Electricity-practice-1-MC *[60 marks]*

1. Two cells each of emf 9.0 V and internal resistance 3.0 Ω are connected in series. A 12.0 Ω resistor is connected in series to the cells. What is the current in the resistor? *[1 mark]*

   A. 0.50 A

   B. 0.75 A

   C. 1.0 A

   D. 1.5 A

2. Charge flows through a liquid. The charge flow is made up of positive and negative ions. In one second 0.10 C of negative ions flow in one direction and 0.10 C of positive ions flow in the opposite direction. *[1 mark]*

   What is the magnitude of the electric current flowing through the liquid?

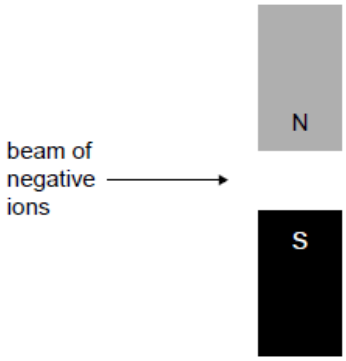
   A. 0 A

   B. 0.05 A

   C. 0.10 A

   D. 0.20 A

3. A beam of negative ions flows in the plane of the page through the magnetic field due to two bar magnets. *[1 mark]*



What is the direction in which the negative ions will be deflected?

A. Out of the page ⊙

B. Into the page X

C. Up the page ↑

D. Down the page ↓

4. A particle with a charge *ne* is accelerated through a potential difference *V*. *[1 mark]*

What is the magnitude of the work done on the particle?

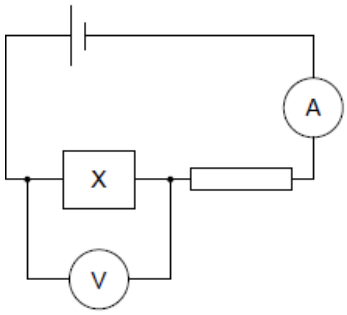
A. eV

B. neV

C. $\frac{nV}{e}$

D. $\frac{eV}{n}$

5. The resistance of component X decreases when the intensity of light incident on it increases. X is connected in series with a cell of negligible internal resistance and a resistor of fixed resistance. The ammeter and voltmeter are ideal. *[1 mark]*



What is the change in the reading on the ammeter and the change in the reading on the voltmeter when the light incident on X is increased?

	Ammeter reading	Voltmeter reading
A.	increases	decreases
B.	increases	increases
C.	decreases	decreases
D.	decreases	increases

6. What is the unit of electrical potential difference expressed in fundamental SI units? *[1 mark]*

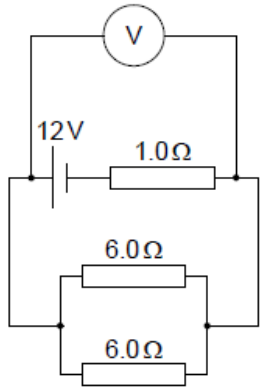
A. kg m s^{-1} C^{-1}

B. kg m^2 s^{-2} C^{-1}

C. kg m^2 s^{-3} A^{-1}

D. kg m^2 s^{-1} A

7. Three resistors of resistance 1.0 Ω, 6.0 Ω and 6.0 Ω are connected as shown. The voltmeter is ideal and the cell has an emf of 12 V with negligible internal resistance. *[1 mark]*



What is the reading on the voltmeter?

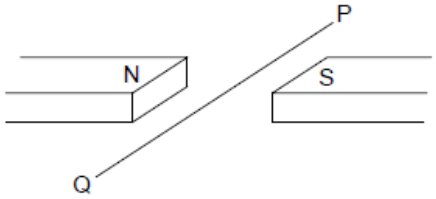
A. 3.0 V

B. 4.0 V

C. 8.0 V

D. 9.0 V

8. A horizontal wire PQ lies perpendicular to a uniform horizontal magnetic field. *[1 mark]*



A length of 0.25 m of the wire is subject to a magnetic field strength of 40 mT. A downward magnetic force of 60 mN acts on the wire.

What is the magnitude and direction of the current in the wire?

	Current magnitude / A	Current direction
A.	6.0	P to Q
B.	6.0	Q to P
C.	0.17	Q to P
D.	0.17	P to Q

9. Two copper wires X and Y are connected in series. The diameter of Y is double that of X. The drift speed in X is v. What is the drift speed in Y? *[1 mark]*

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

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

C. $2v$

D. $4v$

10. A wire of length L is used in an electric heater. When the potential difference across the wire is 200 V, the power dissipated in the wire is 1000 W. The same potential difference is applied across a second similar wire of length $2L$. What is the power dissipated in the second wire? *[1 mark]*

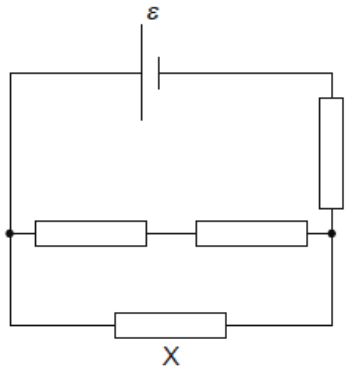
A. 250 W

B. 500 W

C. 2000 W

D. 4000 W

11. A combination of four identical resistors each of resistance R are connected to a source of emf ε of negligible internal resistance. What is the current in the resistor X? *[1 mark]*



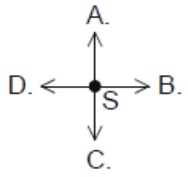
A. $\frac{\varepsilon}{5R}$

B. $\frac{3\varepsilon}{10R}$

C. $\frac{2\varepsilon}{5R}$

D. $\frac{3\varepsilon}{5R}$

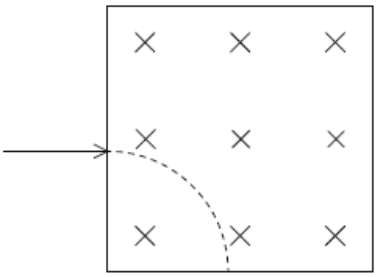
12. Two parallel wires are perpendicular to the page. The wires carry equal currents in opposite directions. Point S is at the same distance from both wires. What is the direction of the magnetic field at point S? *[1 mark]*



⊙ conventional current out of page

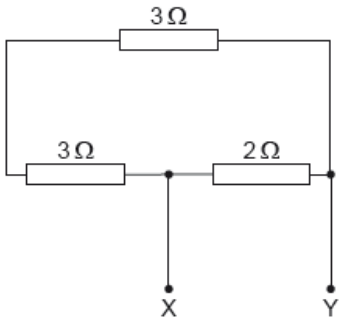
⊗ conventional current into page

13. A particle of mass m and charge of magnitude q enters a region of uniform magnetic field B that is directed into the page. The particle follows a circular path of radius R. What are the sign of the charge of the particle and the speed of the particle? *[1 mark]*



	Charge of the particle	Speed of the particle
A.	positive	$\frac{qBR}{m}$
B.	negative	$\frac{qBR}{m}$
C.	negative	$\sqrt{\frac{qBR}{m}}$
D.	positive	$\sqrt{\frac{qBR}{m}}$

14. Three resistors are connected as shown. What is the value of the total resistance between X and Y? *[1 mark]*



A. 1.5 Ω

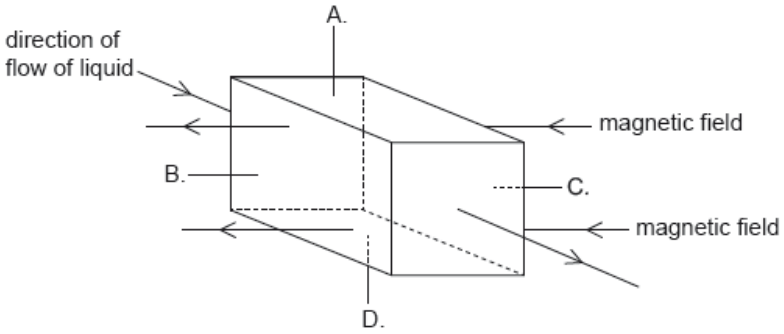
B. 1.9 Ω

C. 6.0 Ω

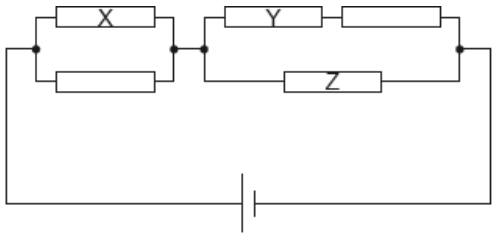
D. 8.0 Ω

15. A liquid that contains negative charge carriers is flowing through a square pipe with sides A, B, C and D. A magnetic field acts in the direction shown across the pipe. *[1 mark]*

On which side of the pipe does negative charge accumulate?



16. Five resistors of equal resistance are connected to a cell as shown. *[1 mark]*



What is correct about the power dissipated in the resistors?

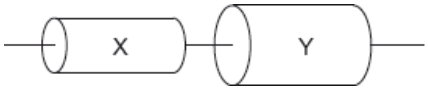
A. The power dissipated is greatest in resistor X.

B. The power dissipated is greatest in resistor Y.

C. The power dissipated is greatest in resistor Z.

D. The power dissipated is the same in all resistors.

17. Two resistors X and Y are made of uniform cylinders of the same material. *[1 mark]*
X and Y are connected in series. X and Y are of equal length and the diameter of Y is twice the diameter of X.



The resistance of Y is R.

What is the resistance of this series combination?

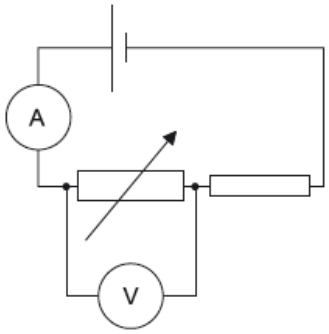
A. $\frac{5R}{4}$

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

C. $3R$

D. $5R$

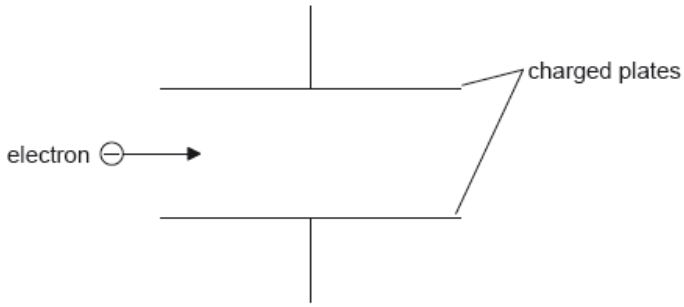
18. A cell with negligible internal resistance is connected as shown. The ammeter and the voltmeter are both ideal. *[1 mark]*



What changes occur in the ammeter reading and in the voltmeter reading when the resistance of the variable resistor is increased?

	Change in ammeter reading	Change in voltmeter reading
A.	increases	increases
B.	increases	decreases
C.	decreases	increases
D.	decreases	decreases

19. An electron enters the region between two charged parallel plates initially moving parallel to the plates. *[1 mark]*



The electromagnetic force acting on the electron

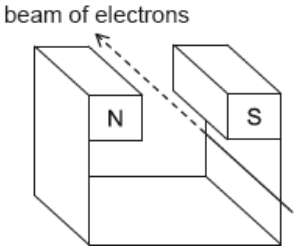
A. causes the electron to decrease its horizontal speed.

B. causes the electron to increase its horizontal speed.

C. is parallel to the field lines and in the opposite direction to them.

D. is perpendicular to the field direction.

20. A beam of electrons moves between the poles of a magnet. *[1 mark]*



What is the direction in which the electrons will be deflected?

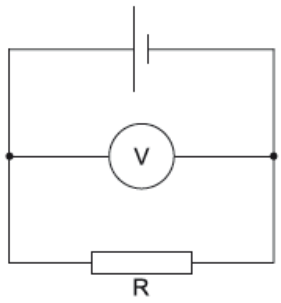
A. Downwards

B. Towards the N pole of the magnet

C. Towards the S pole of the magnet

D. Upwards

21. A cell has an emf of 4.0 V and an internal resistance of 2.0 Ω. The ideal voltmeter reads 3.2 V. *[1 mark]*



What is the resistance of R?

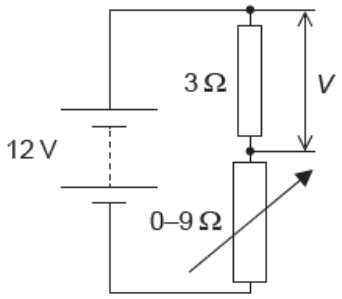
A. 0.8 Ω

B. 2.0 Ω

C. 4.0 Ω

D. 8.0 Ω

22. In the circuit shown, the fixed resistor has a value of 3 Ω and the variable resistor can be varied between 0 Ω and 9 Ω. *[1 mark]*



The power supply has an emf of 12 V and negligible internal resistance. What is the difference between the maximum and minimum values of voltage *V* across the 3 Ω resistor?

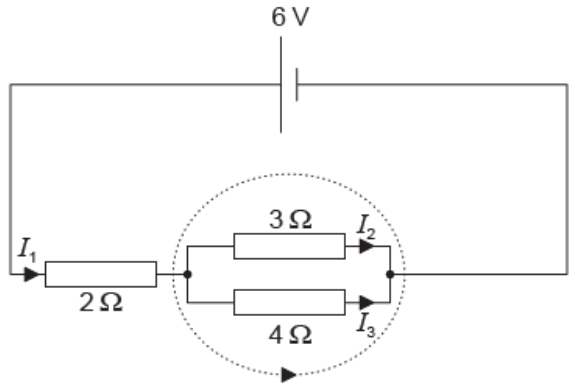
A. 3 V

B. 6 V

C. 9 V

D. 12 V

23. Kirchhoff's laws are applied to the circuit shown. *[1 mark]*



What is the equation for the dotted loop?

A. $0 = 3I_2 + 4I_3$

B. $0 = 4I_3 - 3I_2$

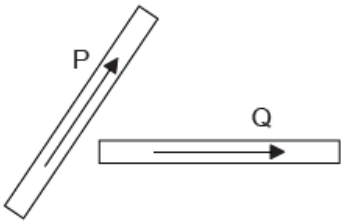
C. $6 = 2I_1 + 3I_2 + 4I_3$

D. $6 = 3I_2 + 4I_3$

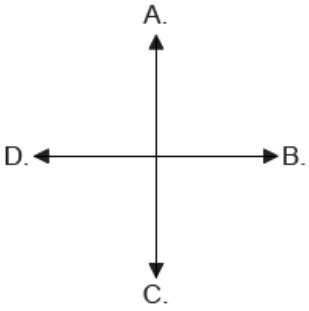
24. With reference to internal energy conversion and ability to be recharged, *[1 mark]* what are the characteristics of a primary cell?

	Internal energy conversion	Ability to be recharged
A.	chemical to electrical	rechargeable
B.	chemical to electrical	not rechargeable
C.	electrical to chemical	rechargeable
D.	electrical to chemical	not rechargeable

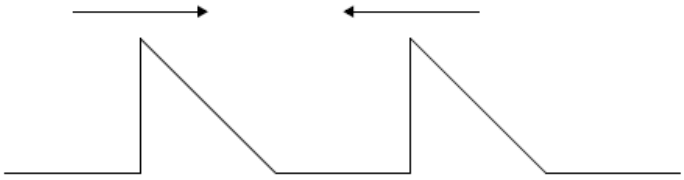
25. The diagram shows two current-carrying wires, P and Q, that both lie in the plane of the paper. The arrows show the conventional current direction in the wires. *[1 mark]*



The electromagnetic force on Q is in the same plane as that of the wires. What is the direction of the electromagnetic force acting on Q?

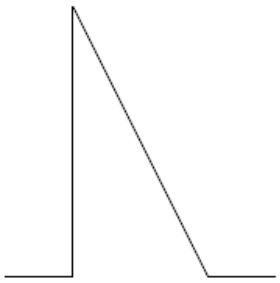


26. Two pulses are travelling towards each other. *[1 mark]*

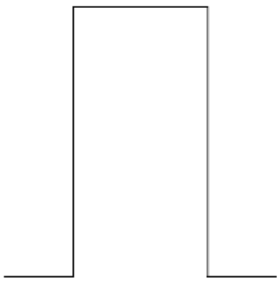


What is a possible pulse shape when the pulses overlap?

A.

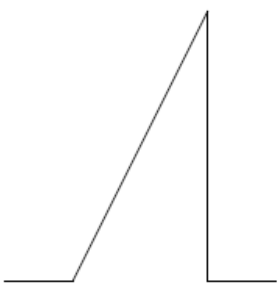


B.

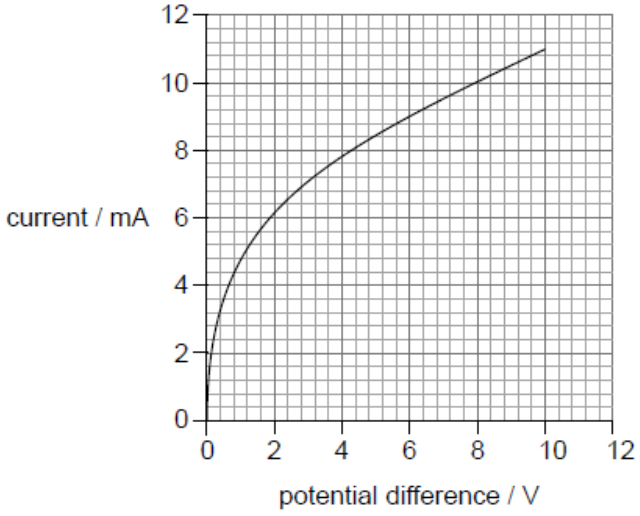


C.

D.



27. The graph shows the variation of current with potential difference for a filament lamp. *[1 mark]*



What is the resistance of the filament when the potential difference across it is 6.0 V?

A. 0.5 mΩ
B. 1.5 mΩ
C. 670 Ω
D. 2000 Ω

28. An electron is accelerated through a potential difference of 2.5 MV. What is the change in kinetic energy of the electron? *[1 mark]*

A. 0.4μJ
B. 0.4 nJ
C. 0.4 pJ
D. 0.4 fJ

29. A cell is connected in series with a resistor and supplies a current of 4.0 A for a time of 500 s. During this time, 1.5 kJ of energy is dissipated in the cell and 2.5 kJ of energy is dissipated in the resistor. *[1 mark]*

What is the emf of the cell?

A. 0.50 V
B. 0.75 V
C. 1.5 V
D. 2.0 V

30. An electron travelling at speed v perpendicular to a magnetic field of strength B experiences a force F. *[1 mark]*

What is the force acting on an alpha particle travelling at $2v$ parallel to a magnetic field of strength $2B$?

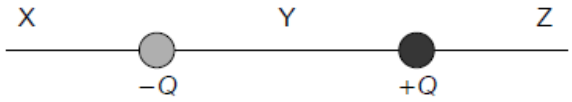
A. 0

B. $2F$

C. $4F$

D. $8F$

31. The diagram shows two equal and opposite charges that are fixed in place. *[1 mark]*



At which points is the net electric field directed to the right?

A. X and Y only

B. Z and Y only

C. X and Z only

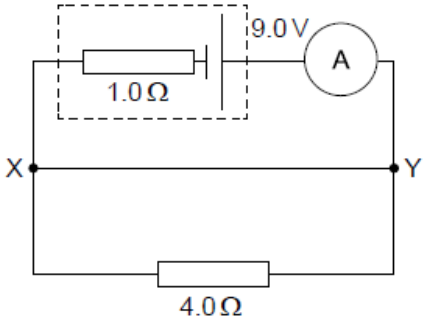
D. X, Y and Z

32. A wire has variable cross-sectional area. The cross-sectional area at Y is double that at X. *[1 mark]*

At X, the current in the wire is I and the electron drift speed is v. What is the current and the electron drift speed at Y?

	Current	Drift speed
A.	I	v
B.	I	$\frac{v}{2}$
C.	$2I$	v
D.	$2I$	$\frac{v}{2}$

33. A circuit contains a cell of electromotive force (emf) 9.0 V and internal resistance 1.0 Ω together with a resistor of resistance 4.0 Ω as shown. The ammeter is ideal. XY is a connecting wire. *[1 mark]*



What is the reading of the ammeter?

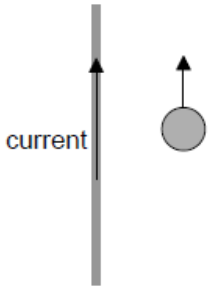
A. 0 A

B. 1.8 A

C. 9.0 A

D. 11 A

34. A positively-charged particle moves parallel to a wire that carries a current upwards. *[1 mark]*



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

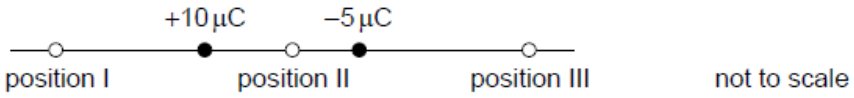
A. To the left

B. To the right

C. Into the page

D. Out of the page

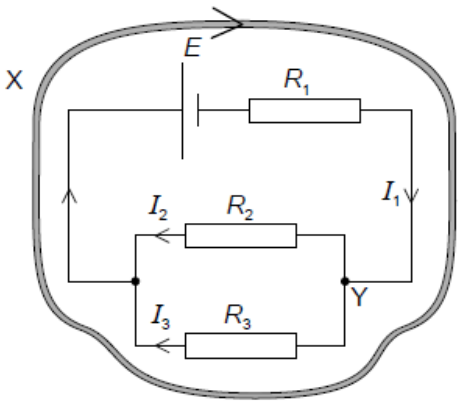
35. A –5μC charge and a +10μC charge are a fixed distance apart. *[1 mark]*



Where can the electric field be zero?

A. position I only
B. position II only
C. position III only
D. positions I, II and III

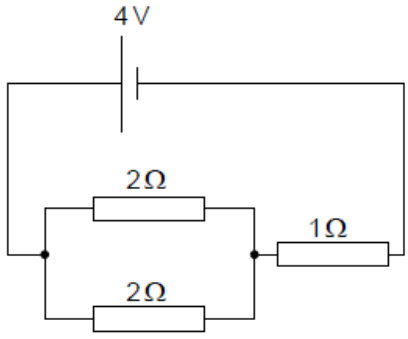
36. An electrical circuit is shown with loop X and junction Y. *[1 mark]*



What is the correct expression of Kirchhoff's circuit laws for loop X and junction Y?

	Loop X	Junction Y
A.	$-E = I_1R_1 + I_3R_3$	$I_1 = I_2 + I_3$
B.	$-E = I_1R_1 + I_3R_3$	$I_1 + I_2 = I_3$
C.	$E = I_1R_1 - I_3R_3$	$I_1 = I_2 + I_3$
D.	$E = I_1R_1 - I_3R_3$	$I_1 + I_2 = I_3$

37. A cell of emf 4V and negligible internal resistance is connected to three resistors as shown. Two resistors of resistance 2Ω are connected in parallel and are in series with a resistor of resistance 1Ω. *[1 mark]*



What power is dissipated in one of the 2Ω resistors and in the whole circuit?

	Power dissipated in 2Ω resistor / W	Power dissipated in whole circuit / W
A.	2	6
B.	1	6
C.	0.5	8
D.	2	8

38. A wire carrying a current I is at right angles to a uniform magnetic field of strength B. A magnetic force F is exerted on the wire. Which force acts when the same wire is placed at right angles to a uniform magnetic field of strength $2B$ when the current is $\frac{I}{4}$? *[1 mark]*

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

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

C. F

D. $2F$

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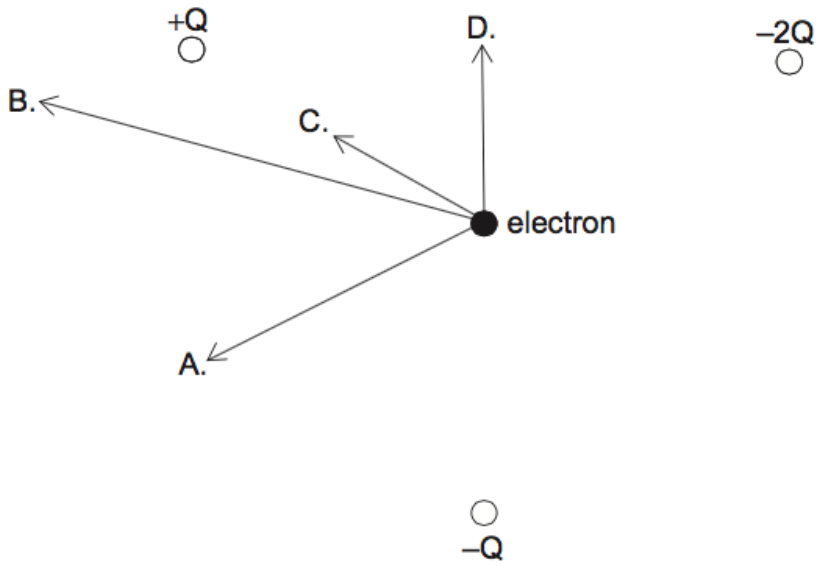
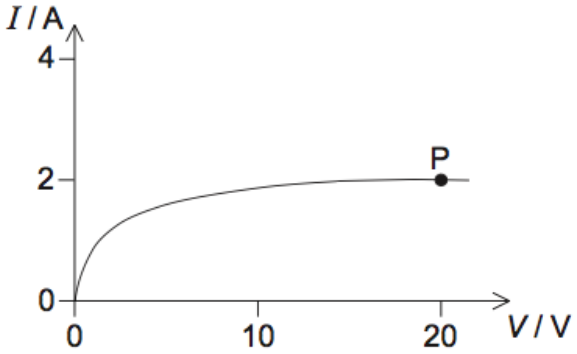
39. Three fixed charges, +Q, –Q and –2Q, are at the vertices of an equilateral triangle. What is the resultant force on an electron at the centre of the triangle? *[1 mark]*



40. The graph shows the variation of current *I* in a device with potential difference *V* across it. *[1 mark]*



What is the resistance of the device at P?

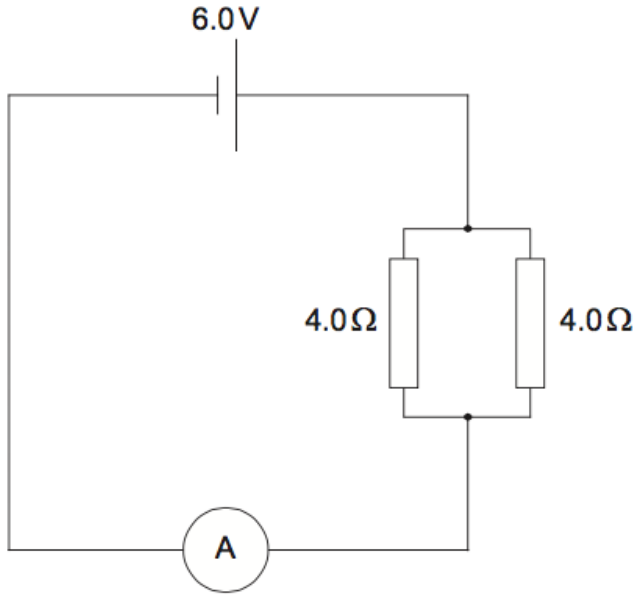
A. zero

B. 0.1Ω

C. 10Ω

D. infinite

41. A circuit consists of a cell of electromotive force (emf) 6.0V and negligible internal resistance connected to two resistors of 4.0Ω. *[1 mark]*



The resistance of the ammeter is 1.0 Ω. What is the reading of the ammeter?

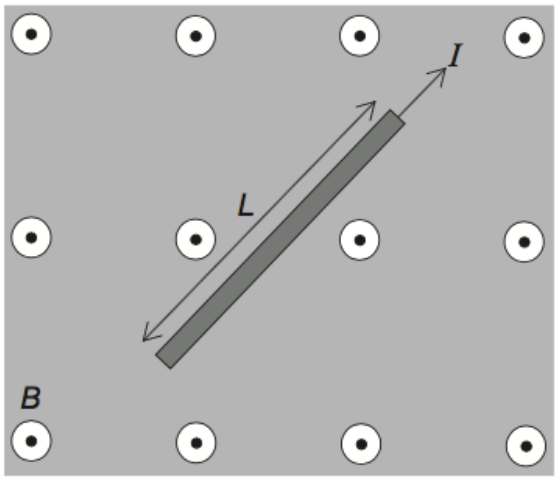
A. 2.0A

B. 3.0A

C. 4.5A

D. 6.0A

42. A wire carrying a current *I* is placed in a region of uniform magnetic field *B*, as shown in the diagram. *[1 mark]*



The direction of the field *B* is out of the page and the length of the wire is *L*. What is correct about the direction and magnitude of the force acting on the wire?

	Direction	Magnitude
A.	↘	equal to *BIL*
B.	↘	smaller than *BIL*
C.	↗	equal to *BIL*
D.	↗	smaller than *BIL*

43. A cylindrical resistor of length l is made from a metal of mass m. It has a resistance R. *[1 mark]*

Two resistors, each of length $2l$ and mass $\frac{m}{2}$, are then created from the same volume of the metal.

What is the resistance of the two resistors when connected in parallel?

A. R

B. $2R$

C. $4R$

D. $8R$

44. Three resistors of resistance R are connected in parallel across a cell of electromotive force (emf) V that has a negligible internal resistance. *[1 mark]*
What is the rate at which the cell supplies energy?

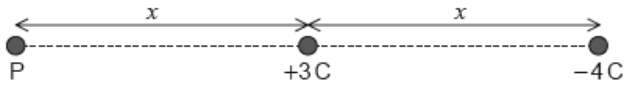
A. $\frac{V^2}{3R}$

B. $\frac{V^2}{9R}$

C. $\frac{9V^2}{R}$

D. $\frac{3V^2}{R}$

45. A $+3\ \mathrm{C}$ charge and a $-4\ \mathrm{C}$ charge are a distance x apart. P is a distance x from the $+3\ \mathrm{C}$ charge on the straight line joining the charges. *[1 mark]*



What is the magnitude of the electric field strength at P?

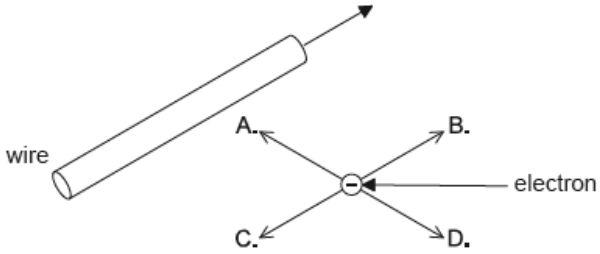
A. $\frac{1}{\pi\varepsilon_0 x^2}$

B. $\frac{1}{2\pi\varepsilon_0 x^2}$

C. $\frac{1}{4\pi\varepsilon_0 x^2}$

D. $\frac{1}{7\pi\varepsilon_0 x^2}$

46. An electron is moving parallel to a straight current-carrying wire. The direction of conventional current in the wire and the direction of motion of the electron are the same. In which direction is the magnetic force on the electron? *[1 mark]*



47. A wire of uniform circular cross-section is replaced in an electrical circuit. The new wire has the same length and same resistance but half the diameter of the old wire. *[1 mark]*

What is the ratio $\frac{\text{resistivity of the new wire}}{\text{resistivity of the old wire}}$?

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

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

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

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

48. A circuit is formed by connecting a resistor between the terminals of a battery of electromotive force (emf) 6 V. The battery has internal resistance. Which statement is correct when 1 C of charge flows around the complete circuit? *[1 mark]*

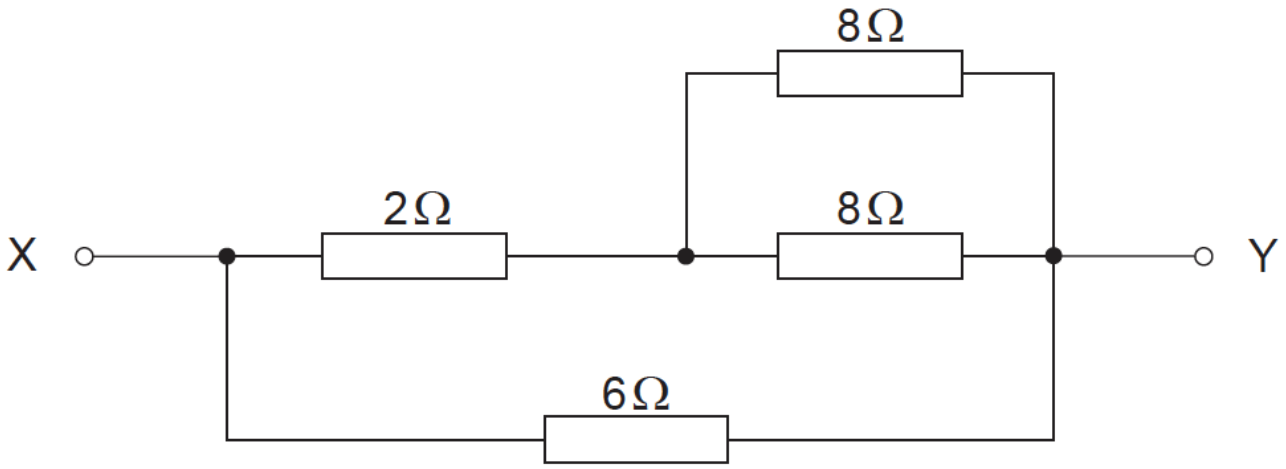
A. 6 V is the potential difference across the resistor.

B. 6 J of thermal energy is dissipated in the battery.

C. 6 J of chemical energy is transformed in the battery.

D. 6 J of thermal energy is dissipated in the resistor.

49. Four resistors are connected as shown. *[1 mark]*



What is the total resistance between X and Y?

A. 3 Ω

B. 4 Ω

C. 6 Ω

D. 24 Ω

50. What is the definition of electric current? *[1 mark]*

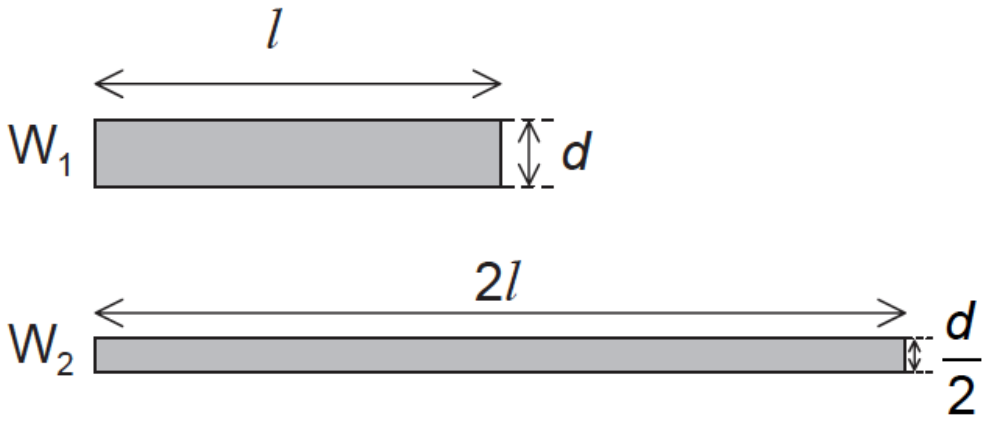
A. The ratio of potential difference across a component to the resistance of the component

B. The power delivered by a battery per unit potential difference

C. The rate of flow of electric charge

D. The energy per unit charge dissipated in a power supply

51. Two cylindrical copper wires, W_1 and W_2, are held at the same temperature. W_2 is twice as long and has half the diameter of W_1. *[1 mark]*



What is the ratio $\frac{\text{resistance of W}_2}{\text{resistance of W}_1}$?

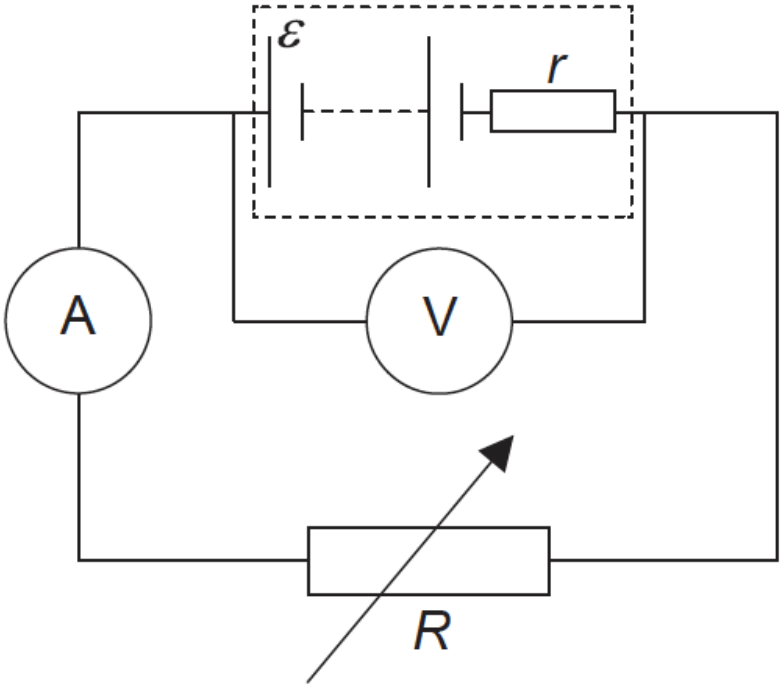
A. 1

B. 2

C. 4

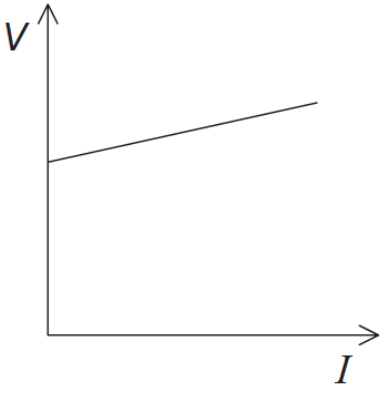
D. 8

52. The diagram shows a circuit used to investigate internal resistance of a cell. *[1 mark]*

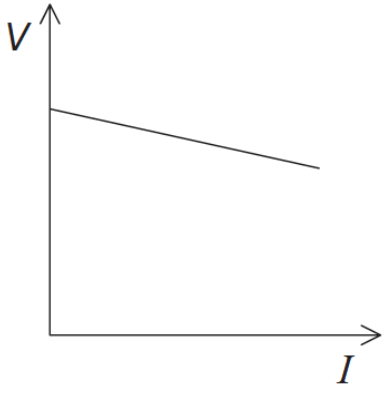


The variable resistor *R* is adjusted and the values of potential difference *V* across the cell and current *I* are recorded. Which graph shows the variation of *V* with *I*?

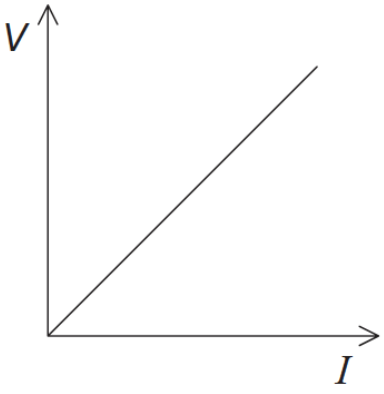
A.



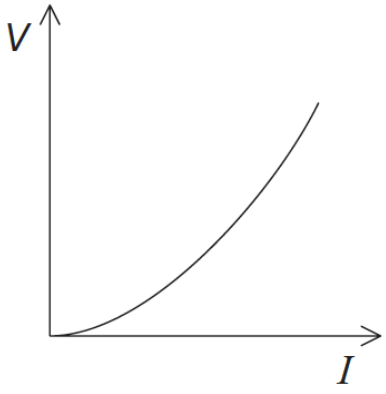
B.



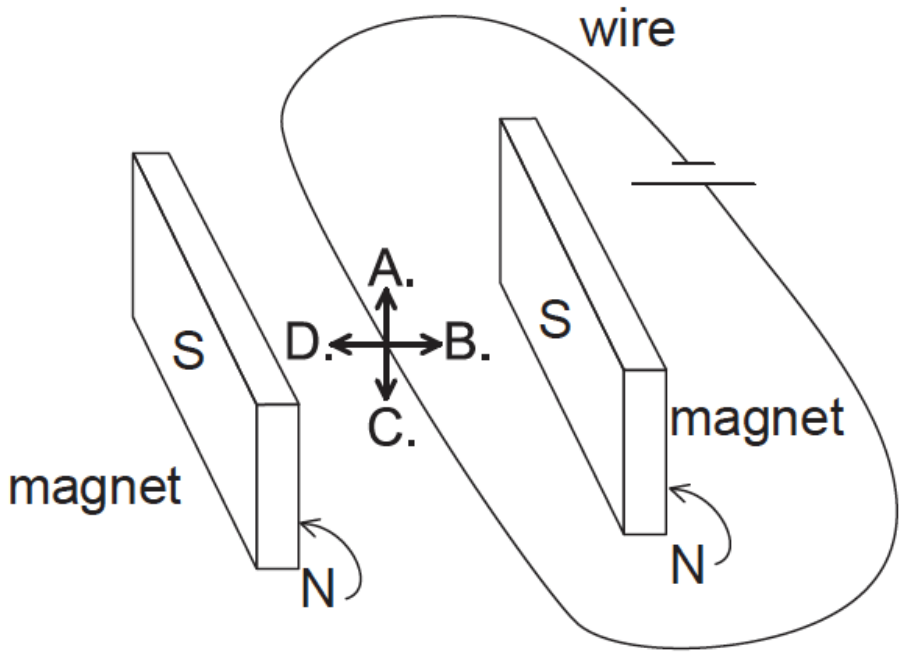
C.



D.



53. A long, straight, current-carrying wire is placed between a pair of magnets as shown. What is the direction of the force on the wire? *[1 mark]*



54. A cylindrical resistor of volume V and length l has resistance R. The resistor has a uniform circular cross-section. What is the resistivity of the material from which the resistor is made? *[1 mark]*

A. $\frac{V}{Rl^2}$

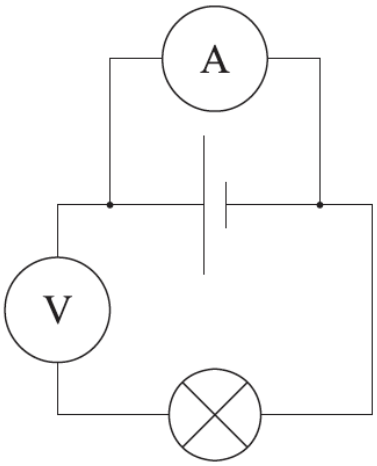
B. $\frac{V^2R}{l}$

C. $\frac{VR}{l^2}$

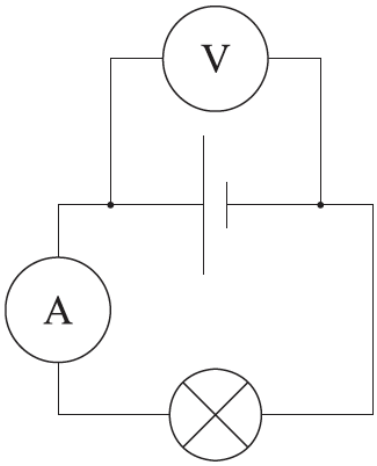
D. $\frac{V^2}{Rl}$

55. A lamp is connected to an electric cell and it lights at its working voltage. *[1 mark]* The lamp is then connected to the same cell in a circuit with an ideal ammeter and an ideal voltmeter. Which circuit allows the lamp to light at the original brightness?

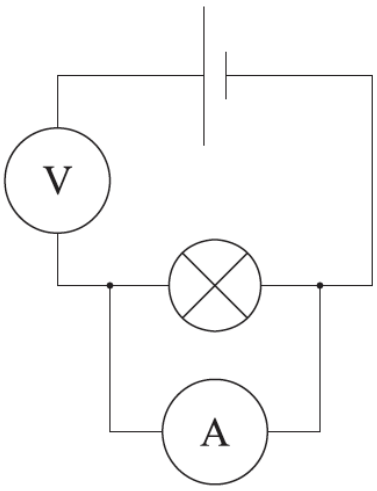
A.



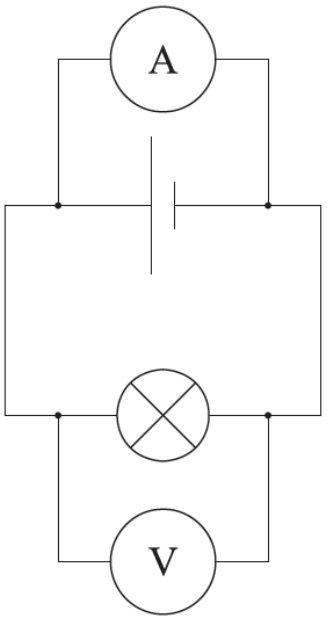
B.



C.



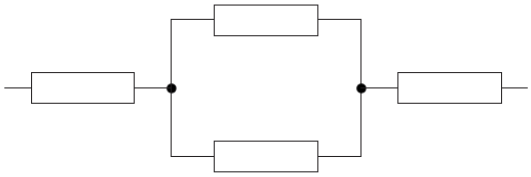
D.



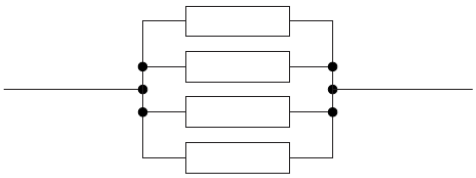
56. Each of the resistors in the arrangements below has resistance *R*. Each arrangement is connected, in turn, to a power supply of constant emf and negligible internal resistance. In which arrangement is the current in the power supply greatest? *[1 mark]*

A.

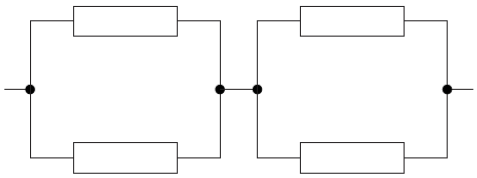
B.



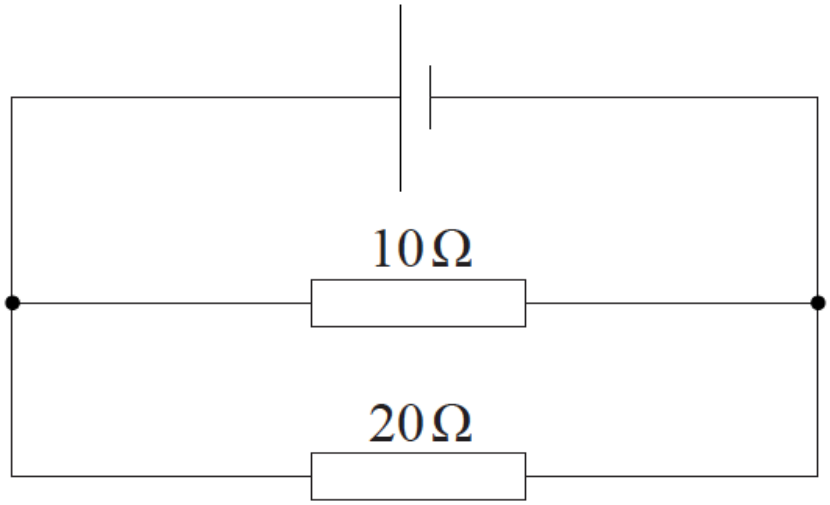
C.



D.



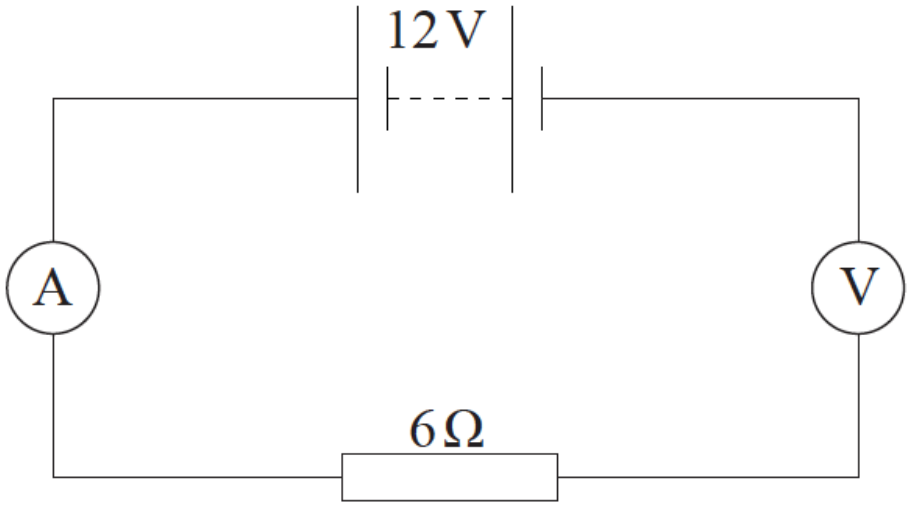
57. Two resistors of resistance 10 Ω and 20 Ω are connected in parallel to a cell of negligible internal resistance. *[1 mark]*



The energy dissipated in the 10 Ω resistor in one second is *Q*. What is the energy dissipated in one second in the 20 Ω resistor?

A. $\frac{Q}{4}$
B. $\frac{Q}{2}$
C. 2Q
D. 4Q

58. A battery of emf 12 V and negligible internal resistance is connected to a resistor of constant resistance 6 Ω, an ideal ammeter and an ideal voltmeter. *[1 mark]*



What is the reading on the ammeter and on the voltmeter?

	Ammeter reading / A	Voltmeter reading / V
A.	2.0	0
B.	2.0	12
C.	0	0
D.	0	12

59. Three parallel wires, X, Y and Z, carry equal currents. The currents in X and Z are directed into the page. The current in Y is directed out of the page. *[1 mark]*

Which arrow shows the direction of the magnetic force experienced by wire Z?

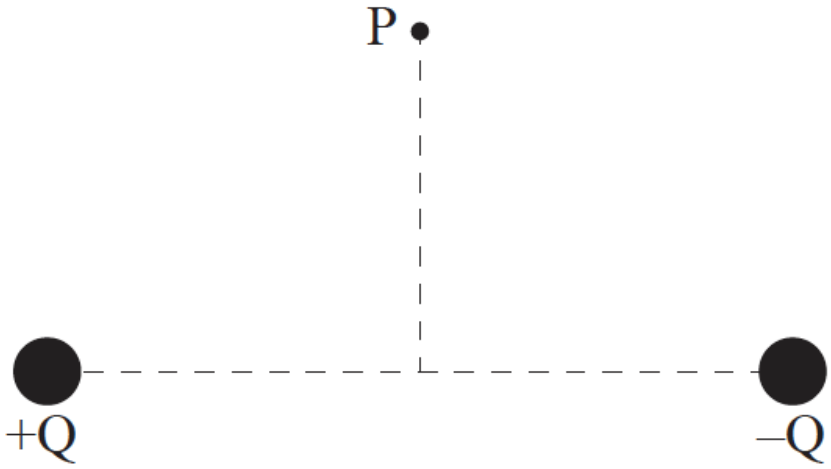
A. 

B. 

C. 

D. 

60. Point P is at the same distance from two charges of equal magnitude and opposite sign. *[1 mark]*



What is the direction of the electric field at point P?

A. 

B. 

C. 

D.