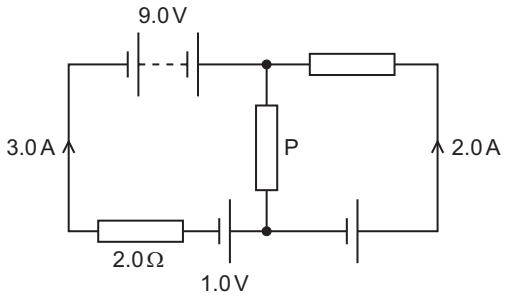
34 The diagram shows a circuit containing a battery and cells with negligible internal resistance.

Some values of current, electromotive force (e.m.f.) and resistance are shown.

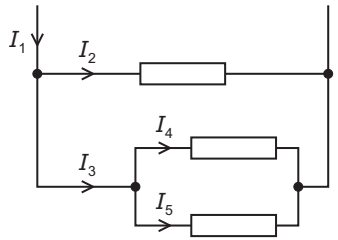
One resistor is labelled P.



What is the resistance of resistor P?

A 0.40 Ω **B** 0.80 Ω **C** 2.0 Ω **D** 2.8 Ω

37 The diagram shows the currents in part of an electric circuit.



The resistors are identical.

Which equation is **not** correct?

A $I_1 = I_2 + I_4 + I_5$

B $I_2 = I_1 - I_3$

C $I_2 = I_3 + I_4 + I_5$

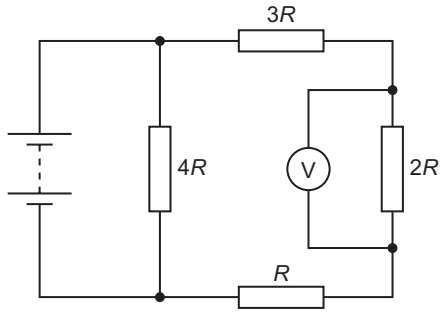
D $I_4 = I_3 - I_5$

37 The principles of conservation of which two quantities are associated with Kirchhoff's first and second laws?

	first law	second law
A	charge	energy
B	charge	voltage
C	energy	charge
D	voltage	charge

36 Four resistors of resistance R, $2R$, $3R$ and $4R$ are connected to form a network.

A battery of negligible internal resistance and a voltmeter are connected to the resistor network as shown.



The voltmeter reading is 2 V.

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

A 2 V **B** 4 V **C** 6 V **D** 10 V

5 **(a)** State Kirchhoff's first law.

.....

..... [1]

(b) Fig. 5.1 shows a circuit containing a thermistor T that has a negative temperature coefficient.

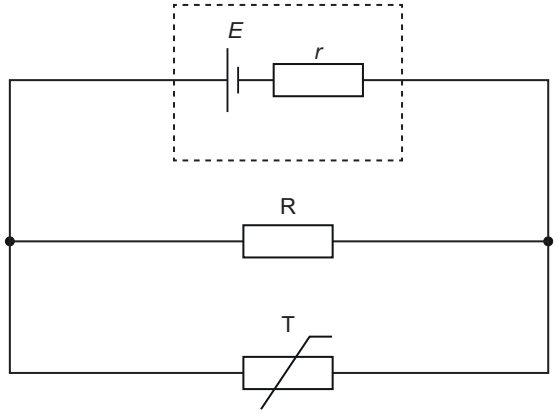


Fig. 5.1

(i) The thermistor has resistance R_0 at a temperature of 0 °C.

On Fig. 5.2, sketch a possible variation of the resistance of the thermistor with temperature between 0 °C and 100 °C.

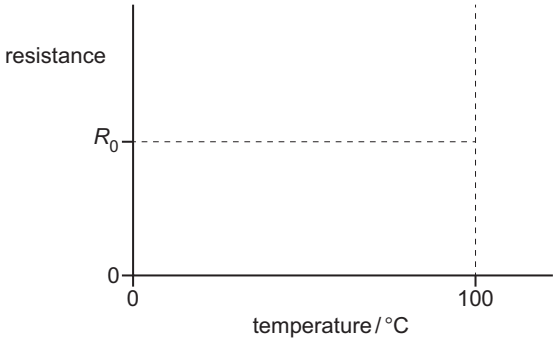


Fig. 5.2

[2]

(ii) With reference to the current in the cell, explain why the current in **resistor R** decreases with increasing temperature of the thermistor.

.....

.....

.....

.....

..... [3]

(c) The electromotive force (e.m.f.) E of the cell in Fig. 5.1 is 1.50 V. The internal resistance r of the cell is 0.12 Ω.

Resistor R has a resistance of 6.00 Ω.

At a particular temperature of the thermistor, the current in R is 0.200 A.

For this temperature of the thermistor, determine:

(i) the current in the cell

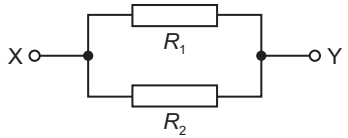
current = ...A [2]

(ii) the resistance of the thermistor.

resistance = ... Ω [2]

[Total: 10]

36 Two resistors of resistances R_1 and R_2 are connected in parallel.



What is the combined resistance between X and Y?

A $R_1 + R_2$ **B** $\frac{R_1 R_2}{R_1 + R_2}$ **C** $\frac{R_1 + R_2}{R_1 R_2}$ **D** $\frac{R_1}{R_2}$

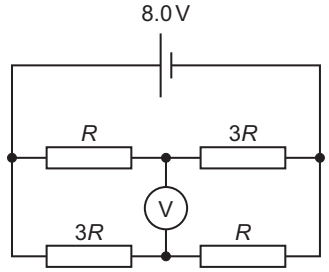
37 Each of Kirchhoff's two laws presumes that some quantity is conserved.

Which row states Kirchhoff's **first** law and names the quantity that is conserved?

	statement	quantity
A	The algebraic sum of currents at a junction is zero.	charge
B	The algebraic sum of currents at a junction is zero.	energy
C	The e.m.f. in a loop is equal to the algebraic sum of the product of current and resistance round the loop.	charge
D	The e.m.f. in a loop is equal to the algebraic sum of the product of current and resistance round the loop.	energy

35 Two resistors of resistance R and two resistors of resistance $3R$ are connected to a cell of e.m.f. 8.0 V as shown.

The cell has negligible internal resistance.



What is the reading on the voltmeter?

A 0.0 V **B** 2.0 V **C** 4.0 V **D** 6.0 V

34 The sum of the electrical currents into a point in a circuit is equal to the sum of the currents out of the point.

Which statement is correct?

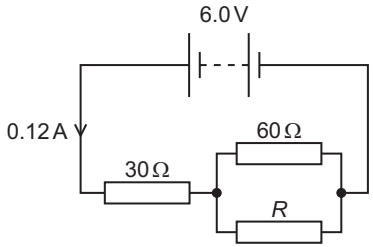
A This is Kirchhoff's first law, which results from the conservation of charge.

B This is Kirchhoff's first law, which results from the conservation of energy.

C This is Kirchhoff's second law, which results from the conservation of charge.

D This is Kirchhoff's second law, which results from the conservation of energy.

35 A battery of electromotive force (e.m.f.) 6.0 V and negligible internal resistance is connected to three resistors, as shown.



The current in the battery is 0.12 A.

What is resistance R?

A 12 Ω **B** 30 Ω **C** 50 Ω **D** 60 Ω

6 A battery of electromotive force (e.m.f.) 6.0 V and negligible internal resistance is connected in series with a variable resistor and a uniform resistance wire XY, as shown in Fig. 6.1.

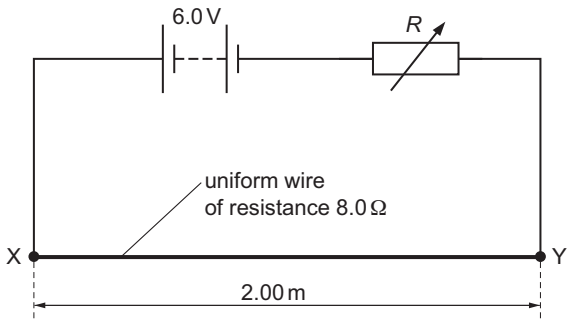


Fig. 6.1

Wire XY has length 2.00 m and resistance 8.0 Ω. The resistance *R* of the variable resistor is adjusted so that the potential difference across wire XY is 2.4 V.

(a) Determine *R*.

R = ... Ω [2]

(b) Explain why the potential difference *V* between any two points on wire XY is proportional to the distance *L* between those points.

.....

.....

.....

..... [2]

(c) A cell of e.m.f. *E* and internal resistance *r* is connected to the circuit, as shown in Fig. 6.2.

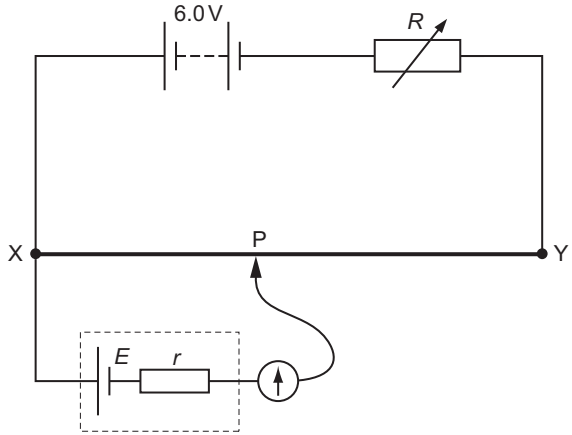


Fig. 6.2

Resistance *R* is unchanged.
The movable connection P is positioned on wire XY so that the galvanometer reading is zero.
Distance XP is 1.24 m.

(i) Calculate *E*.

E = ... V [2]

(ii) The value of *R* is now decreased.

State and explain the change that must be made to the position of P on wire XY so that the galvanometer reads zero again.

.....

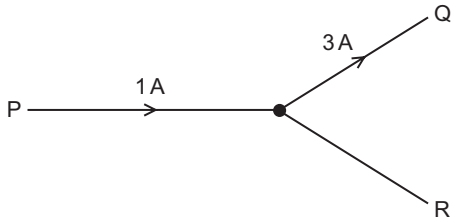
.....

.....

..... [2]

[Total: 8]

35 The diagram shows a junction in a circuit where three wires, P, Q and R, meet. The currents in P and Q are 1 A and 3 A respectively, in the directions shown.



How much charge passes a given point in wire R in a time of 5 s?

A 0.4 C **B** 2 C **C** 10 C **D** 20 C