



22066516

**PHYSICS**  
**STANDARD LEVEL**  
**PAPER 1**

Tuesday 9 May 2006 (afternoon)

45 minutes

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**INSTRUCTIONS TO CANDIDATES**

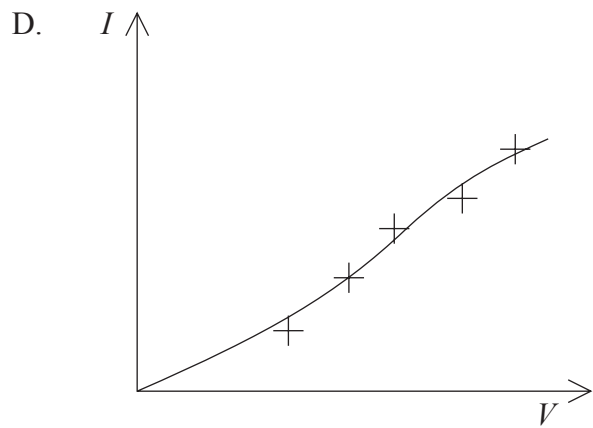
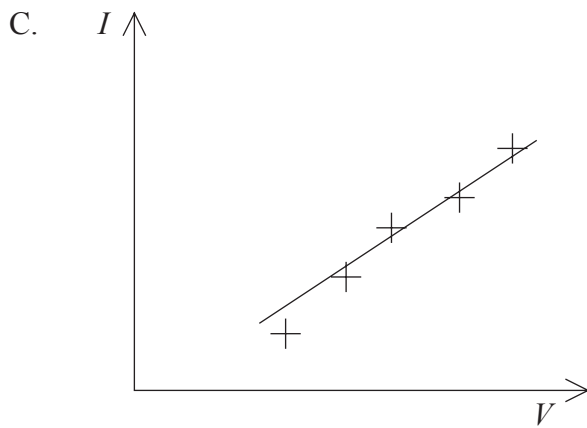
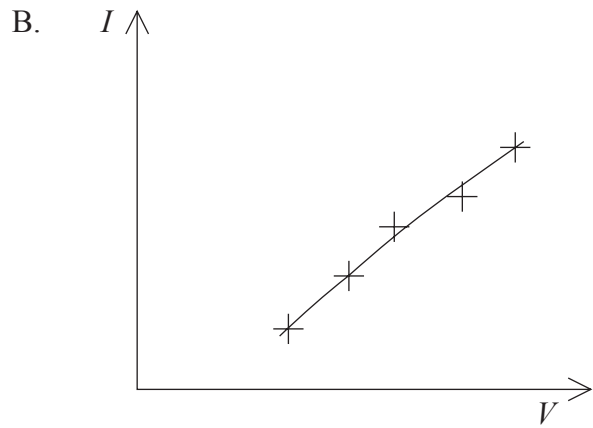
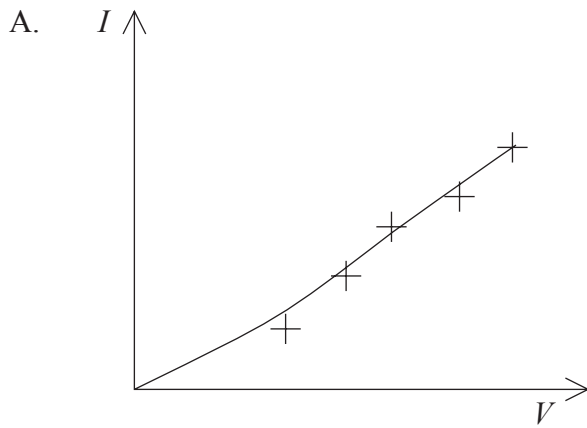
- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.

1. The mass of an electron is  $9.1 \times 10^{-31}$  kg and that of a proton is  $1.7 \times 10^{-27}$  kg. Which **one** of the following is the difference in the order of magnitude of the masses of the electron and the proton?
- A. 10.8
  - B. 7.4
  - C. 5.4
  - D. 3

2. Sub-multiples of units may be expressed using a prefix. Which **one** of the following lists the prefixes in **decreasing** order of magnitude?

A.	centi-	micro-	milli-	nano-
B.	milli-	centi-	nano-	micro-
C.	centi-	milli-	micro-	nano-
D.	milli-	micro-	centi-	nano-

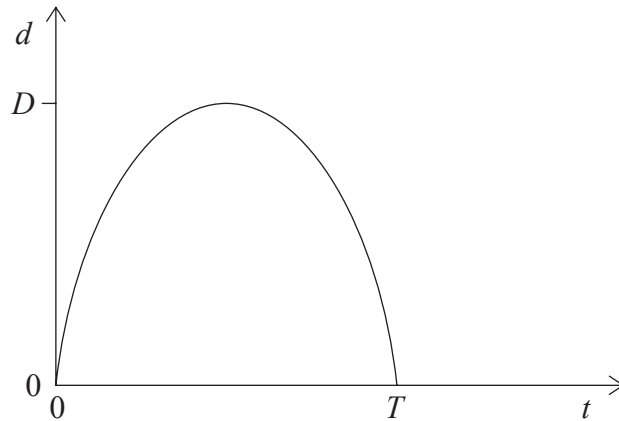
3. Values of current  $I$  in an electrical component and of the corresponding potential difference  $V$  across the component are plotted on a graph. Error bars for each point have been included. Which **one** of the following shows the best-fit line for the plotted points?



4. Which **one** of the following includes three vector quantities?

A.	velocity	weight	field strength
B.	weight	mass	field strength
C.	velocity	energy	weight
D.	mass	energy	field strength

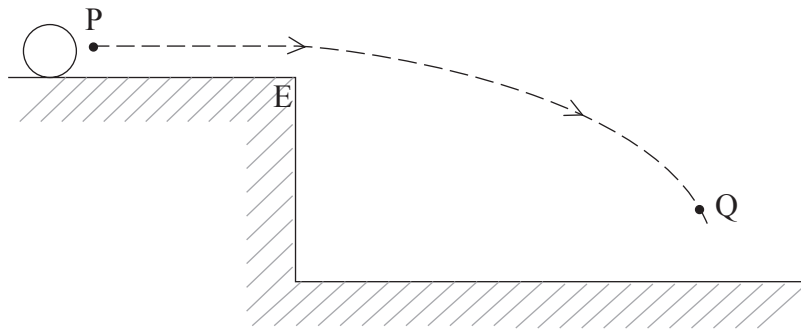
5. A ball is thrown vertically upwards from the ground. The graph shows the variation with time  $t$  of the vertical displacement  $d$  of the ball.



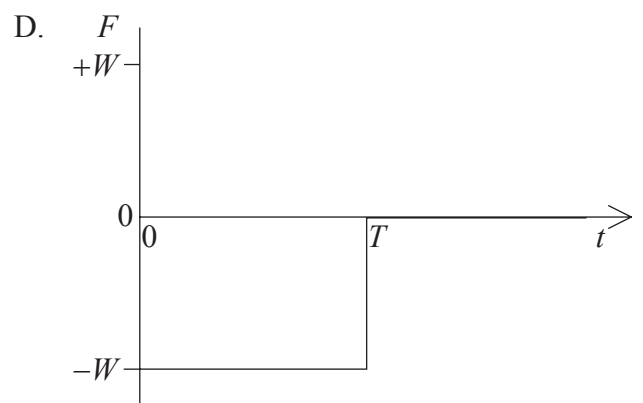
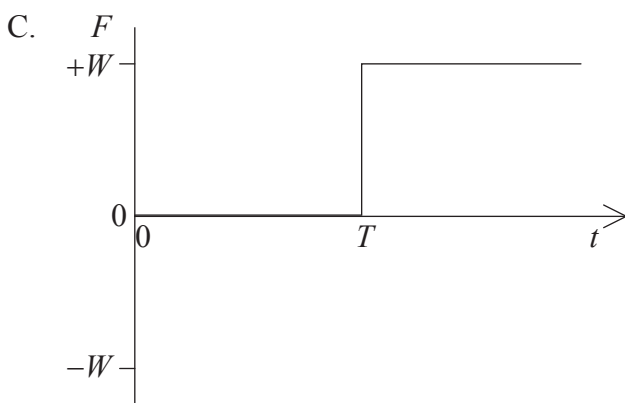
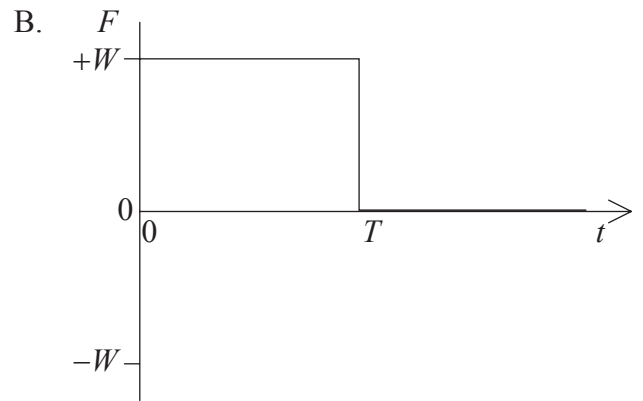
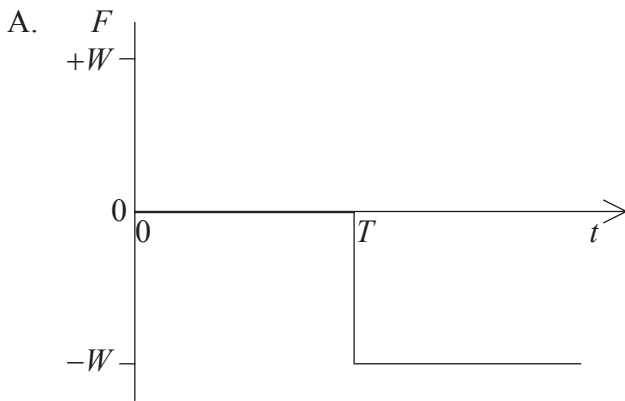
Which **one** of the following gives the final displacement after time  $T$  and the average speed between time  $t = 0$  and time  $t = T$ ?

	<b>Displacement</b>	<b>Average speed</b>
A.	0	0
B.	0	$\frac{2D}{T}$
C.	$2D$	$\frac{2D}{T}$
D.	$2D$	0

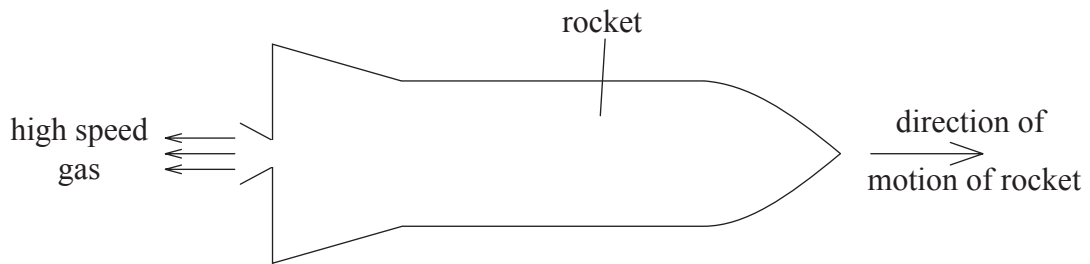
6. A ball of weight  $W$  slides along a frictionless surface as shown below.



At time  $T$ , the ball has moved from point P to the edge E of the surface. The ball then falls freely to point Q. Which graph best shows the variation with time  $t$  of the **resultant upward** vertical force  $F$  acting on the ball between point P and point Q?



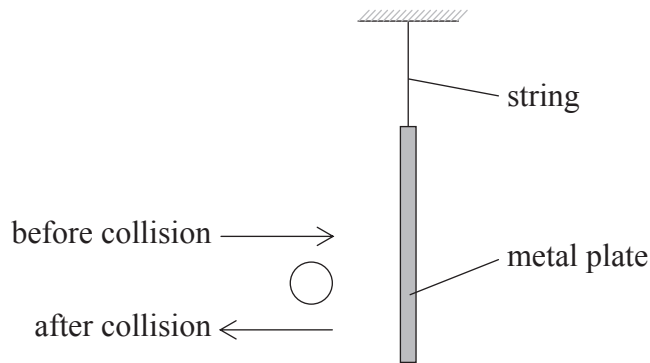
7. The engine of a rocket ejects gas at high speed, as shown below.



The rocket accelerates forwards because

- A. the momentum of the gas is equal but opposite in direction to the momentum of the rocket.
  - B. the gas pushes on the air at the back of the rocket.
  - C. the change in momentum of the gas gives rise to a force on the rocket.
  - D. the ejected gas creates a region of high pressure behind the rocket.
8. Which **one** of the following is the condition necessary for an object to be in translational equilibrium?
- A. The lines of action of all the forces acting on the object must pass through a single point.
  - B. Every force must be balanced by another force that is equal in magnitude but opposite in direction.
  - C. The resultant of all the forces acting on the object in any direction must be zero.
  - D. The total upward force on the object must be equal to the total downward force.

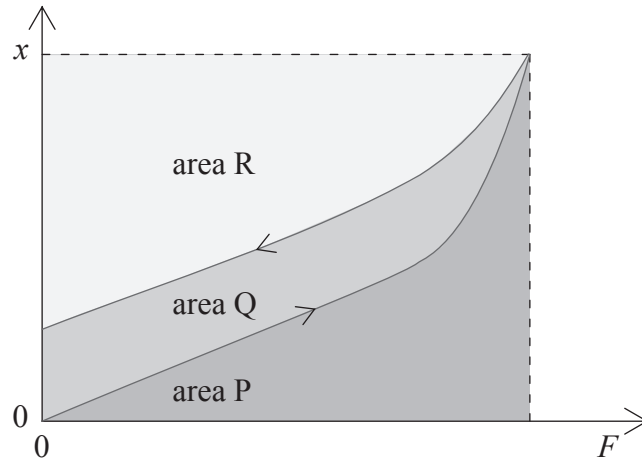
9. A frictionless trolley of mass  $m$  moves down a slope with a constant acceleration  $a$ . A second similar frictionless trolley has mass  $2m$ . The acceleration of the second trolley as it moves down the slope is
- A.  $\frac{1}{2}a$ .
- B.  $a$ .
- C.  $2a$ .
- D.  $4a$ .
10. A stationary metal plate is hanging freely on a string. A steel ball, travelling horizontally, hits the plate. The speed of the ball after the collision is less than before, but still in a horizontal direction, as shown below.



Which **one** of the following gives a correct statement, with a valid reason, about the type of collision between the ball and the plate?

	Type of collision	Reason
A.	inelastic	The sphere has changed its momentum during the collision.
B.	inelastic	The sphere has lost kinetic energy during the collision.
C.	unknown	The change in momentum of the plate during the collision is unknown.
D.	unknown	The kinetic energy of the plate after the collision is unknown.

11. A force stretches a wire that is fixed at one end. The value of this force increases from zero to a maximum value and then returns to zero. The graph below shows the variation with force  $F$  of the extension  $x$  of the wire.

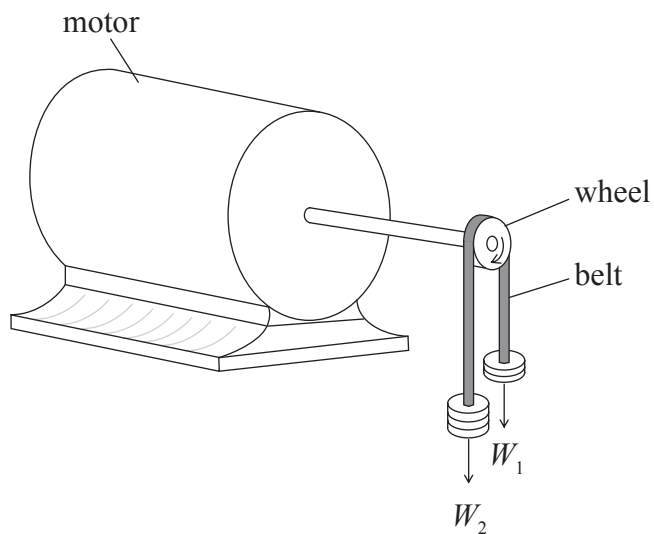


Which area, or areas, represents the net work done on the wire by the force?

- A. Area P
- B. Area Q
- C. Area R
- D. Area Q and area R



12. The output power of an electric motor is determined using the arrangement shown below.

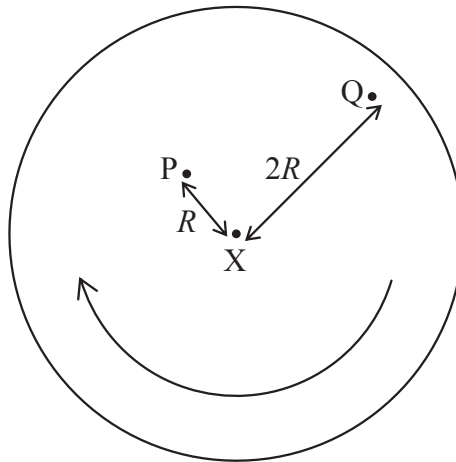


The belt has weights  $W_1$  and  $W_2$  attached to its ends. The wheel has circumference  $S$ . When the wheel is rotating at  $R$  revolutions per second, the belt is stationary.

Which **one** of the following is a correct expression for the output power of the motor?

- A.  $W_1 \times SR$
- B.  $W_2 \times SR$
- C.  $(W_2 - W_1) \times SR$
- D.  $(W_2 + W_1) \times SR$

13. Points P and Q are at distances  $R$  and  $2R$  respectively from the centre X of a disc, as shown below.



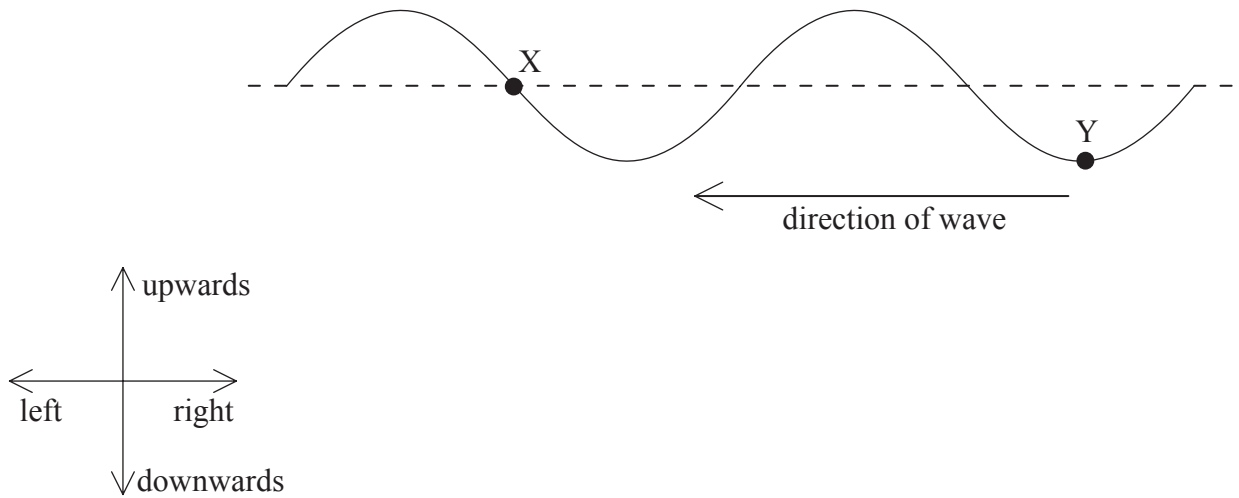
The disc is rotating about an axis through X, normal to the plane of the disc. Point P has linear speed  $v$  and centripetal acceleration  $a$ . Which **one** of the following is correct for point Q?

	Linear speed	Centripetal acceleration
A.	$v$	$a$
B.	$v$	$2a$
C.	$2v$	$2a$
D.	$2v$	$4a$

14. A lump of metal is initially at a temperature of  $100^\circ\text{C}$ . The metal is heated so that its temperature rises by  $\theta$  degrees, as measured on the Celsius scale. The rise in temperature, as measured on the Kelvin scale is
- A.  $\theta - 273$ .
  - B.  $\theta$ .
  - C.  $\theta + 273$ .
  - D.  $\theta + 373$ .

15. Metals are, in general, better thermal conductors than non-metals. The explanation for this difference is that, in a metal, the main mechanism by which energy is transferred is by
- A. lattice vibrations.
  - B. free electrons.
  - C. positive ions.
  - D. photons.
16. A large mass  $M$  of ice of specific latent heat  $L$  is at its melting point ( $0^\circ\text{C}$ ). A small mass  $m$  of water at  $\theta^\circ\text{C}$  is poured on to the block of ice. The specific heat capacity of water is  $S$ . Which **one** of the following is a correct expression for the mass of ice melted?
- A.  $\frac{mL}{S\theta}$
  - B.  $\frac{mS\theta}{L}$
  - C.  $\frac{MS\theta}{L}$
  - D.  $\frac{ML}{S\theta}$
17. The nuclear notation for lithium-7 is  ${}^7_3\text{Li}$ . Which **one** of the following is the mass of 1 mol of lithium-7?
- A. 10 g
  - B. 7 g
  - C. 4 g
  - D. 3 g

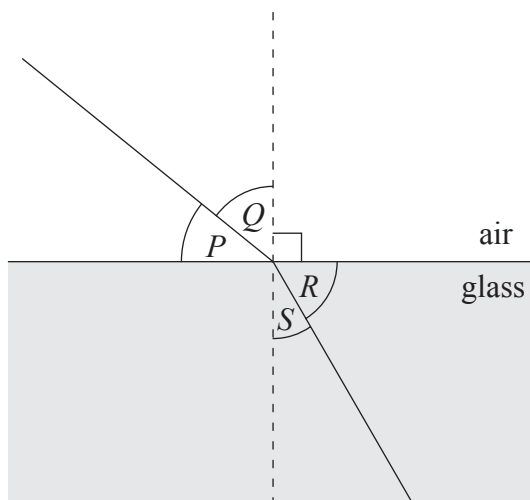
18. The diagram below shows a transverse wave on a string. The wave is moving from right to left.



In the position shown, point X has zero displacement and point Y is at a position of maximum displacement. Which **one** of the following gives the subsequent direction of motion of point X and of point Y?

	<b>Point X</b>	<b>Point Y</b>
A.	left	left
B.	upwards	upwards
C.	downwards	left
D.	downwards	upwards

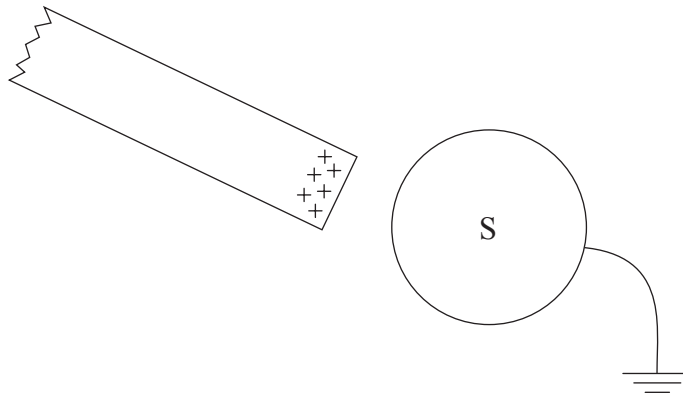
19. Light is incident on an air-glass boundary as shown below.



Which **one** of the following is a correct statement of Snell's law?

- A.  $\sin P = \text{constant} \times \sin R$
  - B.  $\sin P = \text{constant} \times \sin S$
  - C.  $\sin Q = \text{constant} \times \sin R$
  - D.  $\sin Q = \text{constant} \times \sin S$
20. Which **one** of the following correctly describes wave speed when referring to a standing wave?
- A. The difference in speed of the two travelling waves that give rise to the standing wave.
  - B. The speed of one of the travelling waves that gives rise to the standing wave.
  - C. The speed of transfer of energy between neighbouring internodal loops of the standing wave.
  - D. Maximum speed of a particle at an antinode of the standing wave.

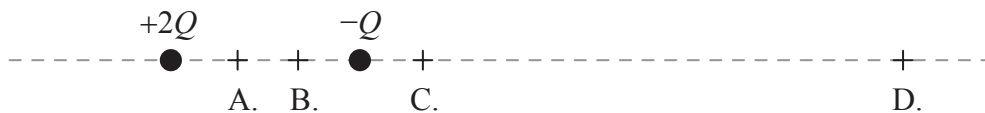
21. A positively charged rod is brought close to an earthed sphere S, as shown below.



The earth connection to the sphere is removed and then the charged rod is removed. The sphere S is found to be negatively charged. Which **one** of the following describes the material of S and the movement of charge between S and earth?

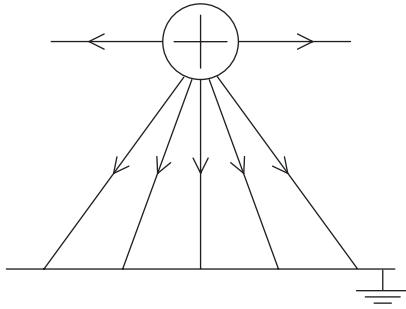
	Material of S	Movement of charge
A.	conductor	negative charge moves from earth to S
B.	insulator	negative charge moves from earth to S
C.	conductor	positive charge moves from S to earth
D.	insulator	positive charge moves from S to earth

22. Two charges of magnitude  $+2Q$  and  $-Q$  are situated as shown below. At which point is the electric field due to the two charges most likely to be zero?

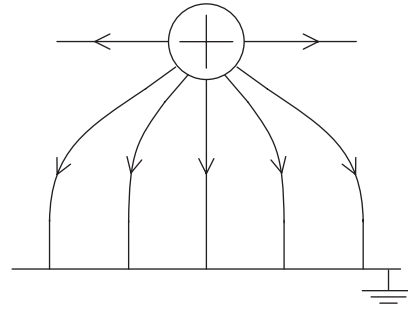


23. Which diagram below best represents the electric field pattern between a positively charged conducting sphere and an earthed metal plate?

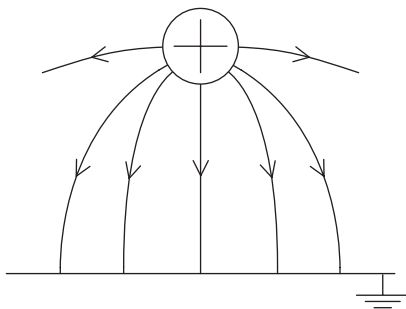
A.



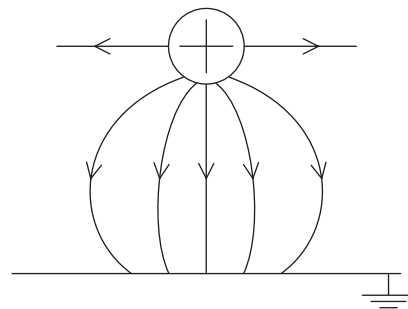
B.



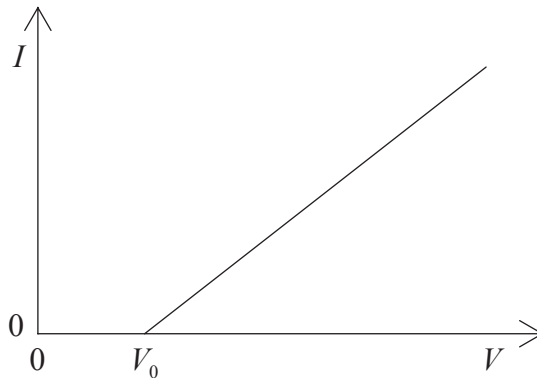
C.



D.



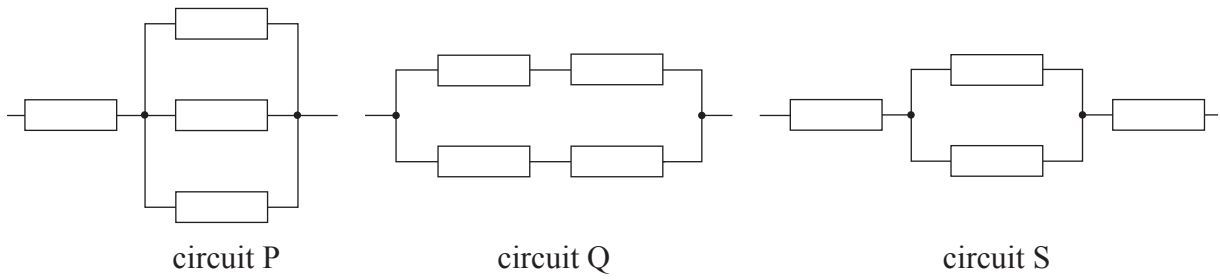
24. The graph below shows the variation with potential difference  $V$  of the current  $I$  in an electrical component.



Which **one** of the following is a correct statement about the resistance of the component?

- A. For potential differences greater than  $V_0$ , the resistance is constant.
- B. For potential differences greater than  $V_0$ , the resistance decreases with increasing potential difference.
- C. The variation of current with potential difference is linear and so Ohm's law is obeyed.
- D. For potential differences less than  $V_0$ , the resistance is zero.

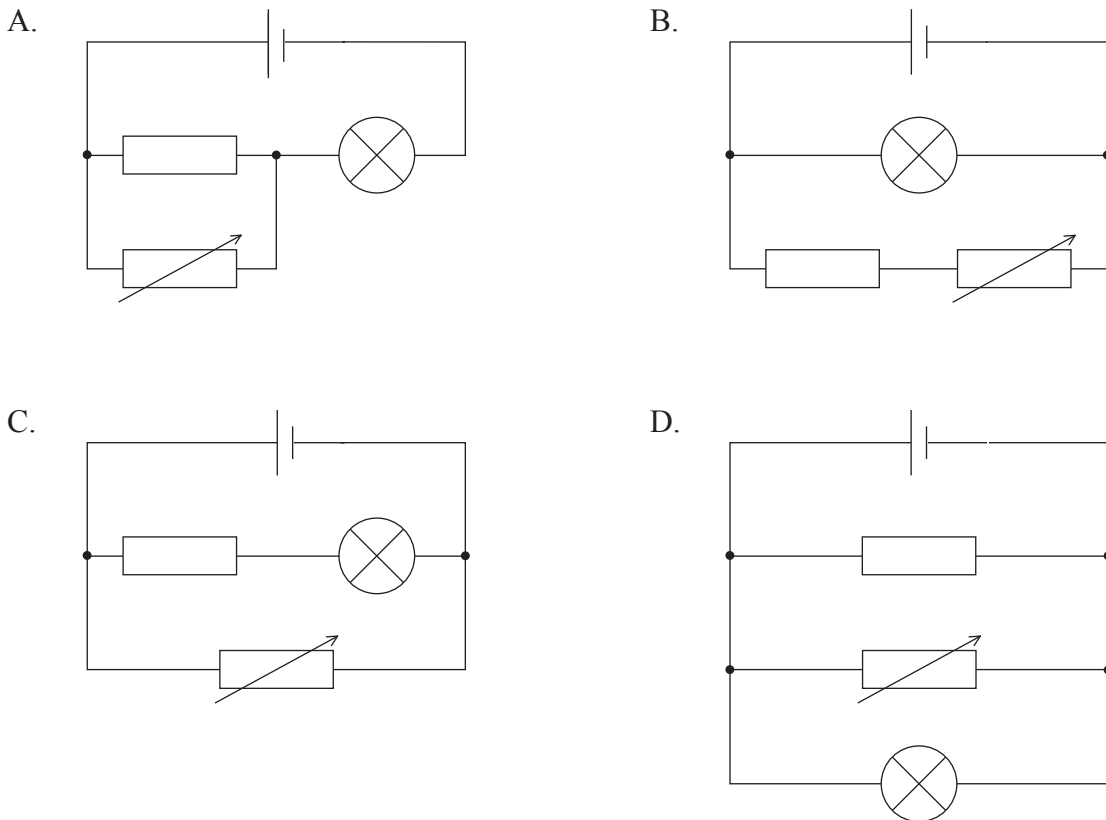
25. The resistors in each of the circuits shown below each have the same resistance.



Which of the following gives the circuits in order of **increasing** total resistance?

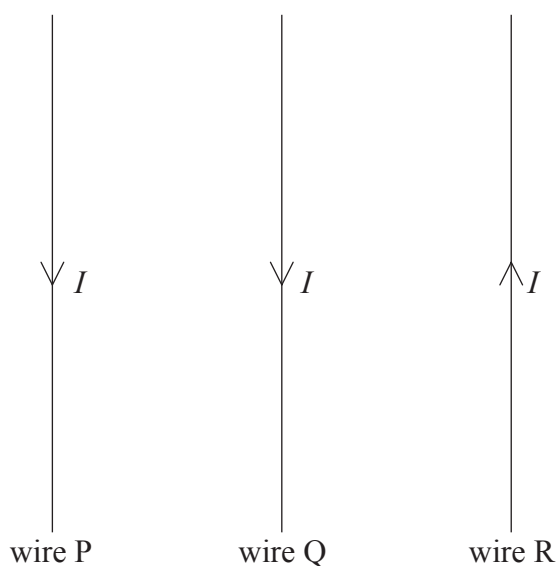
- A. P    Q    S
- B. Q    P    S
- C. S    Q    P
- D. P    S    Q

26. In which **one** of the circuits is it possible to vary the current in the lamp by adjusting the variable resistor? The cell has negligible internal resistance.





27. The diagram below shows three parallel wires P, Q and R that are equally spaced.



The currents in the wires are each of the same magnitude  $I$  and are in the directions shown. The resultant force on wire Q due to the current in wire P and in wire R is

- A. perpendicular and into the plane of the paper.
  - B. perpendicular and out of the plane of the paper.
  - C. in the plane of the paper to the right.
  - D. in the plane of the paper to the left.
28. The nuclear notation for cadmium-114 is  $^{114}_{48}\text{Cd}$ . Which **one** of the following correctly shows the composition of this nucleus?

	Number of protons	Number of neutrons	Number of nucleons
A.	48	66	114
B.	48	114	162
C.	66	48	114
D.	66	48	162

29. A sample of a radioactive isotope of half-life  $T_{\frac{1}{2}}$  initially contains  $N$  atoms. Which **one** of the following gives the number of atoms of this isotope that have **decayed** after a time  $3T_{\frac{1}{2}}$ ?

A.  $\frac{1}{8}N$

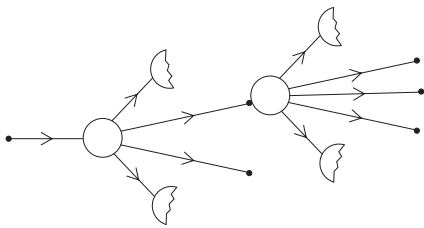
B.  $\frac{1}{3}N$

C.  $\frac{2}{3}N$

D.  $\frac{7}{8}N$

30. Which **one** of the following diagrams best illustrates the first two stages of an uncontrolled fission chain reaction?

A.



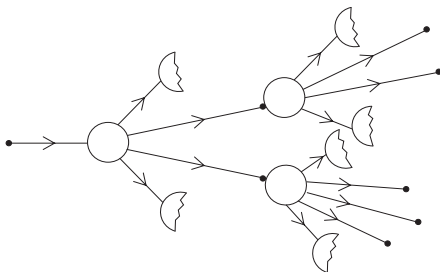
**Key:**

• neutron

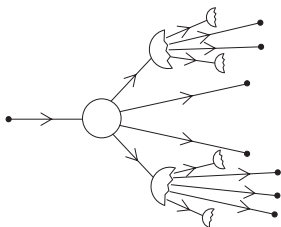
○ uranium nucleus

☾ fission fragment

B.



C.



D.

