Current Electricity – 2021 AS

1. June/2021/Paper_11/No.32

Which two units are used to define the coulomb?

A ampere and second

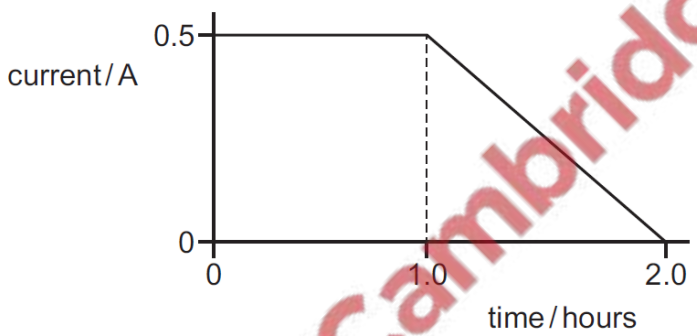
B ampere and volt

C volt and ohm

D volt and second

2. June/2021/Paper_11/No.33

A mobile phone battery is charged by connecting it to a constant potential difference of 5.0 V. After a time of 1.0 hour, the initial current of 0.50 A slowly decreases to zero, as shown.



What is the best estimate of the energy transferred to the battery during the time of 2.0 hours shown in the graph?

A 2700 J **B** 9000 J **C** 14 000 J **D** 18 000 J

3. June/2021/Paper_11/No.34

A length of wire is connected into an electric circuit. The current in the wire is measured.

Which change on its own could increase the current in the wire?

A an increase in the length of the wire

B an increase in the radius of the wire

C an increase in the resistance of the wire

D an increase in the resistivity of the wire

4. June/2021/Paper_11/No.35

A cell is described as having an electromotive force (e.m.f.) of 6 V.

What does this mean?

A 1 coulomb of charge always dissipates 6 J of energy in the internal resistance of the cell.

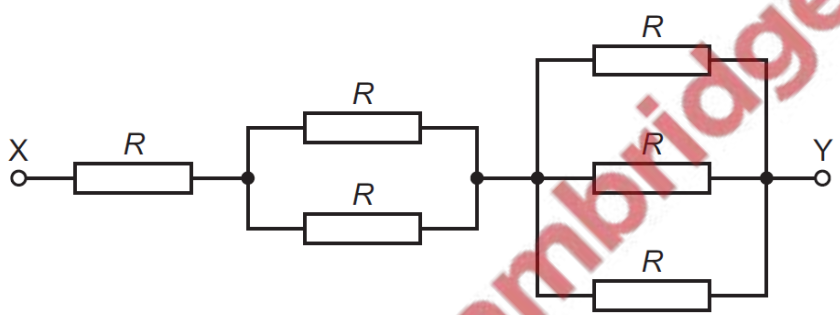
B 1 electron gains 6 J of energy when passing through the cell.

C There is a potential difference of 6 V applied across any external circuit connected to the cell.

D When 1 coulomb of charge passes through the cell, 6 J of chemical energy is transformed.

5. June/2021/Paper_11/No.36

The diagram shows a network of resistors. Each resistor has resistance *R*.

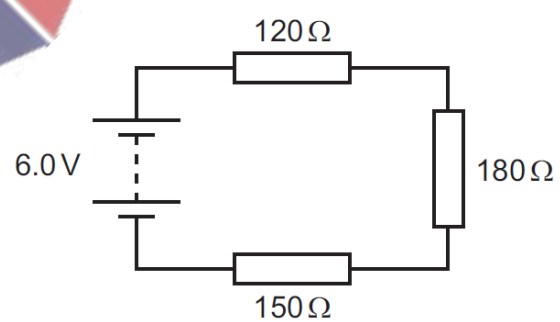


What is the total resistance of the network between points X and Y?

A $\frac{R}{6}$ **B** $\frac{6R}{11}$ **C** $\frac{11R}{6}$ **D** $6R$

6. June/2021/Paper_11/No.37

Three resistors are connected in series with a battery, as shown. The battery has negligible internal resistance.



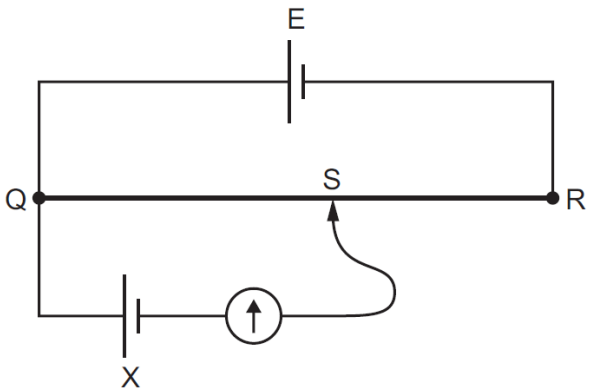
What is the potential difference across the 180 Ω resistor?

A 1.6 V **B** 2.4 V **C** 3.6 V **D** 4.0 V

7. June/2021/Paper_11/No.38

A potentiometer circuit is used to determine the unknown electromotive force (e.m.f.) of a cell X.

In the circuit shown, E is a cell with an e.m.f. that is known accurately. QR is the potentiometer wire, which has a movable contact S. Contact S is connected to a galvanometer and to cell X.



What is **not** a necessary requirement to determine the e.m.f. of X from the circuit?

A The e.m.f. of cell X must be lower than the e.m.f. of cell E.

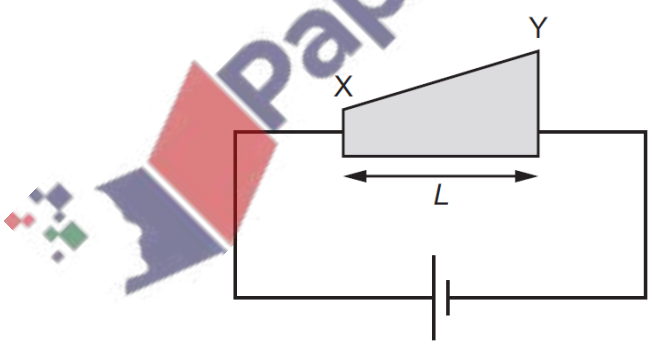
B The internal resistance of cell X must be known.

C The lengths QS and QR must be determined accurately.

D The resistance of the wire QR must be proportional to its length.

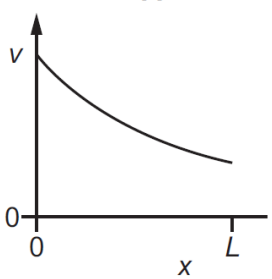
8. June/2021/Paper_12/No.32

A wedge-shaped metal conductor of length *L*, varying width and uniform thickness is connected to a cell, as shown.

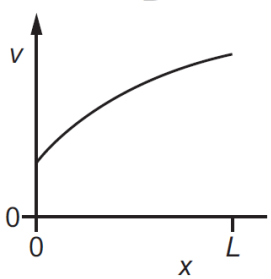


Which graph best shows how the average drift velocity *v* of electrons in the conductor varies with distance *x* from end X?

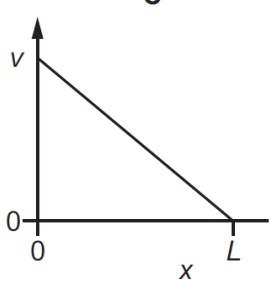
A



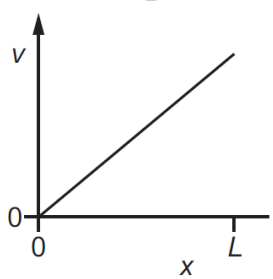
B



C

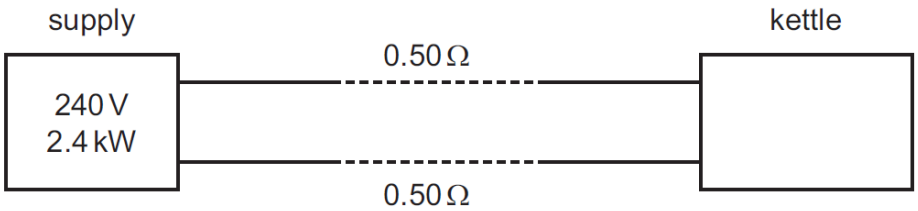


D



9. June/2021/Paper_12/No.33

The power output of an electrical supply is 2.4 kW at a potential difference (p.d.) of 240 V. The two wires between the supply and a kettle each have a resistance of 0.50 Ω, as shown.

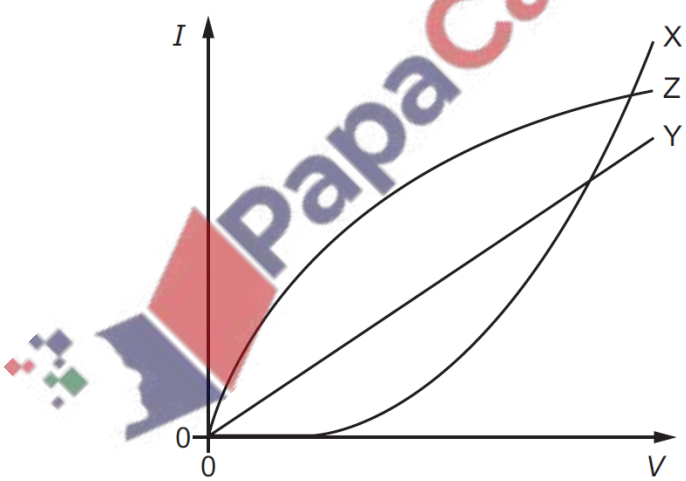


What is the power supplied to the kettle and what is the p.d. across the kettle?

	power / kW	p.d. / V
A	2.3	230
B	2.3	235
C	2.4	230
D	2.4	235

10. June/2021/Paper_12/No.34

The graph shows the variation with potential difference V of the current I in components X, Y and Z.



Which row correctly identifies the components?

	metallic conductor at constant temperature	semiconductor diode	filament lamp
A	X	Z	Y
B	Y	X	Z
C	Y	Z	X
D	Z	Y	X

11. June/2021/Paper_12/No.35

A wire of resistance 9.55 Ω has a diameter of 0.280 mm.

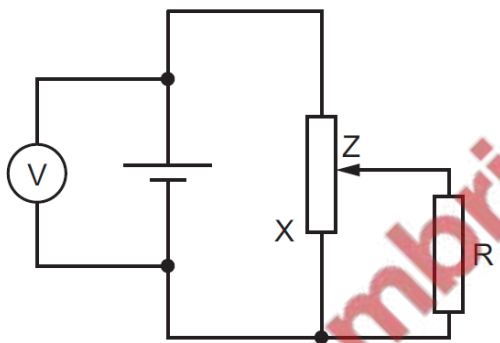
It is made of metal of resistivity $4.90 \times 10^{-7}\ \Omega\,\text{m}$.

What is the length of the wire?

A 1.20 m **B** 4.80 m **C** 19.0 m **D** 76.0 m

12. June/2021/Paper_12/No.36

A cell of constant electromotive force (e.m.f.) but with internal resistance is connected to a fixed resistor R using a potentiometer. A voltmeter measures the potential difference (p.d.) between the terminals of the cell.



Which statement explains the change to the reading of the voltmeter as contact Z is moved towards end X of the potentiometer?

A The voltmeter reading decreases because the current through the cell decreases.

B The voltmeter reading decreases because the current through the cell increases.

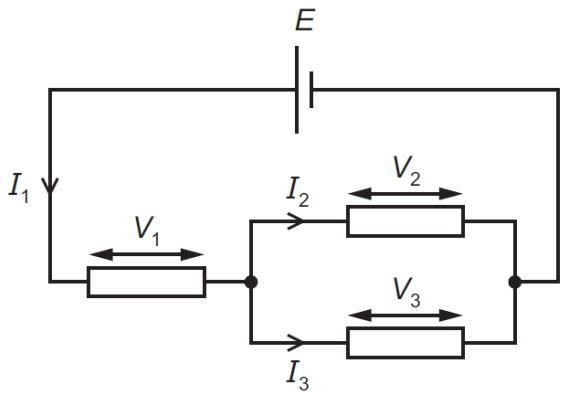
C The voltmeter reading increases because the current through the cell decreases.

D The voltmeter reading increases because the current through the cell increases.

13. June/2021/Paper_12/No.37

A cell of electromotive force (e.m.f.) E and negligible internal resistance is connected to a circuit.

The circuit has currents I_1, I_2 and I_3, and potential differences V_1, V_2 and V_3, as shown.

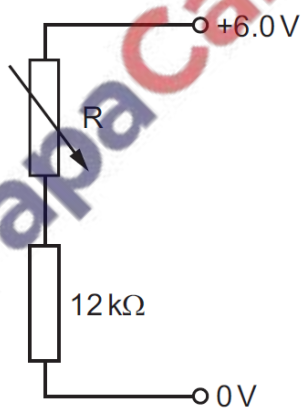


Which equation represents a statement of Kirchhoff's first law?

A $I_1 = I_2 + I_3$ **B** $I_1 = I_2 = I_3$ **C** $E = V_1 + V_2$ **D** $V_1 = V_2 = V_3$

14. June/2021/Paper_12/No.38

Two resistors are connected in series with a 6.0 V power supply, as shown.



What is the resistance of the variable resistor R to give a potential difference of 1.0 V across the 12 kΩ resistor?

A 2.0 kΩ **B** 10 kΩ **C** 60 kΩ **D** 72 kΩ

15. Nov/2021/Paper_11/No.32

The current I in a wire is given by the equation

$$I = nAvq$$

where n is the number density of the free electrons, A is the cross-sectional area of the wire, v is the average drift velocity of the free electrons and q is the charge of an electron.

Which relationship is **not** used in the derivation of this equation?

A charge = current × time

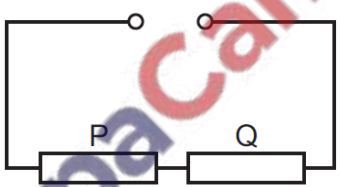
B distance = speed × time

C number = number density × area

D volume = length × area

16. Nov/2021/Paper_11/No.33

A circuit contains two resistors, P and Q, and a power supply of negligible internal resistance, as shown.



The current in resistor P is 2.0 A and the power dissipated by resistor P is 18 W.

Resistor Q dissipates 240 J of energy when a charge of 40 C passes through it.

What is the electromotive force (e.m.f.) of the power supply?

A 3.0 V **B** 6.0 V **C** 9.0 V **D** 15 V

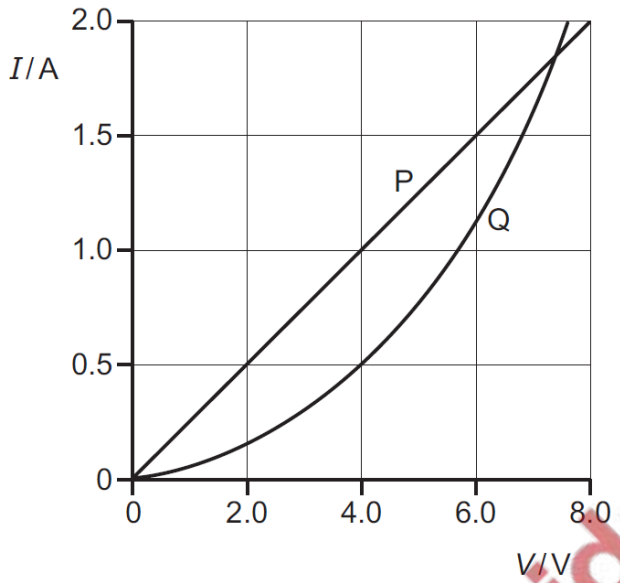
17. Nov/2021/Paper_11/No.35

What is the circuit symbol for an oscilloscope?

A **B** **C** **D**

18. Nov/2021/Paper_11/No.34

The I–V characteristics of two electrical components P and Q are shown.



Which statement is correct?

A For a current of 0.5 A, the power dissipated in Q is double that in P.

B For a current of 1.9 A, the resistance of Q is approximately half that of P.

C The resistance of Q increases as the current in it increases.

D P is a fixed resistor and Q is a filament lamp.

19. Nov/2021/Paper_11/No.35

Two copper wires S and T, of equal length, are connected in parallel. Wire S has a diameter of 3.0 mm. Wire T has a diameter of 1.5 mm.

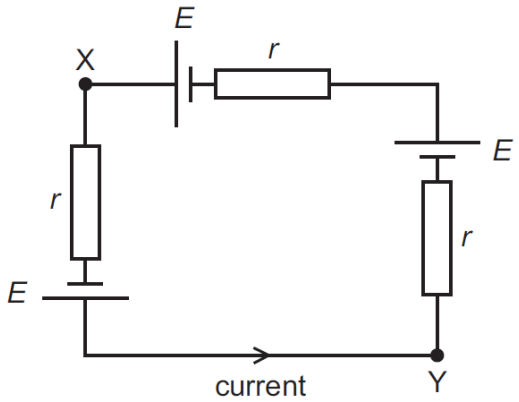
A potential difference is applied across the ends of this parallel arrangement.

What is the value of the ratio $\frac{\text{current in S}}{\text{current in T}}$?

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

20. Nov/2021/Paper_11/No.37

Three identical cells, each of electromotive force (e.m.f.) E and internal resistance r, are connected as shown.

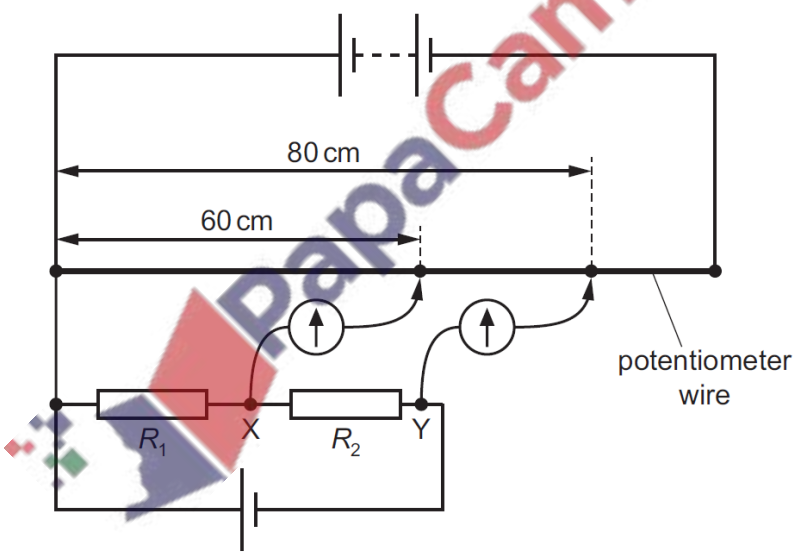


What is the potential difference between points X and Y?

A 0 **B** E **C** $2E$ **D** $3E$

21. Nov/2021/Paper_11/No.38

Potential differences across two resistors of resistances R_1 and R_2 are compared using a potentiometer wire (uniform resistance wire) in the electrical circuit shown.



One terminal of a galvanometer is connected to point X. The galvanometer reads zero when its other terminal is connected to a point that is a distance of 60 cm from one end of the potentiometer wire.

One terminal of a second galvanometer is connected to point Y. This galvanometer reads zero when its other terminal is connected to a point that is a distance of 80 cm from the same end of the potentiometer wire.

What is the ratio $\frac{R_2}{R_1}$?

A $\frac{1}{3}$ **B** $\frac{3}{4}$ **C** $\frac{3}{1}$ **D** $\frac{4}{3}$

22. Nov/2021/Paper_12/No.33

What is a description of the coulomb?

A the electric charge of one electron

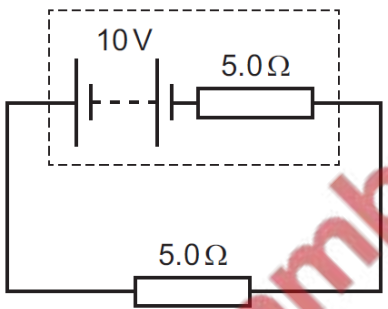
B the electric charge transferred by a current of one ampere in one second

C the kinetic energy gained by an electron accelerated through a potential difference of one volt

D the kinetic energy of an electron moving at a speed of one metre per second

23. Nov/2021/Paper_12/No.34

A battery of electromotive force (e.m.f.) 10 V and internal resistance 5.0 Ω is connected to a 5.0 Ω load resistor.



Which change occurs when the 5.0 Ω load resistor is replaced with a 50 Ω load resistor?

A The current in the circuit increases.

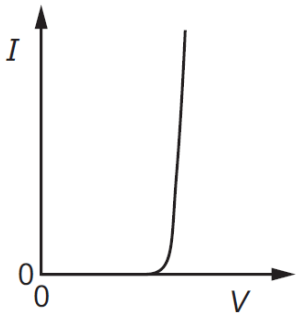
B The potential difference across the load resistor increases.

C The power dissipated in the internal resistance of the battery increases.

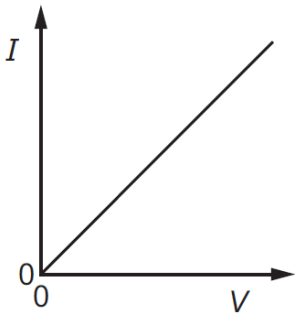
D The total power dissipated in the circuit increases.

24. Nov/2021/Paper_12/No.35

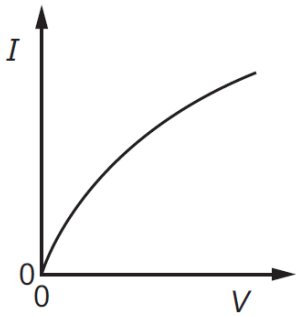
The graphs show the variation with potential difference V of the current I for three circuit components.



graph X



graph Y



graph Z

The components are a metal wire at constant temperature, a semiconductor diode and a filament lamp.

Which row correctly identifies these graphs?

	metal wire at constant temperature	semiconductor diode	filament lamp
A	X	Z	Y
B	Y	X	Z
C	Y	Z	X
D	Z	X	Y

25. Nov/2021/Paper_12/No.36

The electromotive force (e.m.f.) of a cell is 6.0 V. It has negligible internal resistance and is connected across a resistor. The potential difference (p.d.) across the resistor is also 6.0 V.

The e.m.f. and the p.d. have the same numerical value but represent different processes.

Which statement about the different processes is correct?

A The e.m.f. is the energy transferred from chemical energy to electrical energy in the cell and the p.d. is the energy transferred from electrical energy to thermal energy in the resistor.

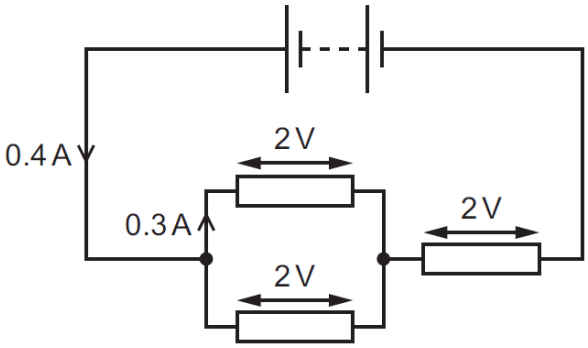
B The p.d. is the energy transferred from chemical energy to electrical energy in the cell and the e.m.f. is the energy transferred from electrical energy to thermal energy in the resistor.

C The e.m.f. is the energy transferred per unit charge from chemical energy to electrical energy in the cell and the p.d. is the energy transferred per unit charge from electrical energy to thermal energy in the resistor.

D The p.d. is the energy transferred per unit charge from chemical energy to electrical energy in the cell and the e.m.f. is the energy transferred per unit charge from electrical energy to thermal energy in the resistor.

26. Nov/2021/Paper_12/No.37

A battery of negligible internal resistance is connected to three resistors, as shown.



The potential difference across each resistor is 2 V.

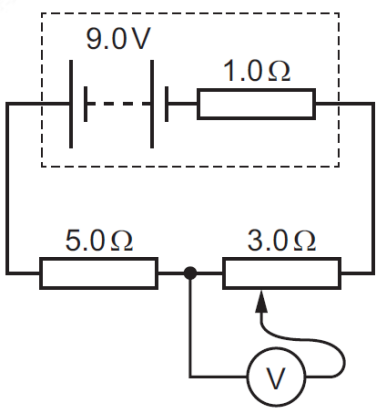
The current from the battery is 0.4 A and the current through one of the resistors connected in parallel is 0.3 A.

What is the current through the other resistor connected in parallel and what is the electromotive force (e.m.f.) of the battery?

	current / A	e.m.f. / V
A	0.1	4
B	0.3	4
C	0.1	6
D	0.3	6

27. Nov/2021/Paper_12/No.38

A battery of electromotive force (e.m.f.) 9.0 V and internal resistance 1.0 Ω is connected to a fixed resistor of resistance 5.0 Ω and a potentiometer of maximum resistance 3.0 Ω, as shown.



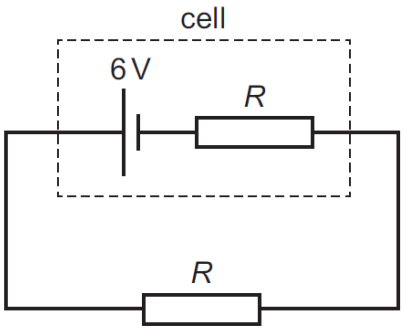
The sliding contact of the potentiometer is moved over its full range of movement.

What is the maximum value of the potential difference that is measured by the voltmeter?

A 3.0 V **B** 3.4 V **C** 4.5 V **D** 5.4 V

28. Nov/2021/Paper_13/No.34

A cell has an electromotive force (e.m.f.) of 6 V and internal resistance R. An external resistor, also of resistance R, is connected across this cell, as shown.



Power P is dissipated by the external resistor.

The cell is replaced by a different cell that has an e.m.f. of 6 V and negligible internal resistance.

What is the new power that is dissipated in the external resistor?

A $0.5P$ **B** P **C** $2P$ **D** $4P$

29. Nov/2021/Paper_13/No.35

A wire of uniform cross-section has resistance R.

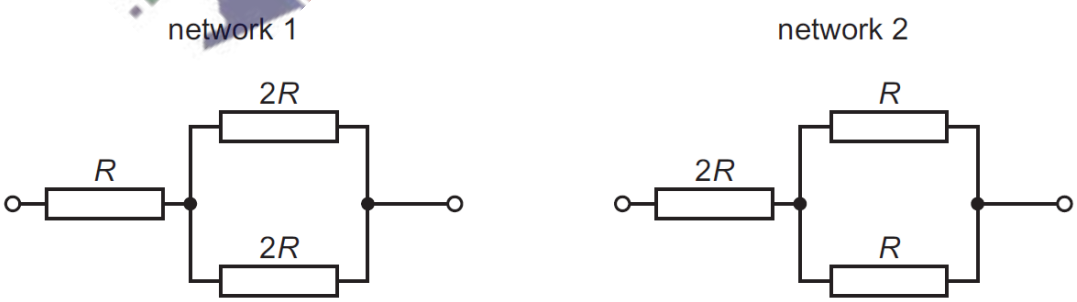
A second wire is made of the same material but is twice as long and has twice the diameter of the first wire.

What is the resistance of the second wire?

A $\frac{R}{8}$ **B** $\frac{R}{2}$ **C** R **D** $8R$

30. Nov/2021/Paper_13/No.36

The diagram shows two resistor networks.

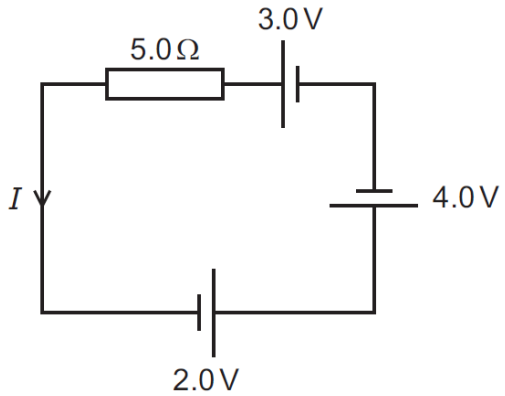


What is the ratio $\frac{\text{total resistance of network 1}}{\text{total resistance of network 2}}$?

A $\frac{4}{5}$ **B** $\frac{5}{4}$ **C** $\frac{1}{2}$ **D** $\frac{2}{1}$

31. Nov/2021/Paper_13/No.37

The circuit shown contains three cells of electromotive forces 3.0 V, 2.0 V and 4.0 V, in series with a resistor of resistance 5.0 Ω. The cells have negligible internal resistance.



What is the current I in the circuit?

A 0.20 A **B** 0.60 A **C** 1.0 A **D** 1.8 A