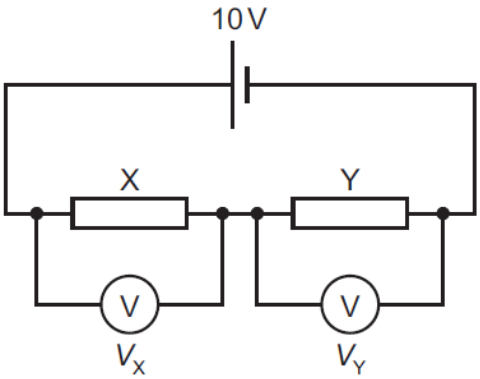
Current Electricity – 2020 O Level 5054

1. Nov/2020/Paper_11/No.35

In the circuit shown, the resistance of resistor Y is four times greater than the resistance of resistor X.



What is the difference $V_Y - V_X$ of the voltages shown on the voltmeters?

A 2.0 V **B** 5.0 V **C** 6.0 V **D** 8.0 V

2. Nov/2020/Paper_11/No.36

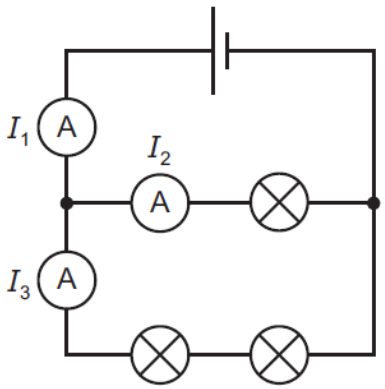
Two identical resistors connected in parallel have a total resistance of 4.0 Ω.

What is the total resistance when the same two resistors are connected in series?

A 1.0 Ω **B** 4.0 Ω **C** 8.0 Ω **D** 16 Ω

3. Nov/2020/Paper_11/No.37

Three identical lamps and three ammeters are connected as shown.



The readings on the ammeters are I_1, I_2 and I_3.

How are the readings related?

A $I_1 = I_2 = I_3$

B $I_1 > I_2$ and $I_2 = I_3$

C $I_1 > I_3 > I_2$

D $I_1 > I_2 > I_3$

4. Nov/2020/Paper_11/No.39

A student calculates the amount of energy used by an electric heater.

What is the equation for calculating the energy E in kW h?

A $E = I$ (ampere) $\times$ V (volt) $\times$ t (second)

B $E = I$ (ampere) $\times$ V (volt) $\times$ t (hour)

C $E = I$ (ampere) $\times$ V (volt) $\times$ t (second) $\div$ 1000

D $E = I$ (ampere) $\times$ V (volt) $\times$ t (hour) $\div$ 1000

5. Nov/2020/Paper_12/No.29

What is stored in a battery and what is its unit?

	quantity	unit
A	current	A
B	current	A s
C	energy	J
D	energy	J / s

6. Nov/2020/Paper_12/No.30

A car battery delivers 150 kC to a circuit before it needs recharging.

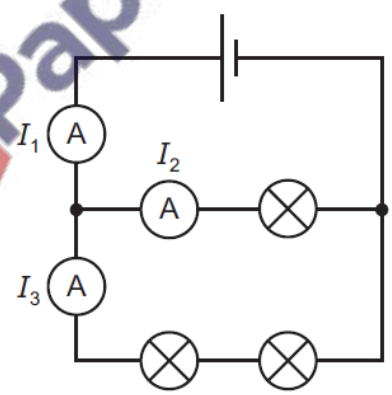
Two headlamps connected in parallel to the battery are switched on. There is a current of 4.0 A in each lamp.

How much time passes before the battery needs recharging?

A 2.6 hours **B** 5.2 hours **C** 7.8 hours **D** 10.4 hours

7. Nov/2020/Paper_12/No.31

Three identical lamps and three ammeters are connected as shown.



The readings on the ammeters are I_1, I_2 and I_3.

How are the readings related?

A $I_1 = I_2 = I_3$

B $I_1 > I_2$ and $I_2 = I_3$

C $I_1 > I_3 > I_2$

D $I_1 > I_2 > I_3$

8. Nov/2020/Paper_12/No.33

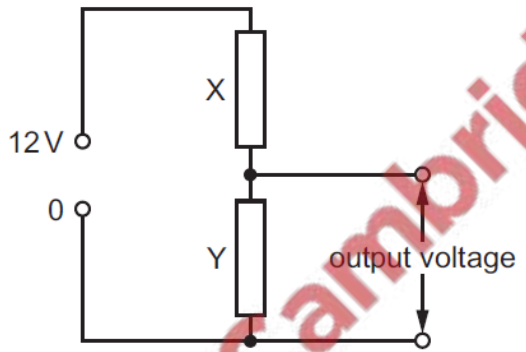
A 240 V mains circuit contains eight 60 W lamps in parallel. At the time when the lamps are switched on, the filaments are cold and the current is four times as large as the final steady current in the circuit.

What is the initial current supplied by the mains?

A 0.25 A **B** 1.0 A **C** 2.0 A **D** 8.0 A

9. Nov/2020/Paper_12/No.38

A potential divider uses a power supply of voltage 12 V. The resistors X and Y initially have equal resistances.



The resistance of X is halved.

What is the change in the output voltage?

A –3.0 V **B** –2.0 V **C** +2.0 V **D** +3.0 V

10. Nov/2020/Paper_21/No.10

Fig. 10.1 shows a wire of length l and cross-sectional area A.

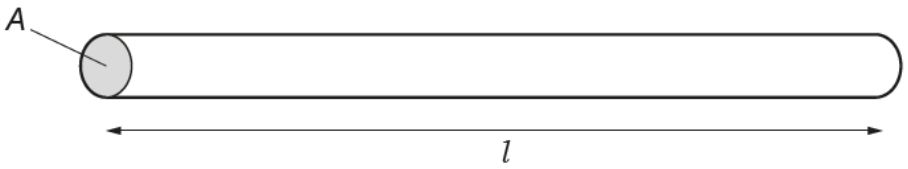


Fig. 10.1

(a) State how the resistance of the wire in Fig. 10.1 depends on:

(i) l

..... [1]

(ii) A.

..... [1]

(b) The cross-sectional area of a piece of metal wire is $7.5 \times 10^{-4}\,\text{cm}^2$. The resistance of a 1.0 m length of the same wire is 6.4 Ω.

The wire is made from metal W.

Fig. 10.2 shows a solid cube of side 1.0 cm. It is also made from metal W.

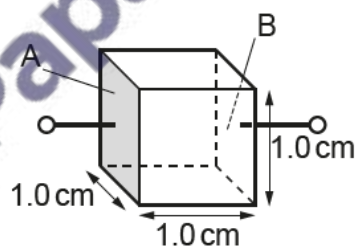


Fig. 10.2

Calculate the resistance between the two opposite faces A and B of the cube.

resistance = ... [2]

(c) The wire in part **(b)** is taped to a metre rule.

Fig. 10.3 shows that a 1.0 m length of the wire (resistance 6.4 Ω) is connected in series with a switch, a cell of electromotive force (e.m.f.) 1.2 V and a resistor of resistance 9.6 Ω.

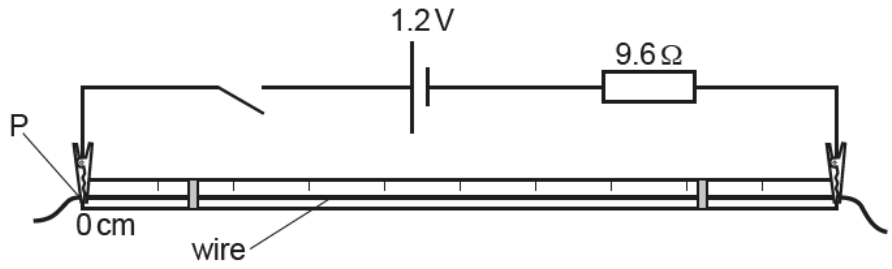


Fig. 10.3

The switch is closed.

(i) Explain what is meant by *electromotive force* (*e.m.f.*).

.....

.....

..... [2]

(ii) Calculate the potential difference (p.d.) across the 1.0 m length of the wire.

p.d. = ... [3]

(iii) One input terminal of an oscilloscope is connected to the wire at point P, the 0 cm mark of the metre rule.

The other terminal of the oscilloscope is connected to a sliding contact. Initially, this contact touches the wire at point P.

The Y-gain setting on the oscilloscope is 0.20 V / cm.

Fig. 10.4 shows the screen of the oscilloscope with a horizontal trace across the middle of the screen.

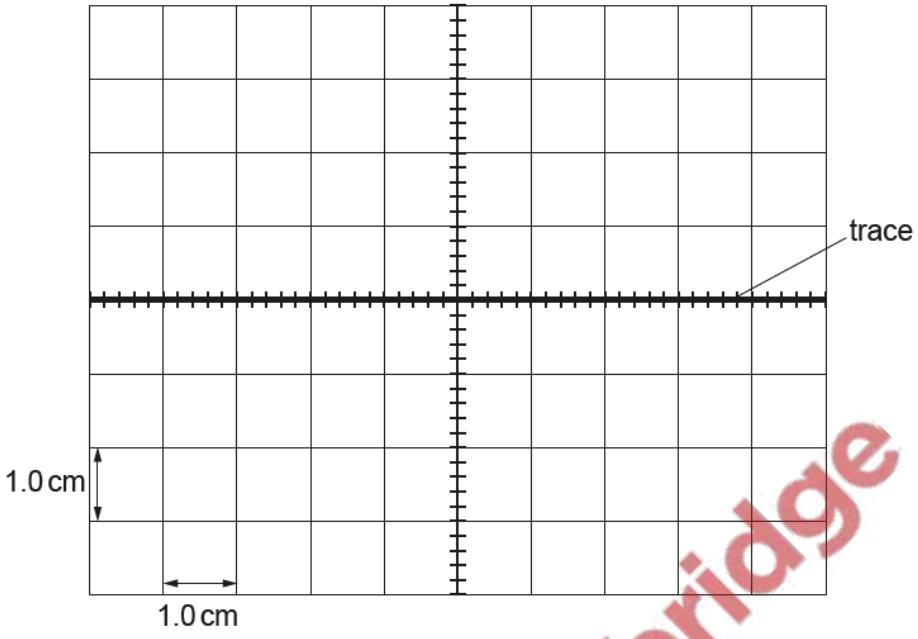


Fig. 10.4

The sliding contact is slowly moved along the wire until it reaches the other end of the metre rule.

Describe and explain what happens to the trace on the screen.

.....

.....

.....

..... [3]

(d) A second, identical 1.2 V cell is connected in parallel with the cell in the circuit in Fig. 10.3.

(i) State **one** advantage of using two cells in parallel rather than a single cell.

.....

..... [1]

(ii) State and explain the effect on the trace in **(c)(iii)** of adding the second cell in parallel.

.....

.....

..... [2]

[Total: 15]

11. Nov/2020/Paper_22/No.5

The cable of a washing machine contains three separate wires. There is a fuse in one of the wires.

(a) Explain how the earth wire and the fuse work together to make the washing machine safer.

.....

.....

.....

.....

..... [3]

(b) **(i)** State the name of the wire in which the fuse is connected.

..... [1]

(ii) Explain why the fuse is connected into this wire.

.....

..... [1]

(c) The cable of a hair-dryer contains only **two** wires.

(i) State the name of each of these wires.

1. .....

2. .....

[1]

(ii) Suggest why the hair-dryer does not need an earth wire.

.....

..... [1]

[Total: 7]

12. June/2020/Paper_11/No.36

A battery consists of three identical cells in parallel.

What is the unit of electromotive force (e.m.f.) and to what is the e.m.f. of the battery equal?

	unit	e.m.f. of the battery is equal to
A	J/C	the sum of the e.m.f.s of the three cells
B	J/C	the e.m.f. of one of the cells
C	N/V	the sum of the e.m.f.s of the three cells
D	N/V	the e.m.f. of one of the cells

13. June/2020/Paper_12/No.37

A metal wire of length l and cross-sectional area A has resistance R.

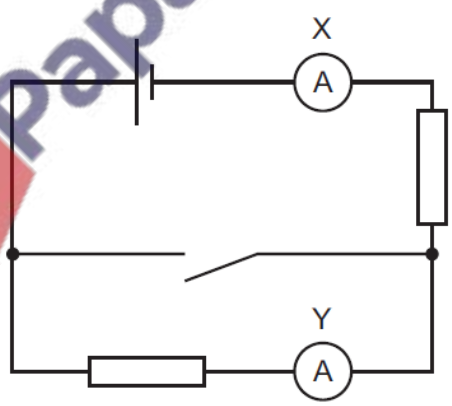
A second wire is made from the same metal. It has a length $2l$ and a cross-sectional area $4A$.

What is the resistance of the second wire?

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

14. June/2020/Paper_12/No.38

The diagram shows a circuit.



What effect does closing the switch have on the readings of ammeters X and Y?

	reading on ammeter X	reading on ammeter Y
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

15. June/2020/Paper_21/No.8

Fig. 8.1 shows a lamp from a car. It contains two metal filaments.

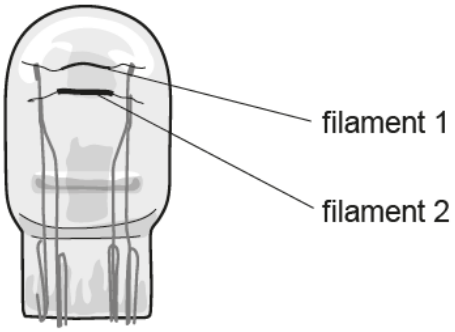


Fig. 8.1

(a) **(i)** Complete the boxes to describe the transfer of energy that takes place when the lamp is switched on.

..... energy	→	..... and ..... energy

[3]

(ii) The efficiency of the metal filament lamp is less than 10%.

State what is meant by *efficiency*.

.....

..... [2]

(b) The two filaments are usually connected in parallel to a car battery.

A student investigates what happens when the filaments are connected in series, rather than in parallel. He uses the same battery for the investigation.

State whether the current, the voltage across each filament and the total power produced *increases*, *decreases* or *stays the same* when the two filaments are connected in series.

current .....

voltage .....

power .....

[2]

(c) Fig. 8.2 shows the current–voltage graph for the two filaments.

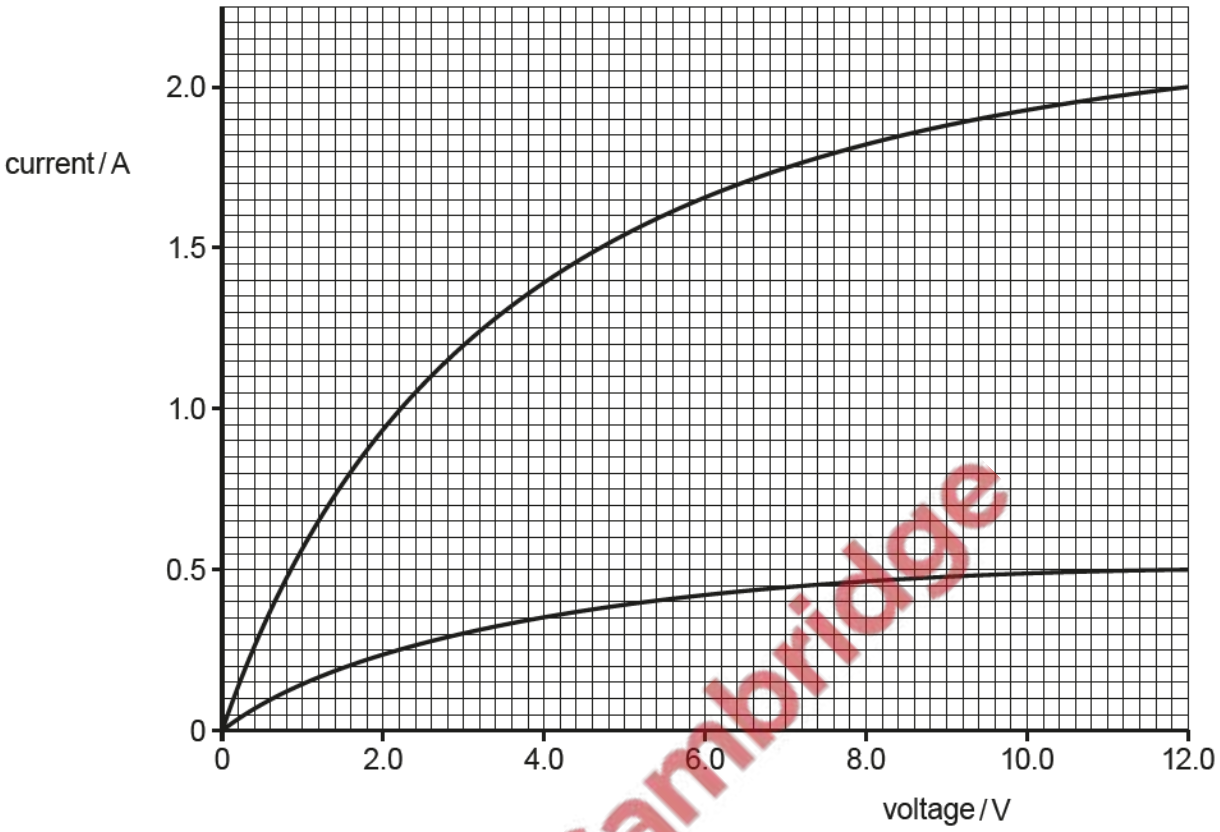


Fig. 8.2

(i) Calculate the total resistance of the two filaments when they are connected in parallel to a voltage of 12 V.

resistance = ... [3]

(ii) The two filaments are made from the same type of metal and have the same length, when uncoiled. They both operate at the same temperature.

Suggest why one filament has a resistance that is greater than that of the other filament.

.....

..... [1]

(d) Fig. 8.3 shows a relay used to switch on a car headlamp.

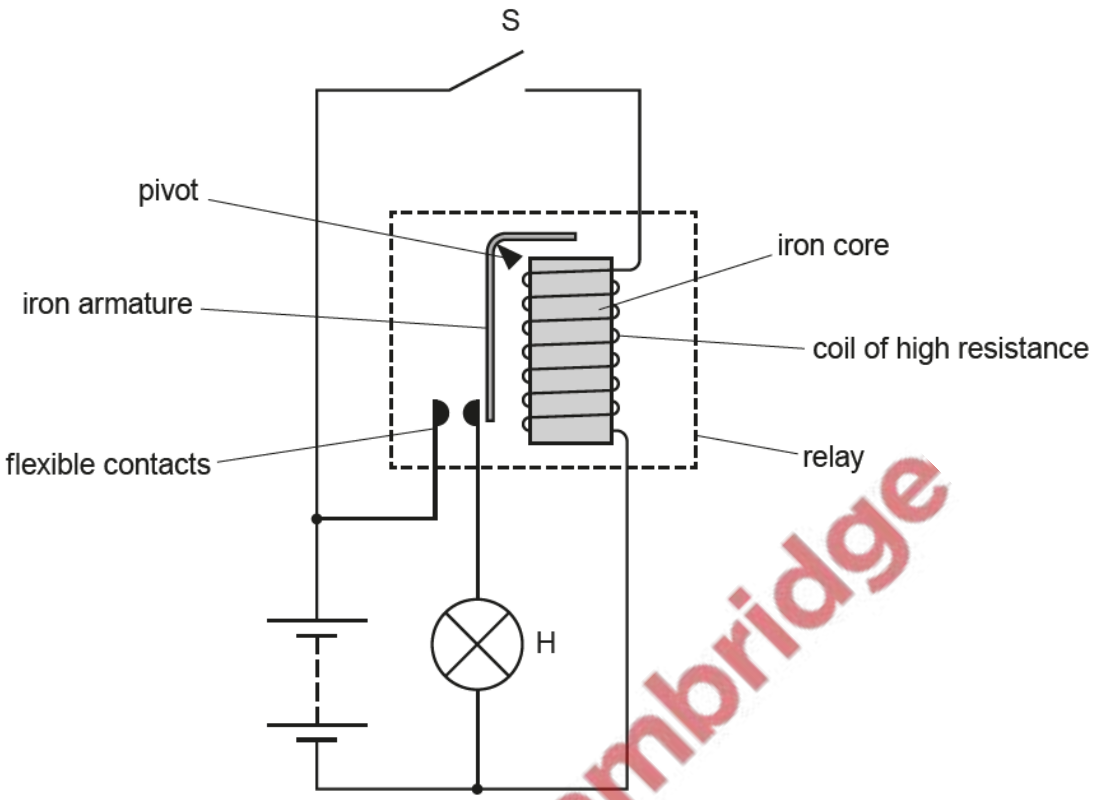


Fig. 8.3

Explain why headlamp H lights up when switch S is closed.

.....

.....

.....

.....

.....

..... [4]

[Total: 15]

16. June/2020/Paper_22/No.6

The clothes iron shown in Fig. 6.1 is connected to the electrical mains.

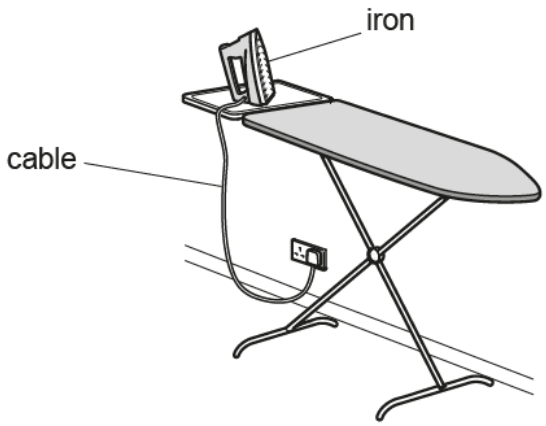


Fig. 6.1

(a) The boxes in the left column below contain some electrical hazards. The boxes in the right column contain methods of protection from these hazards.

For each hazard, draw **one** line to the appropriate method of protection.

electrical hazard	**method of protection**
worn insulation on the cable to the iron	earth wire and fuse in plug correctly connected to iron
loose live wire in the iron touches its metal case	circuit breaker correctly connected in circuit
cable becomes too hot because current is too high	visual check of cable before connecting to mains

[2]

(b) The power of the iron is 1200 W. The cost of 1 kW h of electrical energy is 20 cents (20 c).

(i) Define the *kilowatt-hour* (kW h).

.....

..... [1]

(ii) The iron is on at full power for 20 minutes.

Calculate the cost of running the iron for this time.

cost = ... [2]

[Total: 5]