2 – Electricity

Total mark – 18

Question: 1

1. A student investigated how the current in a series circuit varied with the resistance of a variable resistor.

Figure 1 shows the circuit used.

Figure 1

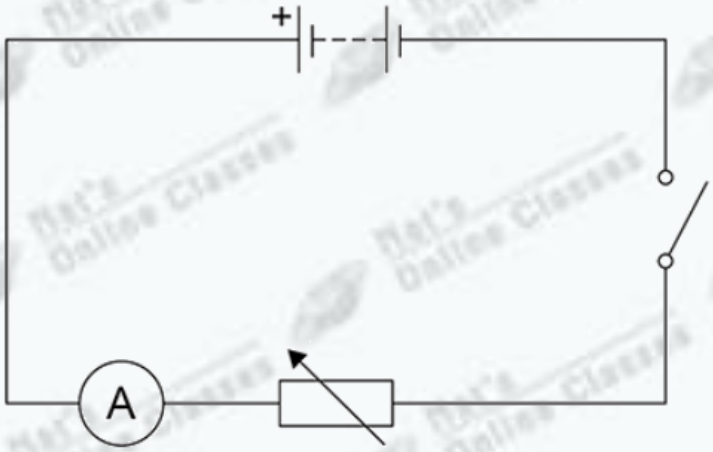
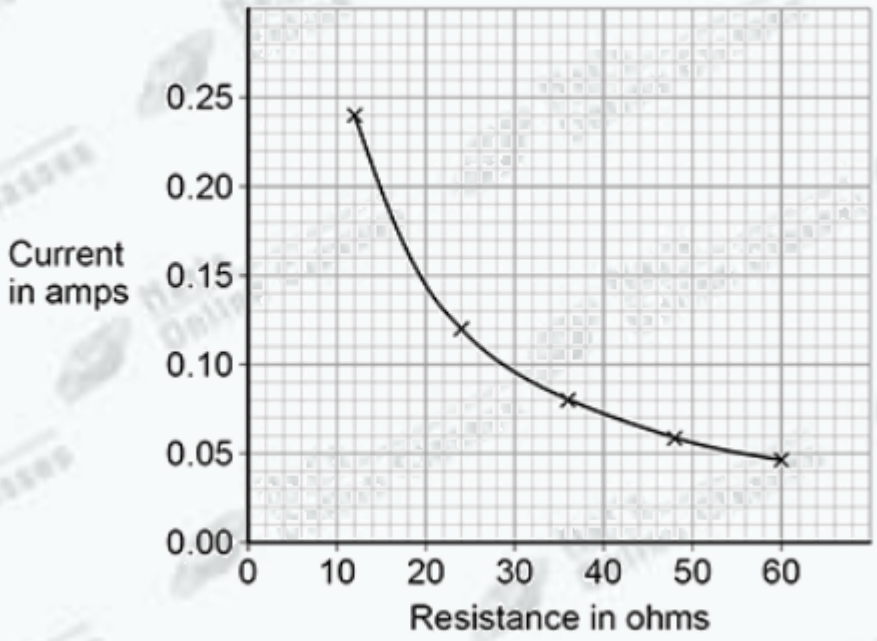


Figure 2 shows the results.

Figure 2



(a) The battery had a power output of 230 mW when the resistance of the variable resistor was 36 Ω.

Determine the potential difference across the battery.

_____

_____

_____

_____

_____

_____

Potential difference = _____ V

(4)

(b) The student concluded:

'the current in the circuit was inversely proportional to the resistance of the variable resistor.'

Explain how **Figure 2** shows that the student is correct.

_____

_____

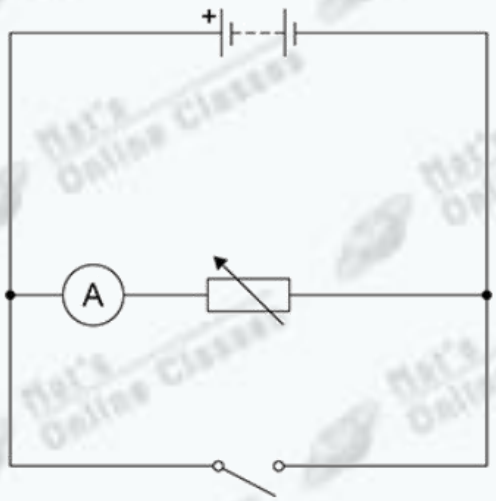
_____

_____

(2)

(c) **Figure 3** shows a circuit with a switch connected incorrectly.

Figure 3



Explain how closing the switch would affect the current in the variable resistor.

_____

_____

_____

_____

_____

(2)

(Total 8 marks)

1. (a) I = 0.08 (A)

an incorrect value of I from the graph can score all subsequent marks

1

$0.230 = 0.08 \times V$

allow a correct substitution of an incorrectly/not converted value of P

1

$V = \frac{0.230}{0.08}$

allow a correct rearrangement using an incorrectly/not converted value of P

1

V = 2.875 (V)

OR

I = 0.08 (A) (1)

V = 0.08 × 36 (2)

V = 2.88 (V) (1)

OR

$0.230 = I^2 \times 36$ (1)

I = 0.08 (A) (1)

V = 0.08 × 36 (1)

V = 2.88 (V) (1)

allow a correct calculation using an incorrectly/not converted value of P

1

(b) the product of current and resistance = a constant

1

calculation of constant (2.88) using three or more pairs of values

if no other marks scored allow for one mark a statement that doubling one quantity (R or I) halves the other quantity

1

(c) current would be (almost) zero (in the variable resistor)

1

(because) the switch has (effectively) zero resistance

or

the potential difference across the variable resistor is (effectively) zero

the switch's resistance is much lower than the variable resistor

allow the switch creates a short circuit

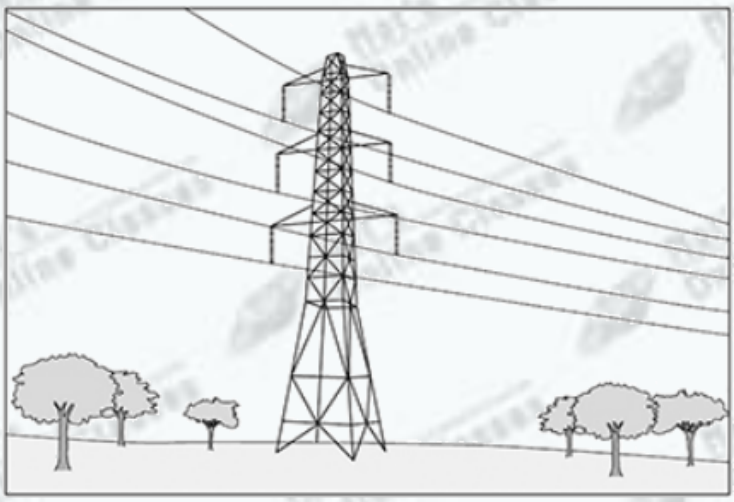
1

[8]

Question: 2

2. **Figure 1** shows some overhead power cables in the National Grid.

Figure 1



(a) Explain the advantage of transmitting electricity at a very high potential difference.

(3)

(b) It is dangerous for a person to fly a kite near an overhead power cable.

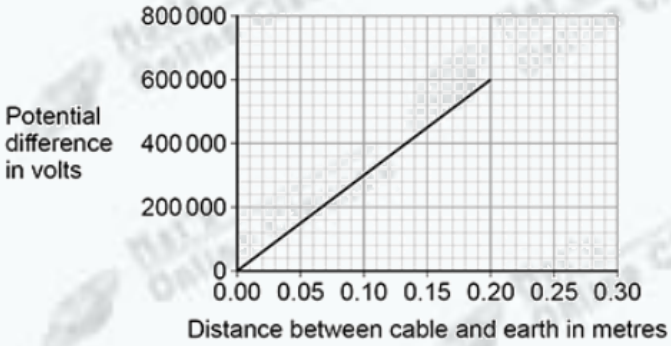
Figure 2 shows a person flying a kite.

Figure 2

The person could receive a fatal electric shock if the kite was very close to, but not touching the power cable.

Explain why.

(3)



(c) The data in **Figure 3** gives the relationship between potential difference and distance when the air is dry.

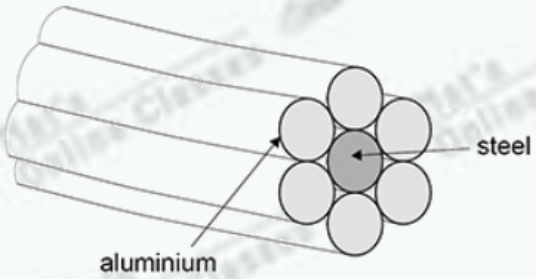
When the humidity of air increases the air becomes a better conductor of electricity.

Draw a line on **Figure 3** to show how the potential difference changes with distance if the humidity of the air increases.

(2)

(d) **Figure 4** shows a cross-section through a power cable.

Figure 4



A 1 metre length of a single aluminium wire is a better conductor than a 1 metre length of the steel wire.

The individual wires behave as if they are resistors connected in parallel.

Explain why the current in the steel wire is different to the current in a single aluminium wire.

_____

_____

_____

_____

_____

_____

(2)

(Total 10 marks)

2. (a) (very high p.d. means) very low currents

1

which means less (thermal) energy is transferred to surroundings

allow less power loss in cables

1

which increases the efficiency of power transmission

1

(b) electric field strength is very high

1

causing the air to become ionised

allow the air breaks down

allow the air becomes a conductor

allow the air conducts charge

1

(the kite / string) conducts charge to the person / earth

ignore answers referring to the kite touching the power cables

1

(c) straight line passing through the origin

1

line drawn below existing line for all values

1

(d) the potential difference across the wires/cable is the same

1

(but) the resistance of the steel wire is greater (and so less current in the steel)

1

[10]