Electricity-practice-2-MC *[57 marks]*

1. Which of the following is a statement of Ohm’s law? *[1 mark]*

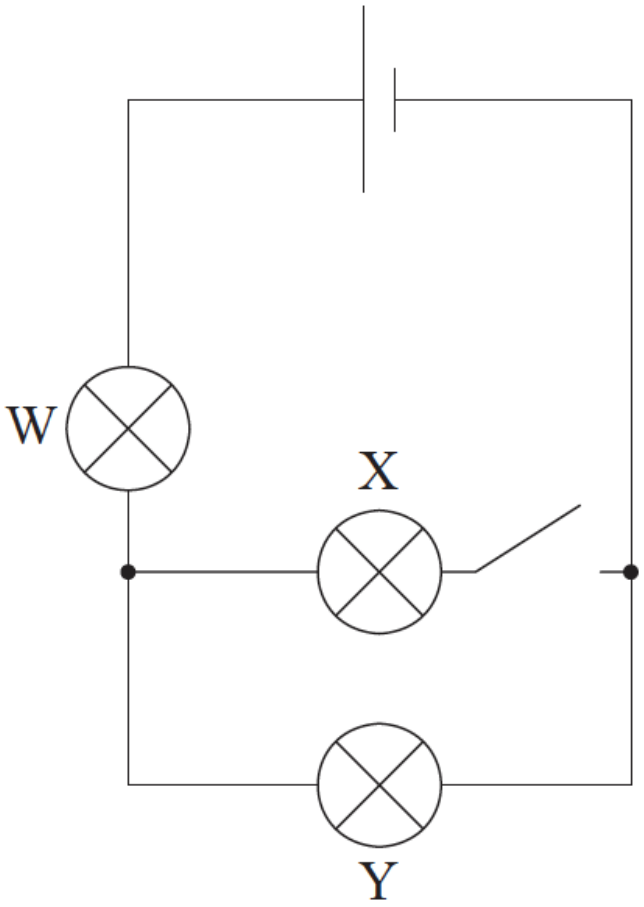
   A. The resistance of a conductor is constant.

   B. The current in a conductor is inversely proportional to the potential difference across the conductor provided the temperature is constant.

   C. The resistance of a conductor is constant provided that the temperature is constant.

   D. The current in a conductor is proportional to the potential difference across it.

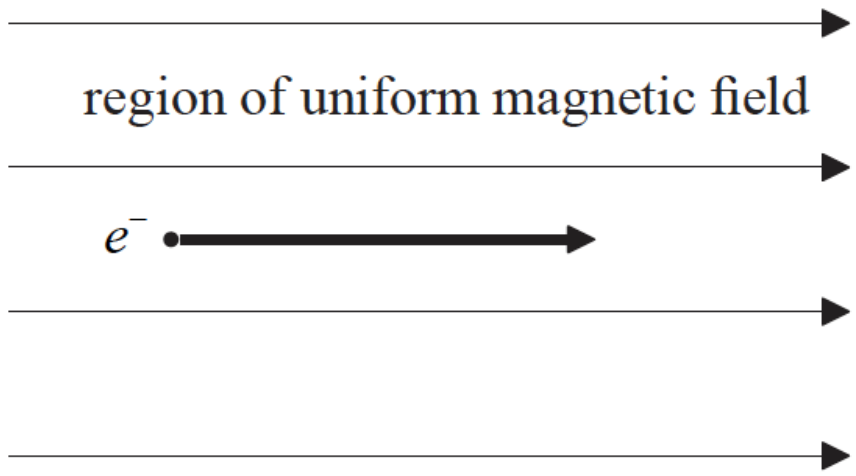
2. Three identical filament lamps W, X and Y are connected in the circuit as shown. The cell has negligible internal resistance. *[1 mark]*



When the switch is closed, all the lamps light. Which of the following correctly describes what happens to the brightness of lamp W and lamp Y when the switch is opened?

	Lamp W	Lamp Y
A.	decreases	decreases
B.	increases	decreases
C.	decreases	increases
D.	increases	increases

3. An electron is travelling in a region of uniform magnetic field. At the instant shown, the electron is moving parallel to the field direction. *[1 mark]*



The magnetic force on the electron is

A. upwards.

B. downwards.

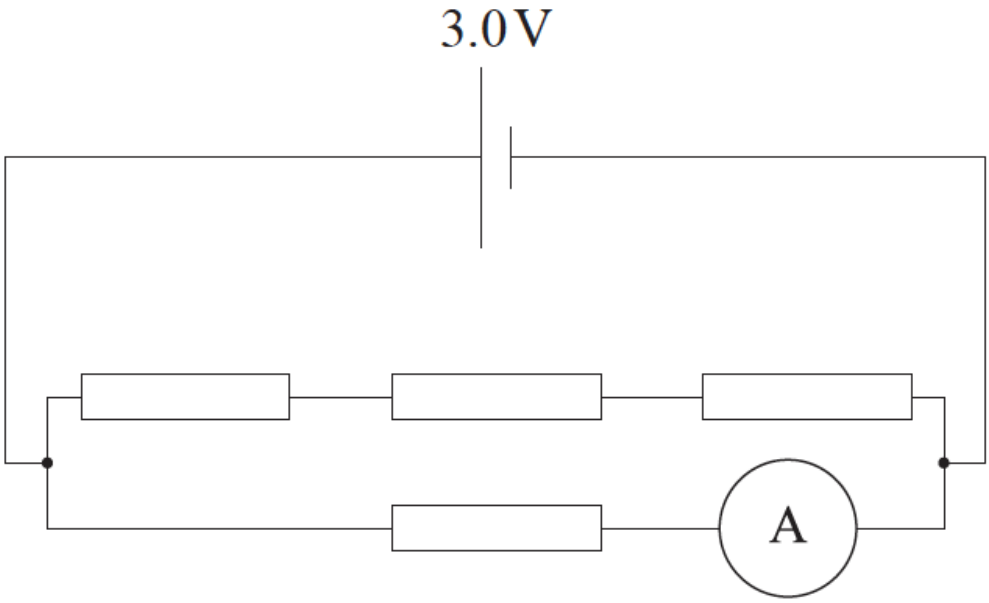
C. to the right.

D. zero.

4. A resistor X of resistance R is made of wire of length L and cross-sectional area A. Resistor Y is made of the same material but has a length $4L$ and a cross-sectional area $2A$. X and Y are connected in series. What is the total resistance of the combination? *[1 mark]*

A. $1.5R$
B. $2R$
C. $3R$
D. $9R$

5. Each of the resistors in the circuit has a resistance of 2.0 Ω. The cell has an emf of 3.0 V and negligible internal resistance. The ammeter has negligible resistance. *[1 mark]*

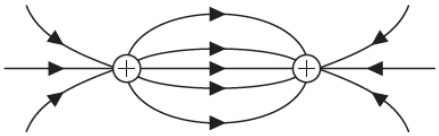


What is the ammeter reading?

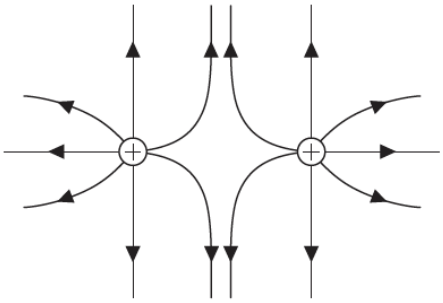
A. 0.4 A
B. 0.5 A
C. 1.5 A
D. 2.0 A

6. Which diagram represents the pattern of electric field lines of two small positive point charges held at the positions shown? *[1 mark]*

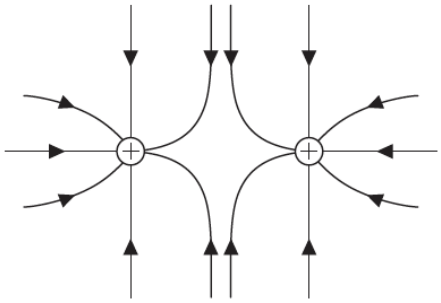
A.



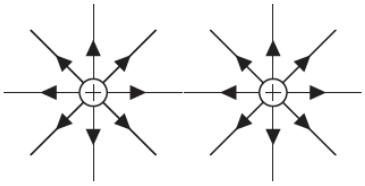
B.



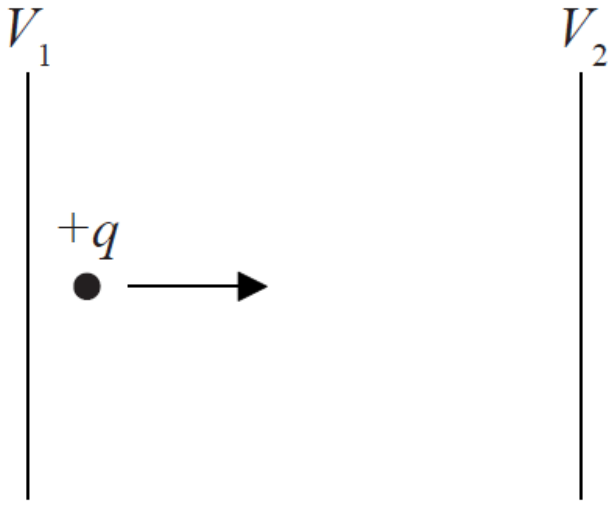
C.



D.



7. A particle with positive charge $+q$ moves freely from one plate held at potential V_1 to another plate held at potential V_2. *[1 mark]*



Which of the following is the electric potential energy lost by the charge?

A. qV_1

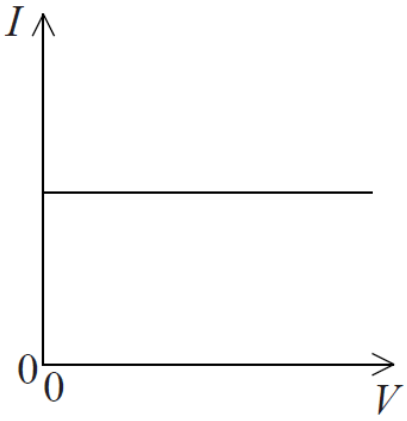
B. qV_2

C. $q(V_1+V_2)$

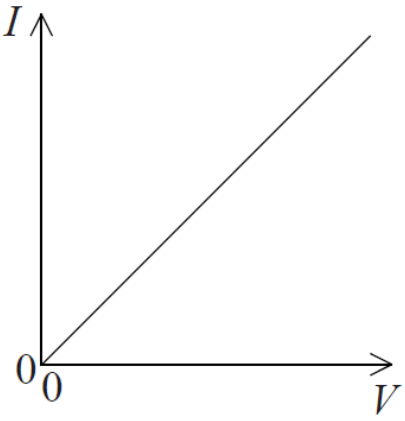
D. $q(V_1-V_2)$

8. Which of the following graphs shows the relationship between current I and voltage V for a filament lamp? *[1 mark]*

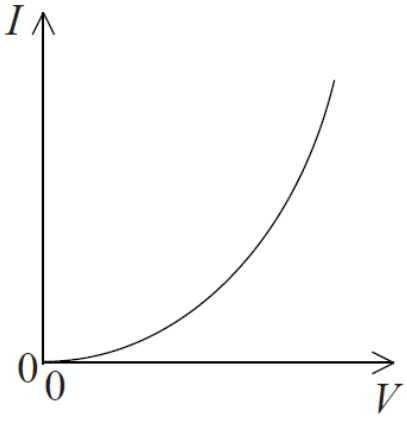
A.



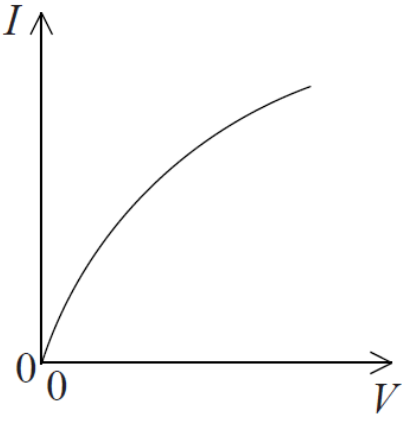
B.



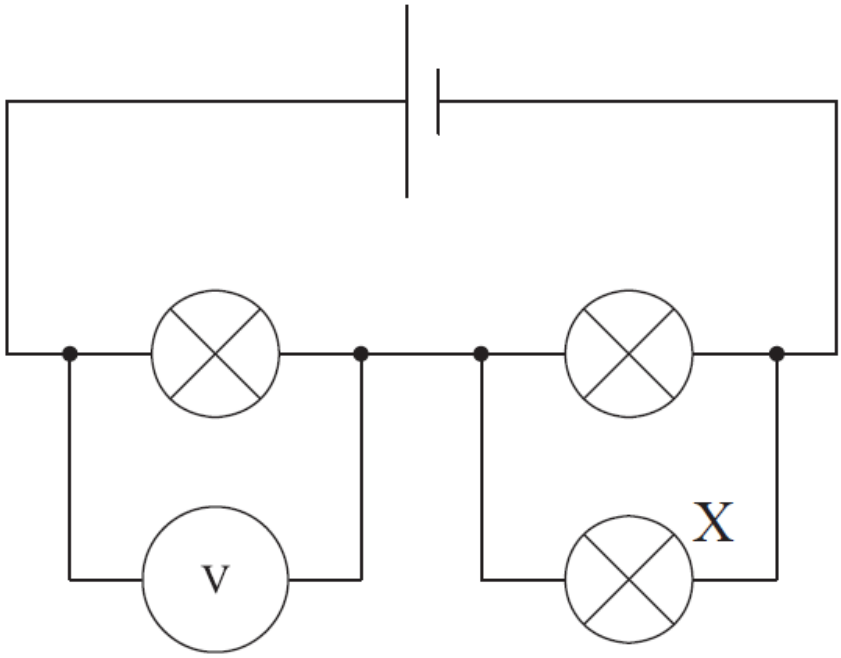
C.



D.



9. A cell of negligible internal resistance is connected to three identical lamps. A voltmeter is connected across one of the lamps. *[1 mark]*



If the filament in lamp X breaks, the reading on the voltmeter will

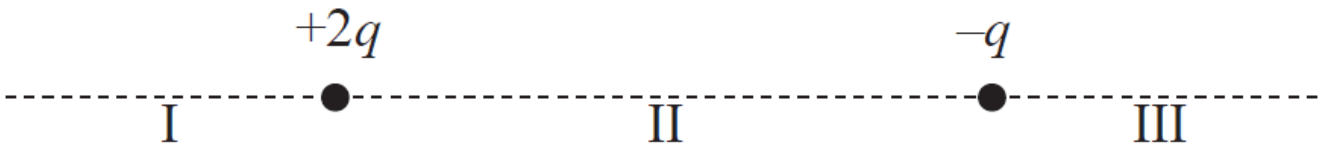
A. become zero.

B. decrease.

C. stay the same.

D. increase.

10. Two point charges of size $+2q$ and $-q$ are placed as shown below. In which of the regions I, II and III can the resultant electric field strength be zero? *[1 mark]*



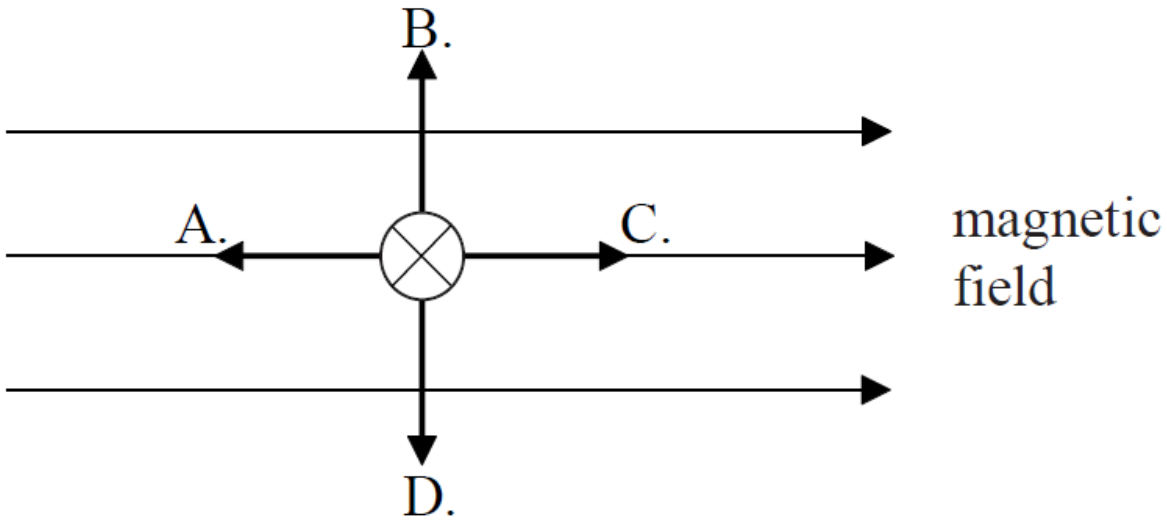
A. I only

B. II only

C. III only

D. I and III only

11. A wire is placed in a magnetic field which is directed to the right. The wire carries a current directed into the page. Which of the following is the direction of the force on the wire? *[1 mark]*



12. A copper wire with length *L* and radius *r* has a resistance *R*. *[1 mark]*

What is the radius of a copper wire with length $\frac{L}{2}$ and resistance *R*?

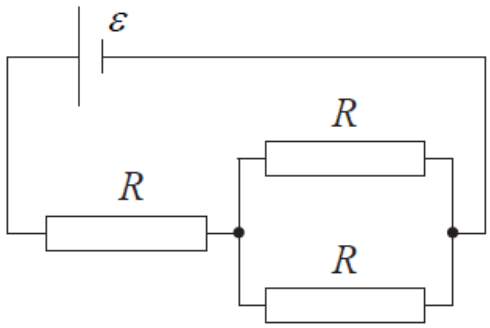
A. $2r$

B. $\sqrt{2}r$

C. $\frac{r}{\sqrt{2}}$

D. $\frac{r}{2}$

13. An electric circuit consists of three identical resistors of resistance R connected to a cell of emf ε and negligible internal resistance. *[1 mark]*



What is the magnitude of the current in the cell?

A. $\frac{\varepsilon}{3R}$

B. $\frac{2\varepsilon}{3R}$

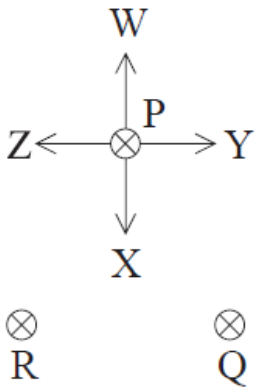
C. $\frac{3\varepsilon}{2R}$

D. $\frac{3\varepsilon}{R}$

14. A proton is accelerated from rest through a potential difference of 1000 V. *[1 mark]* What is the potential difference through which an alpha particle must be accelerated to gain the same kinetic energy as the accelerated proton?

A. 4000 V
B. 2000 V
C. 500 V
D. 250 V

15. Three wires, P, Q and R, carry equal currents directed into the plane of the paper. *[1 mark]*



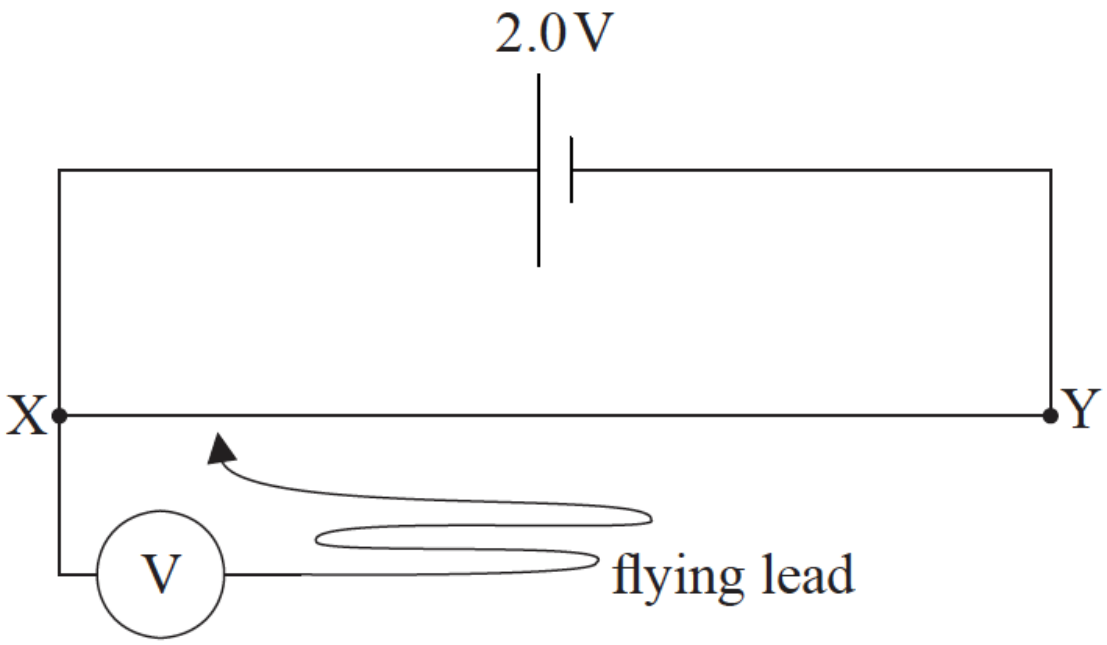
Which arrow correctly identifies the direction of the magnetic force on wire P?

A. W
B. X
C. Y
D. Z

16. An ideal ammeter is used to measure the current in a resistor. Which of the following gives the resistance of an ideal ammeter and the way it is connected to the resistor? *[1 mark]*

	Resistance	Connection
A.	infinite	in parallel
B.	infinite	in series
C.	zero	in parallel
D.	zero	in series

17. A cell with an emf of 2.0 V and negligible internal resistance is connected across a 1.00 m length of uniform resistance wire XY. The free end of the flying lead can be connected to any position on the wire. *[1 mark]*



What is the voltmeter reading when the flying lead is connected 0.25m from end X?

A. 0.00 V
B. 0.50 V
C. 1.50 V
D. 2.00 V

18. An electron has a kinetic energy of 4.8×10^{-10}J. What is the equivalent value of this kinetic energy? *[1 mark]*

A. 3.0 eV
B. 3.0 keV
C. 3.0 MeV
D. 3.0 GeV

19. The magnetic field produced by a current in a straight wire is in *[1 mark]*

A. the same direction as the current.
B. the opposite direction to the current.
C. the same plane as the wire.
D. any plane perpendicular to the wire.

20. The ampere is defined in terms of *[1 mark]*

A. power dissipated in a wire of known length, cross-sectional area and resistivity.

B. potential difference across a resistance of known value.

C. number of electrons flowing past a point in a circuit in a given time.

D. force per unit length between parallel current-carrying conductors.

21. A battery of emf 6.0V is connected to a 2.0Ω resistor. The current in the circuit is 2.0A. The internal resistance of the battery is *[1 mark]*

A. zero.

B. 1.0 Ω.

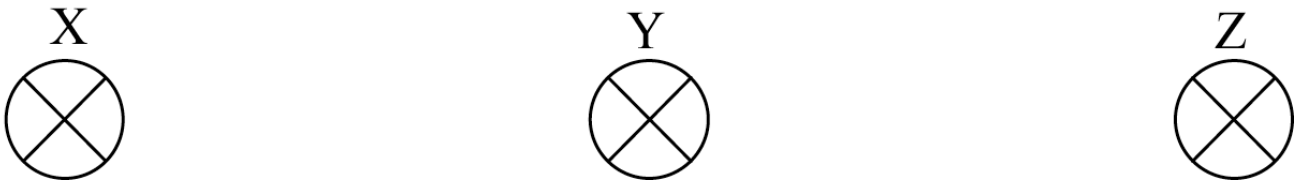
C. 3.0 Ω.

D. 4.0 Ω.

22. Which of the following gives the resistances of an ideal ammeter and an ideal voltmeter? *[1 mark]*

	Resistance of ideal ammeter	Resistance of ideal voltmeter
A.	infinite	infinite
B.	zero	infinite
C.	infinite	zero
D.	zero	zero

23. Three parallel wires, X, Y and Z, carry equal currents into the page. *[1 mark]*



Which arrow represents the direction of the magnetic force on wire Z?

A. 

B. 

C. 

D. 

24. A metal wire X with length L and radius r has a resistance R. A wire Y of length $4L$ made from the same material as X has the same resistance R. What is the radius of Y? *[1 mark]*

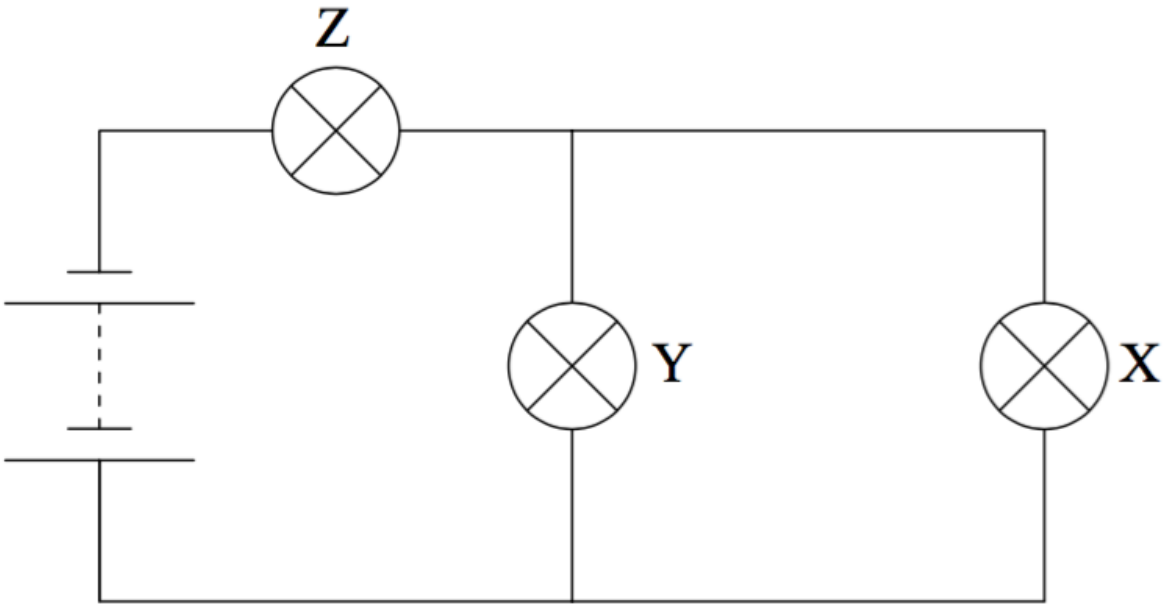
A. $2r$

B. $4r$

C. $\frac{r}{2}$

D. $\frac{r}{4}$

25. Three identical filament lamps, X, Y and Z, are connected as shown to a battery of negligible internal resistance. *[1 mark]*



The filament of lamp X breaks. Which of the following correctly describes the change in brightness of lamp Y and of lamp Z?

	Lamp Y	Lamp Z
A.	increase	increase
B.	decrease	increase
C.	increase	decrease
D.	decrease	decrease

26. Which of the following is the correct way of connecting an ammeter and of connecting a voltmeter in a circuit designed to measure the characteristics of a thermistor? *[1 mark]*

	Ammeter	Voltmeter
A.	in series with thermistor	in series with thermistor
B.	in parallel with thermistor	in series with thermistor
C.	in series with thermistor	in parallel with thermistor
D.	in parallel with thermistor	in parallel with thermistor

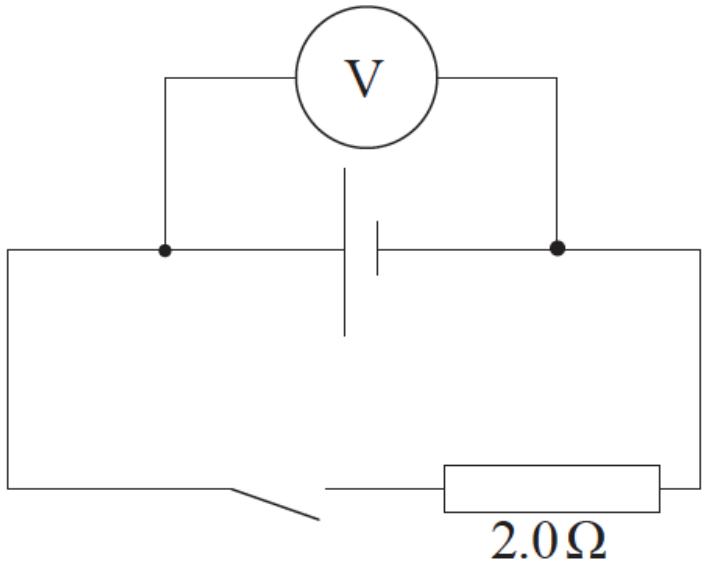
27. Coulomb's law refers to electric charges that are *[1 mark]*

A. on any charged objects.
B. charged hollow spheres.
C. charged solid spheres.
D. point charges.

28. Which of the following will **not** give rise to a magnetic field? *[1 mark]*

A. A moving electron
B. A moving neutron
C. A proton and electron moving away from each other
D. A proton and electron moving towards each other

29. A cell is connected in series with a 2.0Ω resistor and a switch. The voltmeter is connected across the cell and reads 12V when the switch is open and 8.0V when the switch is closed. *[1 mark]*



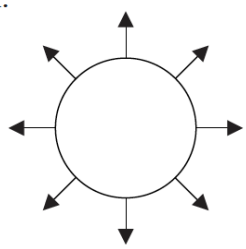
What is the internal resistance of the cell?

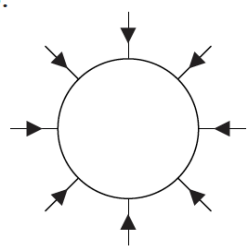
A. 1.0 Ω
B. 2.0 Ω
C. 3.0 Ω
D. 4.0 Ω

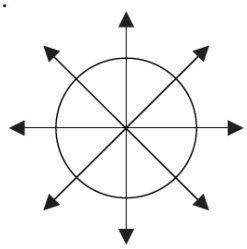
30. Which of the following is the SI unit of gravitational field strength? *[1 mark]*

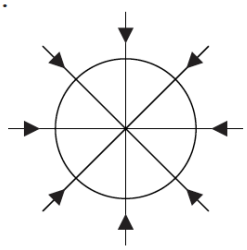
A. N
B. N m
C. Nkg^{-1}
D. Nm^2kg^{-2}

31. Which of the following is the best representation of the electric field lines around a negatively charged metal sphere? *[1 mark]*

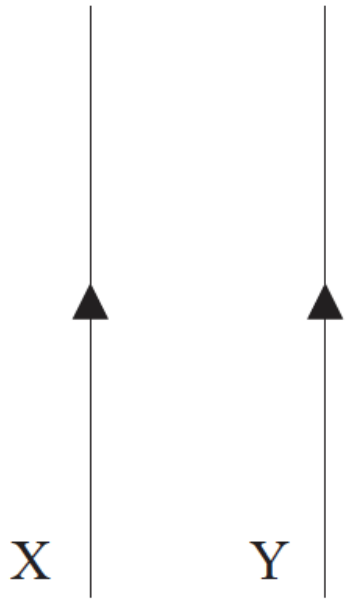
A.


B.


C.


D.


32. The diagram shows two long wires X and Y carrying identical currents in the same direction. *[1 mark]*



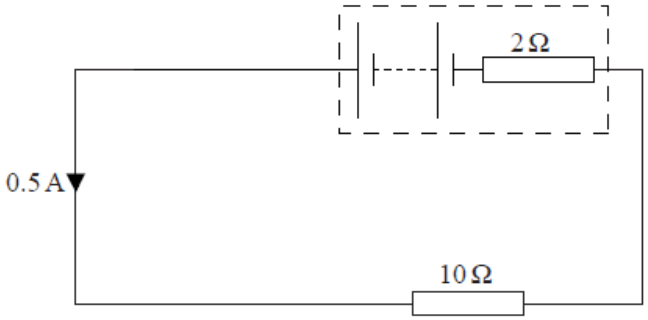
The direction of the force experienced by Y is

A. to the left.
B. to the right.
C. into the plane of the page.
D. out of the plane of the page.

33. One electronvolt is equal to *[1 mark]*

A. 1.6×10^{-19} C.
B. 1.6×10^{-19} J.
C. 1.6×10^{-19} V.
D. 1.6×10^{-19} W.

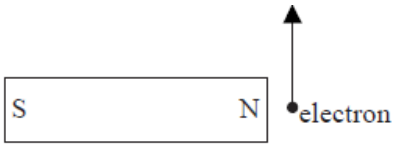
34. A battery of internal resistance 2 Ω is connected to an external resistance of 10 Ω. The current is 0.5 A. *[1 mark]*



What is the emf of the battery?

A. 1.0 V
B. 5.0 V
C. 6.0 V
D. 24.0 V

35. An electron passes the north pole of a bar magnet as shown below. *[1 mark]*



What is the direction of the magnetic force on the electron?

A. Into the page
B. Out of the page
C. To the left
D. To the right

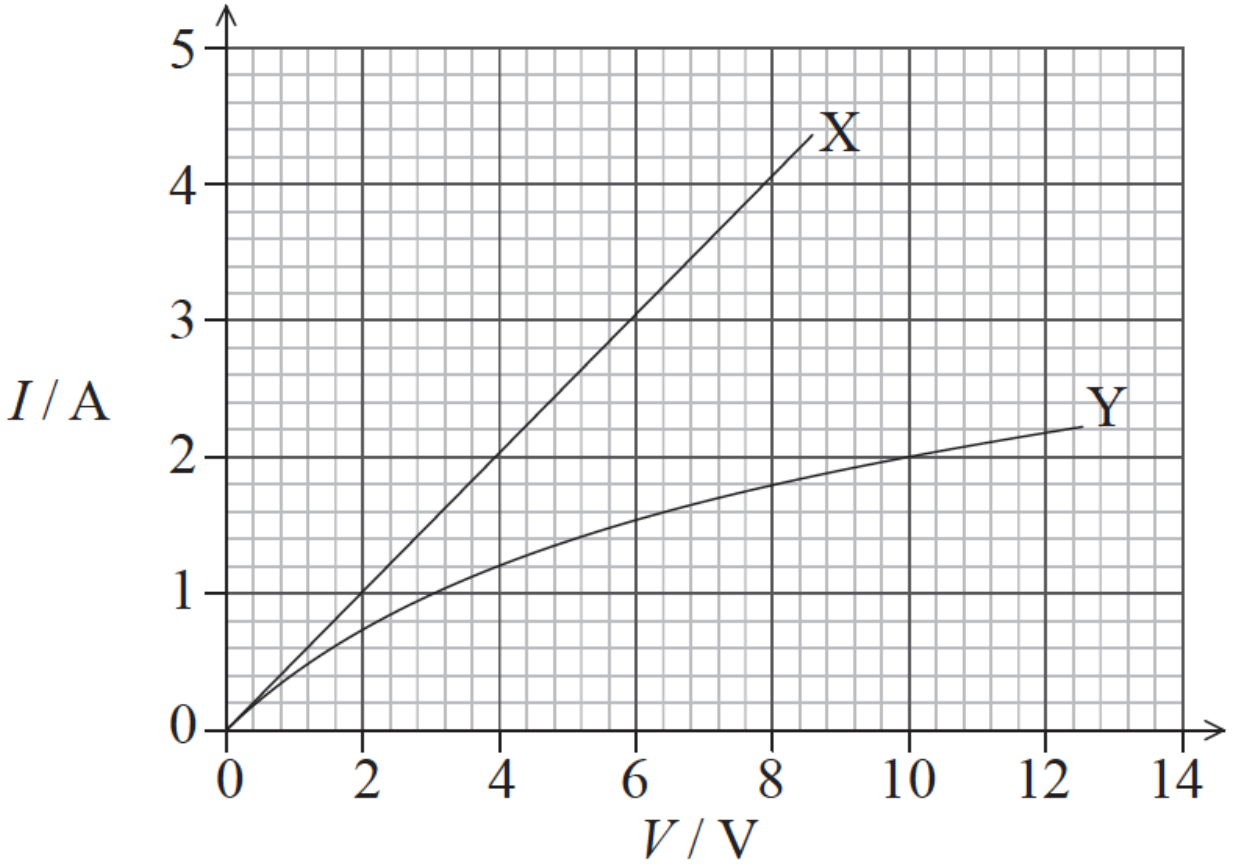
36. Two electrodes, separated by a distance d, in a vacuum are maintained at a constant potential difference. An electron, accelerated from one electrode to the other, gains kinetic energy E_k. *[1 mark]*

The distance between the electrodes is now changed to $\frac{1}{3}d$.

What is the gain in kinetic energy of an electron that is accelerated from one electrode to the other?

1. $\frac{E_k}{3}$
2. E_k
3. $3E_k$
4. $9E_k$

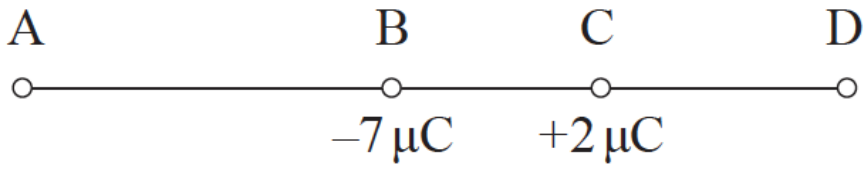
37. The graph shows the *I*–*V* characteristics of two resistors. *[1 mark]*



When resistors X and Y are connected in series, the current in the resistors is 2.0 A. What is the resistance of the series combination of X and Y?

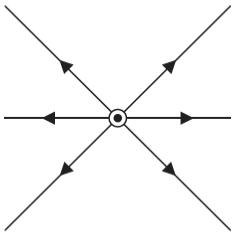
1. 7.0 Ω
2. 1.3 Ω
3. 1.1 Ω
4. 0.14 Ω

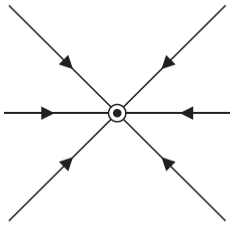
38. Two isolated point charges, -7 μC and +2 μC, are at a fixed distance apart. At which point is it possible for the electric field strength to be zero? *[1 mark]*

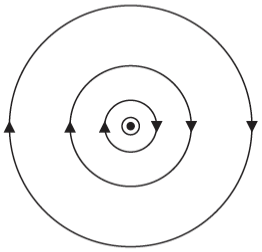


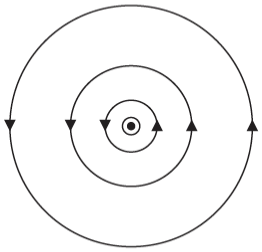
(not to scale)

39. A long straight wire carries an electric current perpendicularly out of the paper. Which of the following represents the magnetic field pattern due to the current? *[1 mark]*

A. 

B. 

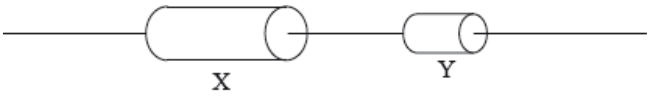
C. 

D. 

40. Which nucleons in a nucleus are involved in the Coulomb interaction and the strong short-range nuclear interaction? *[1 mark]*

	Coulomb interaction	Strong short-range interaction
A.	protons	protons, neutrons
B.	protons	neutrons
C.	protons	protons
D.	protons, neutrons	neutrons

41. Two resistors, made of the same material, are connected in series to a battery. The length of resistor X is twice that of resistor Y, and X has twice the cross-sectional area of Y. *[1 mark]*



Which of the following gives $\frac{\text{resistance of X}}{\text{resistance of Y}}$?

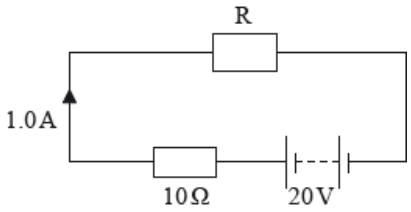
A. $\frac{1}{4}$

B. $\frac{1}{2}$

C. 1

D. 4

42. The circuit shows a resistor R connected in series with a battery and a resistor of resistance $10\ \Omega$. The emf of the battery is 20 V and it has negligible internal resistance. The current in the circuit is 1.0 A. *[1 mark]*



Which of the following is the resistance of R?

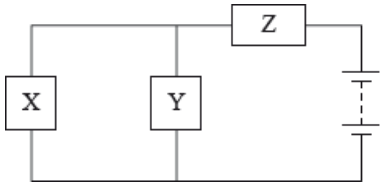
A. $1.0\ \Omega$

B. $2.0\ \Omega$

C. $10\ \Omega$

D. $20\ \Omega$

43. Three identical resistors are connected to a battery as shown. *[1 mark]*



Which of the following is a correct statement?

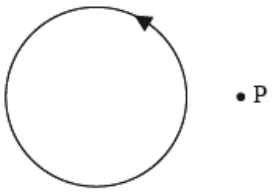
A. The current through X is greater than that through Z.

B. The potential difference across Z is greater than that across Y.

C. The potential difference across resistor X and Y together is the same as that across Z.

D. The current through Z is less than the total current through X and Y.

44. A current is established in a coil of wire in the direction shown. *[1 mark]*



The direction of the magnetic field at point P is

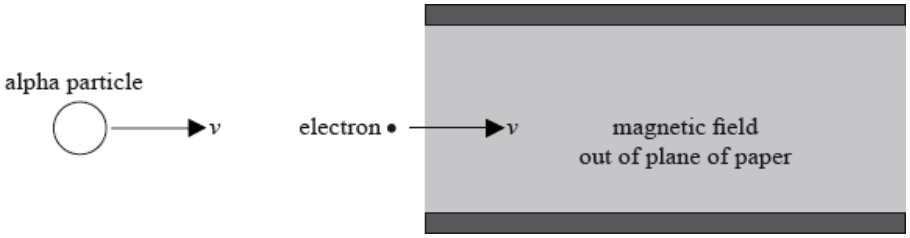
A. out of the plane of the paper.

B. into the plane of the paper.

C. to the left.

D. to the right.

45. An electron enters the vacuum between two oppositely charged plates with velocity v. The electron is followed by an alpha particle moving with the same initial velocity as the electron. A uniform magnetic field is directed out of the plane of the paper. *[1 mark]*



The electron's path is undeflected. The path of the alpha particle will be

A. deflected out of the plane of the paper.

B. undeflected.

C. deflected upward.

D. deflected downward.

46. A resistor of resistance $12\ \Omega$ is connected in series with a cell of negligible internal resistance. The power dissipated in the resistor is P. The resistor is replaced with a resistor of resistance $3.0\ \Omega$. What is the power dissipated in this resistor? *[1 mark]*

A. $0.25\ P$

B. P

C. $2.0\ P$

D. $4.0\ P$

47. The electromotive force (emf) of a cell is defined as *[1 mark]*

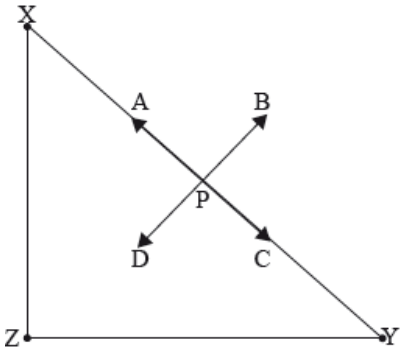
A. the power supplied by the cell per unit current from the cell.

B. the force that the cell provides to drive electrons round a circuit.

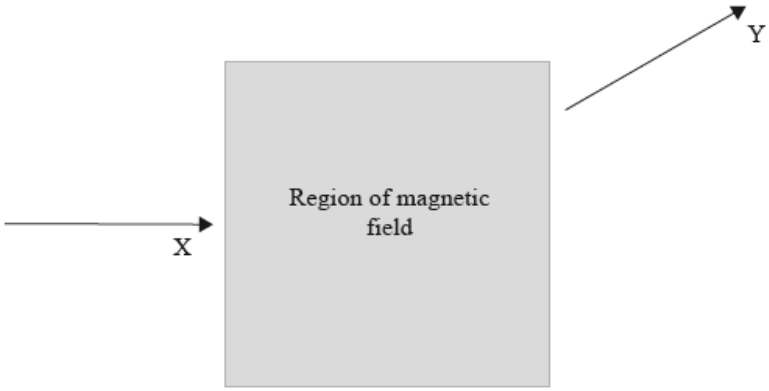
C. the energy supplied by the cell per unit current from the cell.

D. the potential difference across the terminals of the cell.

48. Three positive point charges of equal magnitude are held at the corners X, Y and Z of a right-angled triangle. The point P is at the midpoint of XY. Which of the arrows shows the direction of the electric field at point P? *[1 mark]*



49. An electron travelling in the direction shown by the arrow X, enters a region of uniform magnetic field. It leaves the region of field in the direction shown by the arrow Y. *[1 mark]*



The direction of the magnetic field is

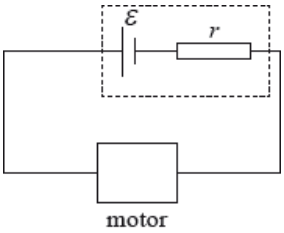
A. in the direction of X.

B. into the plane of the paper.

C. in the opposite direction to X.

D. out of the plane of the paper.

50. A cell of emf ε and internal resistance r delivers current to a small electric motor. *[1 mark]*



450 C of charge flows through the motor and 9000 J of energy are converted in the motor. 1800 J are dissipated in the cell. The emf of the cell is

A. 4.0 V.

B. 16 V.

C. 20 V.

D. 24 V.

---

51. A cylindrical conductor of length l, diameter D and resistivity ρ has resistance R. A different cylindrical conductor of resistivity 2ρ, length $2l$ and diameter $2D$ has a resistance *[1 mark]*

A. $2R$

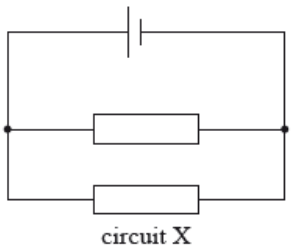
B. R

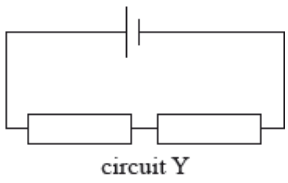
C. $\frac{R}{2}$

D. $\frac{R}{4}$

---

52. In the circuits below the cells have the same emf and zero internal resistance. The resistors all have the same resistance. *[1 mark]*





Which of the following gives the ratio $\frac{\text{power dissipated in X}}{\text{power dissipated in Y}}$?

A. $\frac{1}{4}$

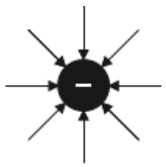
B. $\frac{1}{2}$

C. 2

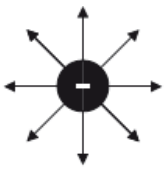
D. 4

53. Which of the following diagrams illustrates the electric field pattern of a negatively charged sphere? *[1 mark]*

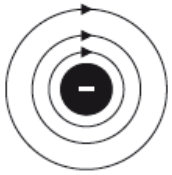
A.



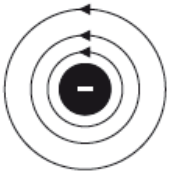
B.



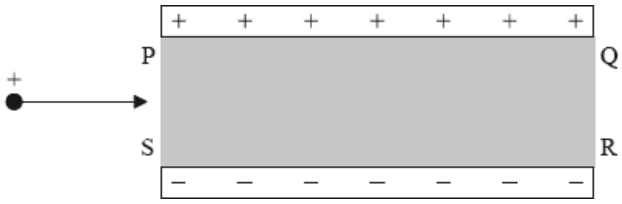
C.



D.



54. A positively charged particle enters the space between two charged conducting plates, with a constant velocity directed parallel to the plates, as shown. *[1 mark]*



The top plate is positively charged and the bottom plate is negatively charged. There is a magnetic field in the shaded region PQRS. The particle continues to move in a horizontal straight line between the plates. Which of the following correctly describes the magnetic field direction?

A. Into plane of paper

B. Out of plane of paper

C. Up

D. Down

55. Two rectangular blocks, X and Y, of the same material have different dimensions but the same overall resistance. Which of the following equations is correct? *[1 mark]*

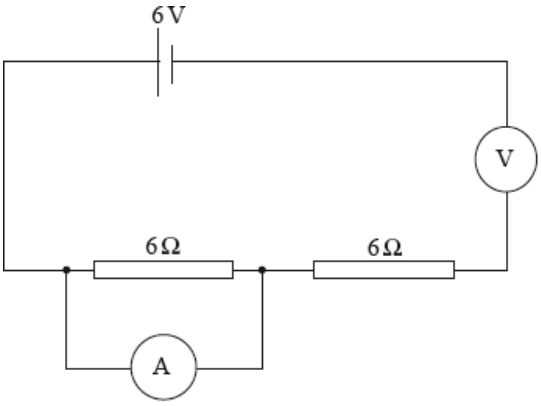
A. resistivity of $X \times$ length of $X =$ resistivity of $Y \times$ length of Y

B. $\dfrac{\text{length of } X}{\text{cross sectional area of } X} = \dfrac{\text{length of } Y}{\text{cross sectional area of Y}}$

C. resistivity of
$X \times$ cross sectional area of $X =$ resistivity of $Y \times$ cross sectional area of Y

D. $\dfrac{\text{length of } X}{\text{cross sectional area of } Y} = \dfrac{\text{length of } Y}{\text{cross sectional area of } X}$

56. Two $6\ \Omega$ resistors are connected in series with a 6 V cell. A student **incorrectly** connects an ammeter and a voltmeter as shown below. *[1 mark]*

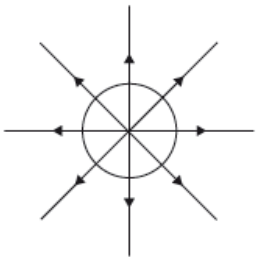


The readings on the ammeter and on the voltmeter are

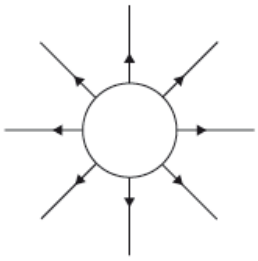
	Ammeter reading / A	Voltmeter reading / V
A.	0.0	0.0
B.	0.0	6.0
C.	1.0	0.0
D.	1.0	6.0

57. Which diagram best represents the electric field due to a negatively charged conducting sphere? *[1 mark]*

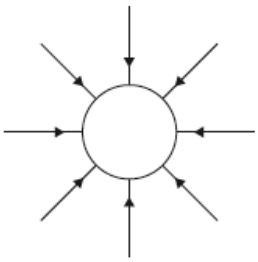
A.



B.



C.



D.