 \times 10^1 \text{ N m}^{-2}$
- C  $3.4 \times 10^5 \text{ N m}^{-2}$
- D  $3.4 \times 10^9 \text{ N m}^{-2}$

3 Four physical quantities P, Q, R & S are related by the equation  $P = QR - S$ . Which of the statement must be correct for the equation to be homogeneous?

- A P, Q, R & S all have the same units.
- B P, Q, R & S are all scalar quantities.
- C The product QR has the same units as S.
- D The product RS is numerically equal to (Q-P).

4 The table shows the x-component and y-component of four force vectors. Which force vector has the largest magnitude?

	<u>x-component / N</u>	<u>y-component / N</u>
A	2	9
B	3	6
C	4	7
D	5	6

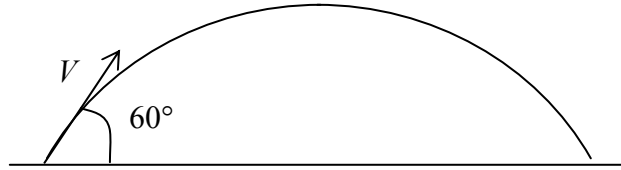
5 Find the percentage uncertainty for the density of a steel ball where the percentage uncertainty for the diameter and mass are 5% and 3% respectively.

- A 10%
- B 13%
- C 15%
- D 18%

- 6 The acceleration of free fall on planet P is  $\frac{1}{6}$  of the acceleration of free fall on the Earth. The mass of a body on planet P is 30 kg. What is its weight on planet P?

A 4.9 N      B 49 N      C 180 N      D 290 N

- 7 A projectile leaves the ground at an angle of  $60^\circ$  to the horizontal. Its initial velocity is  $V$ . Neglecting air resistance, find in terms of  $V$  its velocity at the highest point of the motion.

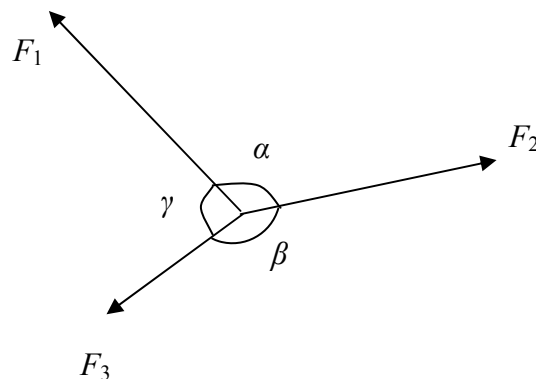


A zero      B  $\frac{1}{2} V$       C  $\frac{1}{4} V$       D  $V$

- 8 A stone is dropped from the top of a tower of height  $H$ . The stone falls from rest and air resistance is negligible. The time taken to hit the ground is  $t$ . What is the time taken for the stone to fall in terms of  $t$  if the height increases to  $2H$ ?

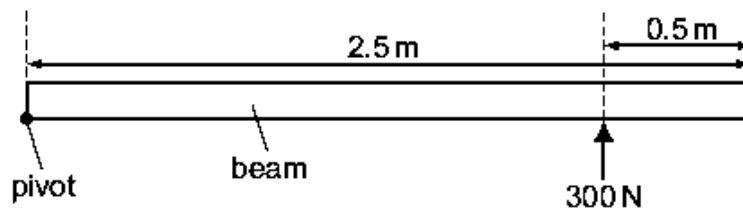
A  $2t$       B  $\sqrt{2}t$       C  $\frac{1}{2}t$       D  $4t$

- 9 The diagram (not drawn to scale) below shows three forces  $F_1$ ,  $F_2$  and  $F_3$  act at a point. If  $F_1 > F_2 > F_3$  and they are in equilibrium, find the necessary relationship between  $\alpha$ ,  $\beta$  and  $\gamma$ .



A  $\alpha > \beta > \gamma$       B  $\gamma > \alpha > \beta$       C  $\alpha > \gamma > \beta$       D  $\alpha = \beta > \gamma$

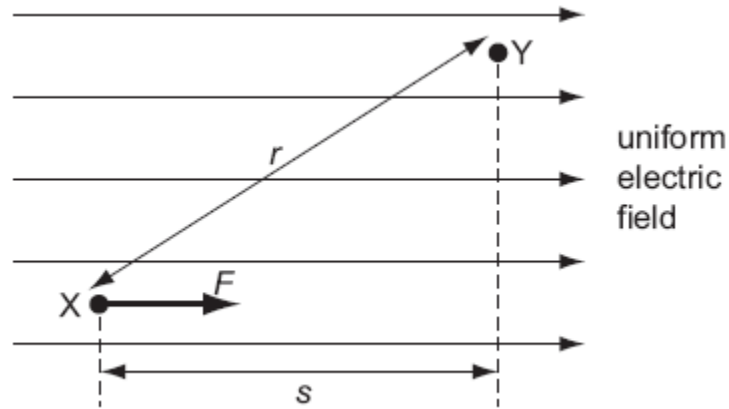
- 10 The probable maximum magnitude and the minimum magnitude for the resultant force are respectively 10 N and 4 N. The magnitude of the two forces are
- A 3 N and 7 N
  - B 4 N and 6 N
  - C 4 N and 10 N
  - D 6 N and 14 N
- 11 A ball is falling at terminal speed in still air. The forces acting on the ball are upthrust, viscous drag and weight. What is the order of increasing magnitude of these three forces?
- A viscous drag  $\rightarrow$  upthrust  $\rightarrow$  weight
  - B upthrust  $\rightarrow$  viscous drag  $\rightarrow$  weight
  - C viscous drag  $\rightarrow$  weight  $\rightarrow$  upthrust
  - D weight  $\rightarrow$  upthrust  $\rightarrow$  viscous drag
- 12 A long uniform beam is pivoted at one end. A force of 300 N is applied to hold the beam horizontally.



What is the weight of the beam?

- A 300 N
- B 480 N
- C 500 N
- D 960 N

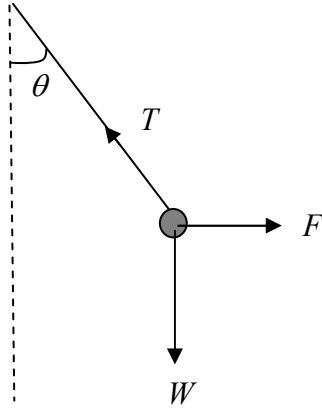
- 13 A positive charge experiences a force  $F$  when placed at point X in a uniform electric field. The charge is then moved from point X to point Y. Distances  $r$  and  $s$  are shown on the diagram.



What is the change in the potential energy of the charge?

- A increases by  $Fr$
  - B increases by  $Fs$
  - C decreases by  $Fr$
  - D decreases by  $Fs$
- 14 To travel at a constant speed, a car engine provides 24 kW of useful power. The driving force on the car is 600 N. At what speed does it travel?
- A  $2.5 \text{ ms}^{-1}$
  - B  $25 \text{ ms}^{-1}$
  - C  $4.0 \text{ ms}^{-1}$
  - D  $40 \text{ ms}^{-1}$
- 15 Which of the following expressions defines power?
- A Force x velocity
  - B Work done / time taken
  - C Work done x time taken
  - D Force x distance moved in the direction of force

- 16** A small ball of weight  $W$  is suspended by a light thread. A strong wind blows horizontally, exerting a constant force  $F$  on the ball. The thread makes an angle  $\theta$  to the vertical as shown.

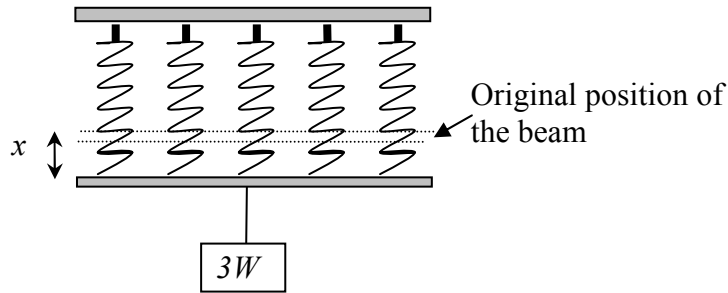


Which equation correctly relates  $\theta$ ,  $F$  and  $W$ ?

- A**  $\cos \theta = F/W$
  - B**  $\sin \theta = F/W$
  - C**  $\tan \theta = F/W$
  - D**  $\tan \theta = W/F$
- 17** Which statement about the evaporation and boiling of a liquid is correct?
- A** Boiling always occurs at a higher temperature than evaporation.
  - B** Evaporation occurs at any temperature but the boiling point depends on the external pressure.
  - C** Evaporation results in the loss of the most energetic molecules from a liquid but in boiling, all molecules have the same energy.
  - D** The rates of evaporation and boiling are unaffected by changes in the surface area of liquid.

- 18** Two solid substances P and Q have atoms of mass  $m_p$  and  $m_Q$  respectively. They have  $n_p$  and  $n_Q$  atom per unit volume. The density of P is greater than the density of Q. Which of the following must be correct?
- A**  $m_p > m_Q$
  - B**  $n_p > n_Q$
  - C**  $m_p n_p > m_Q n_Q$
  - D**  $\frac{m_p}{n_p} > \frac{m_Q}{n_Q}$
- 19** Nylon breaks when the stress within it reaches  $1 \times 10^9$  Pa. Which range includes the heaviest load that could be lifted by a nylon thread of diameter 1 mm?
- A** 2 N to 20 N
  - B** 20 N to 200 N
  - C** 200 N to 2000 N
  - D** 2000 N to 20 000 N
- 20** A uniform vertical wire is stretched by hanging a mass from its lower end. Which of the following does not affect the strain in the wire?
- A** the stress
  - B** the unstretched length
  - C** its cross-sectional area
  - D** the Young modulus of metal

- 21** A beam, the weight of which may be neglected, is supported by five identical springs. When a weight  $3W$  is hung from the middle of the beam, the extension of each spring is  $x$ .



What is the extension when the two end-springs are removed?

- A**  $\frac{2}{5}x$       **B**  $\frac{3}{5}x$       **C**  $\frac{5}{3}x$       **D**  $3x$

- 22** Which of the following is a longitudinal wave?

- A** a light wave travelling through air  
**B** a radio wave from a broadcasting station  
**C** a ripple on the surface of water  
**D** a sound wave travelling through air

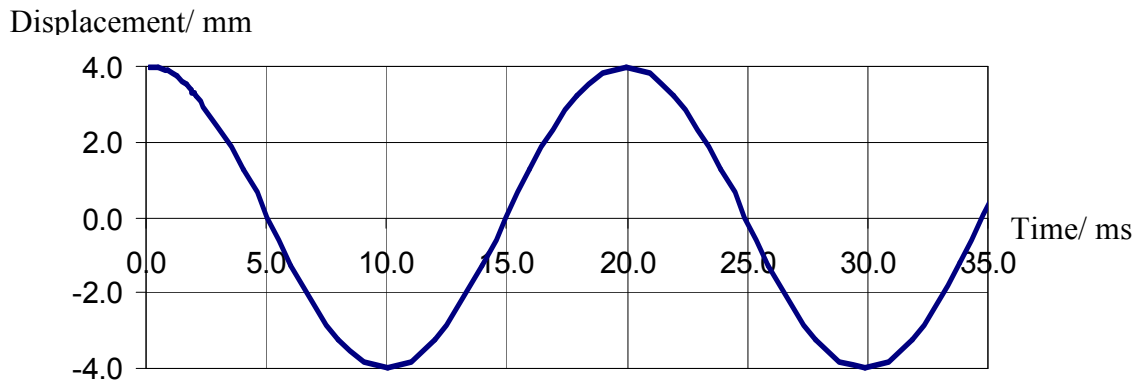
- 23** Which value is a possible wavelength for radiation in the microwave region of the electromagnetic spectrum?

- A**  $3 \times 10^{-2} \text{ m}$       **B**  $3 \times 10^{-5} \text{ m}$       **C**  $3 \times 10^{-8} \text{ m}$       **D**  $3 \times 10^{-10} \text{ m}$

- 24** Monochromatic light of wavelength  $590 \text{ nm}$  is incident normally on a diffraction grating. The angle between the two second-order diffracted beams is  $43^\circ$ . What is the spacing of the lines on the grating?

- A**  $0.87 \mu\text{m}$       **B**  $1.6 \mu\text{m}$       **C**  $1.7 \mu\text{m}$       **D**  $3.2 \mu\text{m}$

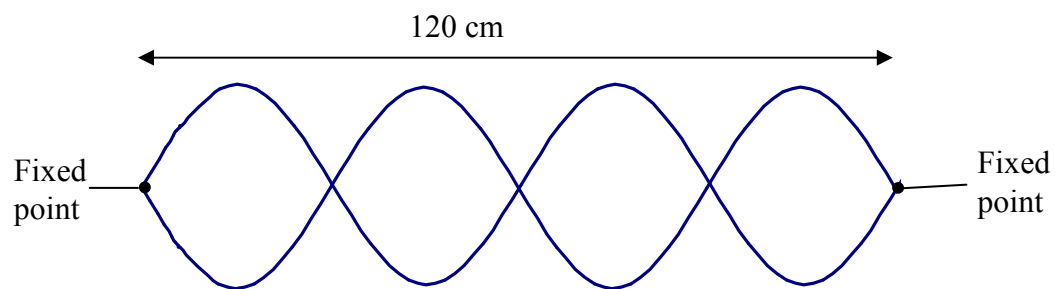
25 The diagram shows a displacement-time graph for a wave.



What are the amplitude and the frequency of the wave?

	Amplitude	Frequency
<b>A</b>	4 mm	20 Hz
<b>B</b>	4 mm	50 Hz
<b>C</b>	8 mm	20 Hz
<b>D</b>	8 mm	50 Hz

26 Stationary transverse waves are set up in a stretched string as shown.



The distance between the fixed points is 120 cm. For one particular frequency, the pattern shown is formed.  
What is the wavelength?

- A** 20 cm      **B** 40 cm      **C** 60 cm      **D** 120 cm



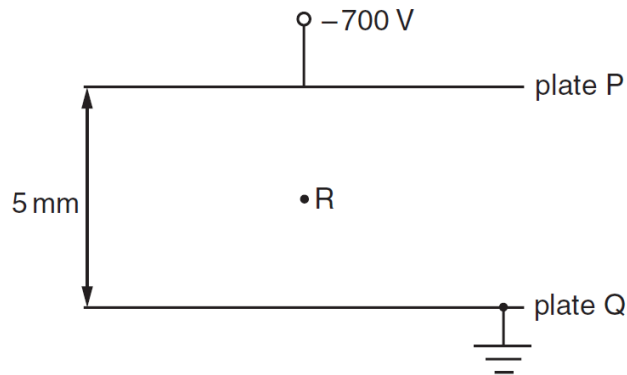
27 In an interference experiment, two slits are illuminated with white light.



What is seen on the screen?

- A The central fringe is black with black and white fringes on each side.
- B The central fringe is black with coloured fringes on each side.
- C The central fringe is white with black and white fringes on each side.
- D The central fringe is white with coloured fringes on each side.

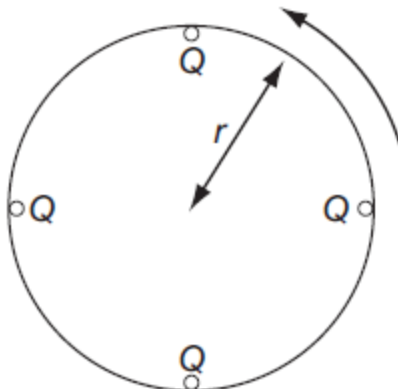
28 The diagram shows two metal plates P and Q between which there is a potential difference.



What is the magnitude and direction of the electric field at point R?

- A  $0.7 \times 10^2 \text{ N C}^{-1}$  from P towards Q
- B  $1.4 \times 10^2 \text{ N C}^{-1}$  from Q towards P
- C  $1.4 \times 10^5 \text{ N C}^{-1}$  from P towards Q
- D  $1.4 \times 10^5 \text{ N C}^{-1}$  from Q towards P

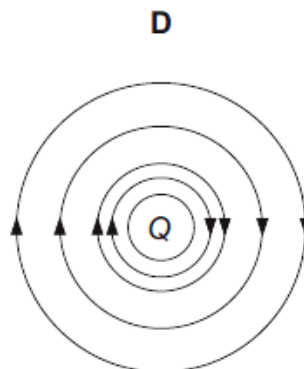
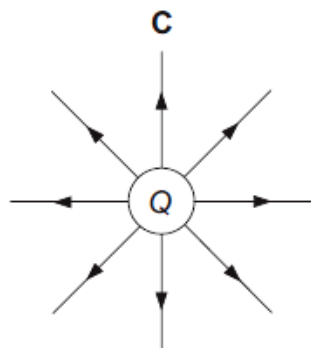
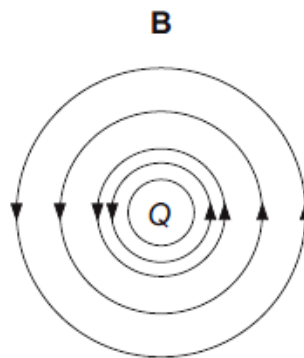
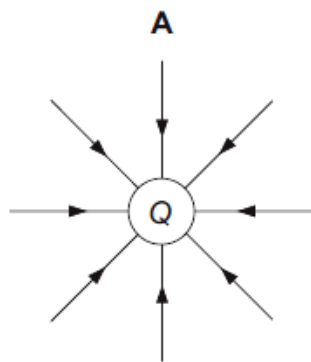
- 29 Four point charges, each of charge  $Q$ , are placed on the edge of an insulating disc of radius  $r$ . The frequency of rotation of the disc is  $f$ .



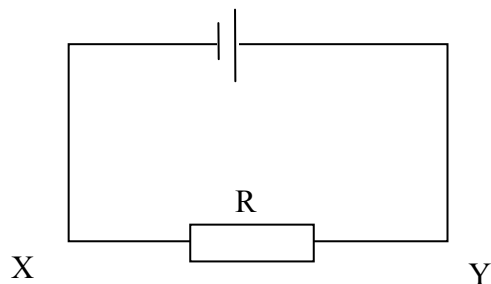
What is the equivalent electric current at the edge of the disc?

- A  $4Qf$       B  $\frac{4Q}{f}$       C  $8\pi rQf$       D  $\frac{2Qf}{\pi r}$

- 30 Which diagram represents the electric field in the vicinity of a positive electric charge of magnitude  $Q$ ?



**31** The current in the circuit is 4.8 A.



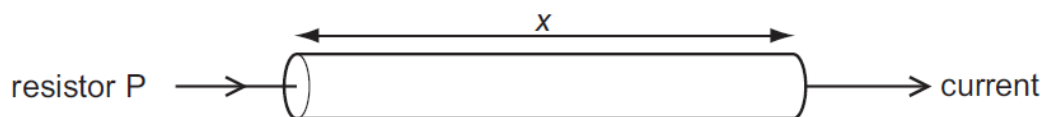
What is the rate of flow and the direction of flow of electrons through the resistor R?

- A**  $3.0 \times 10^{19} \text{ s}^{-1}$  in direction X to Y
- B**  $6.0 \times 10^{18} \text{ s}^{-1}$  in direction X to Y
- C**  $3.0 \times 10^{19} \text{ s}^{-1}$  in direction Y to X
- D**  $6.0 \times 10^{18} \text{ s}^{-1}$  in direction Y to X

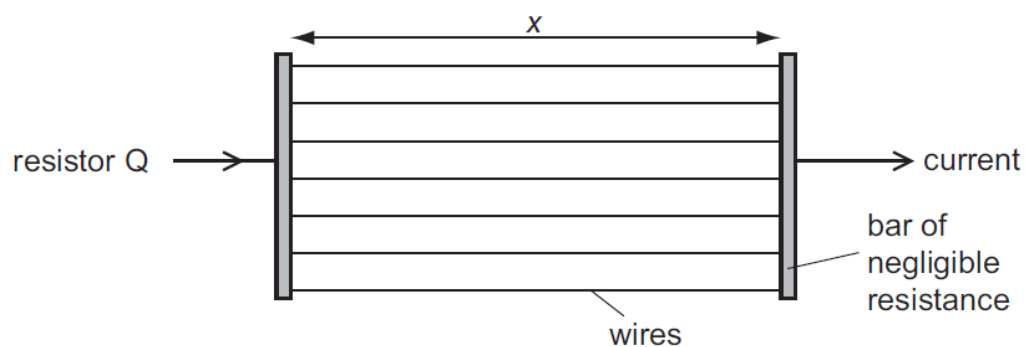
**32** Which equation is used to define resistance?

- A**  $\text{energy} = (\text{current})^2 \times \text{resistance} \times \text{time}$
- B**  $\text{potential difference} = \text{current} \times \text{resistance}$
- C**  $\text{power} = (\text{current})^2 \times \text{resistance}$
- D**  $\text{resistivity} = \text{resistance} \times \text{area} \div \text{length}$

- 33 A researcher has two pieces of copper of the same volume. All of the first piece is made into a cylindrical resistor P of length  $x$ .



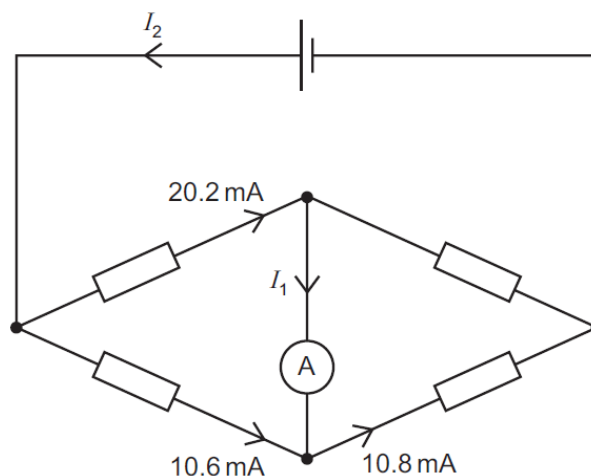
All of the second piece is made into uniform wires each of the same length  $x$  which he connects between two bars of negligible resistance to form a resistor Q.



How do the electrical resistances of P and Q compare?

- A P has a larger resistance than Q.
- B Q has a larger resistance than P.
- C P and Q have equal resistance.
- D Q may have a larger or smaller resistance than P, depending on the number of wires made.

34 The diagram represents a circuit.



Some currents have been shown on the diagram.  
What are the currents  $I_1$  and  $I_2$ ?

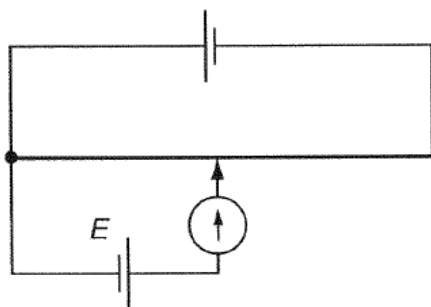
- |          | $I_1$   | $I_2$   |
|----------|---------|---------|
| <b>A</b> | 0.2 mA  | 10.8 mA |
| <b>B</b> | 0.2 mA  | 30.8 mA |
| <b>C</b> | -0.2 mA | 20.0 mA |
| <b>D</b> | -0.2 mA | 30.8 mA |

35 Each of Kirchhoff's laws is linked to the conservation of a physical quantity. What physical quantity is assumed to be conserved in the formulation of Kirchhoff's first law and of Kirchhoff's second law?

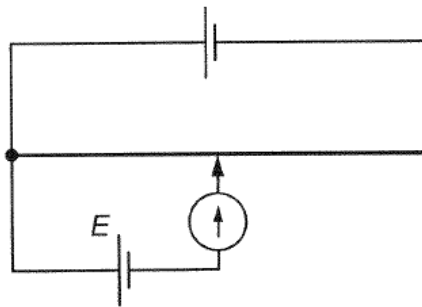
	Kirchhoff's first law	Kirchhoff's second law
<b>A</b>	Energy	Charge
<b>B</b>	Energy	Momentum
<b>C</b>	Charge	Energy
<b>D</b>	Momentum	Energy

- 36 The unknown e.m.f. of a cell is to be determined using a potentiometer circuit. The balance length is to be measured when the galvanometer records a null reading. What is the correct circuit to use?

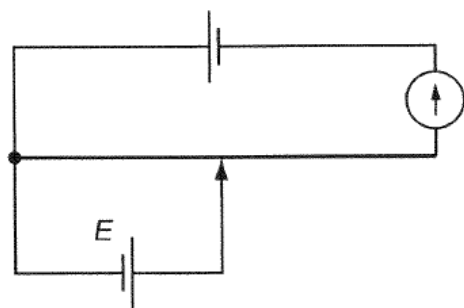
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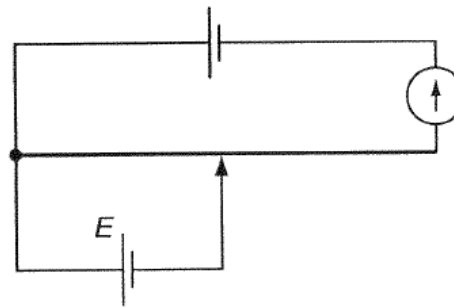
B



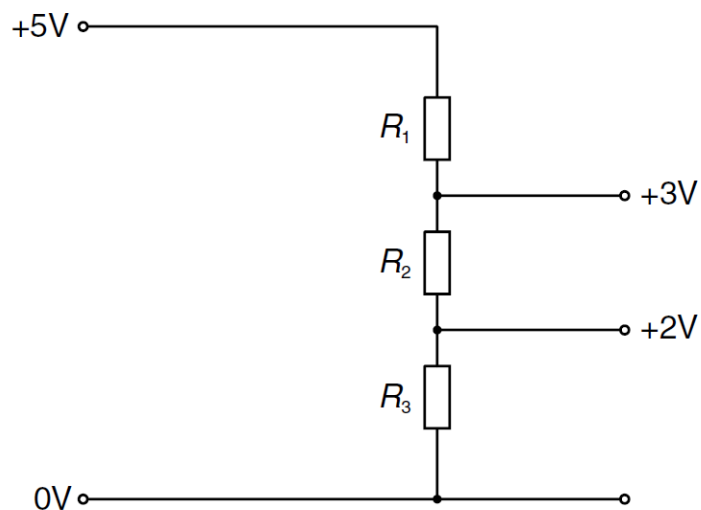
C



D



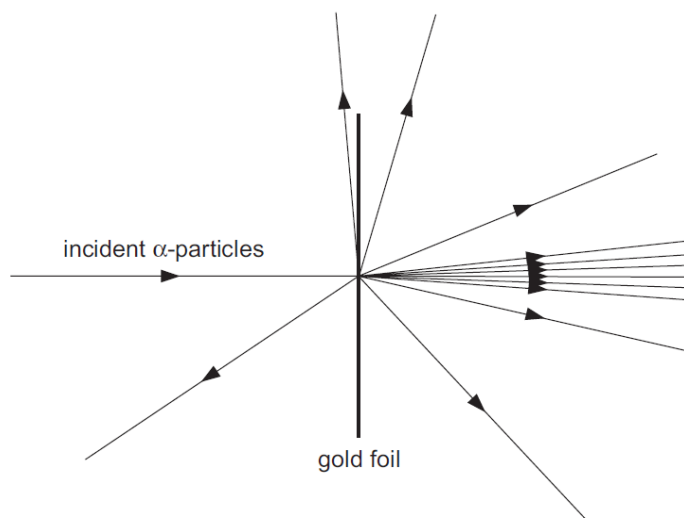
- 37 A potential divider is used to give outputs of 2 V and 3V from a 5 V source, as shown.



What are possible values for the resistances  $R_1$ ,  $R_2$  and  $R_3$ ?

	$R_1/\text{k}\Omega$	$R_2/\text{k}\Omega$	$R_3/\text{k}\Omega$
<b>A</b>	2	1	5
<b>B</b>	3	2	2
<b>C</b>	4	2	4
<b>D</b>	4	6	10

38 A thin gold foil is bombarded with  $\alpha$ -particles as shown.



What can be deduced from this experiment?

- A the binding energy of a gold nucleus
- B the energy levels of electrons in gold atoms
- C the small size of a gold nucleus
- D the structure of a gold nucleus

39 The symbol  ${}_{32}^{77}\text{Ge}$  represents a nucleus of germanium that decays to a nucleus of arsenic by emitting a  $\beta$ -particle.

What is the symbol of this arsenic nucleus?

- A  ${}_{32}^{76}\text{As}$       B  ${}_{32}^{78}\text{As}$       C  ${}_{31}^{78}\text{As}$       D  ${}_{33}^{77}\text{As}$

40 The following particles are each accelerated from rest through the same potential difference. Which one will have the least momentum?

- A  $\alpha$ -particle
- B electron
- C lithium ion
- D proton