**Name of the Student**:_____
**Max. Marks : 19 Marks** **Time : 19 Minutes**

## Q1.

An electrician is replacing an old electric shower with a new one.

The inside of the old shower is shown in **Figure 1**.

**Figure 1**



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(a) If the electrician touches the live wire he will receive an electric shock.

Explain why.

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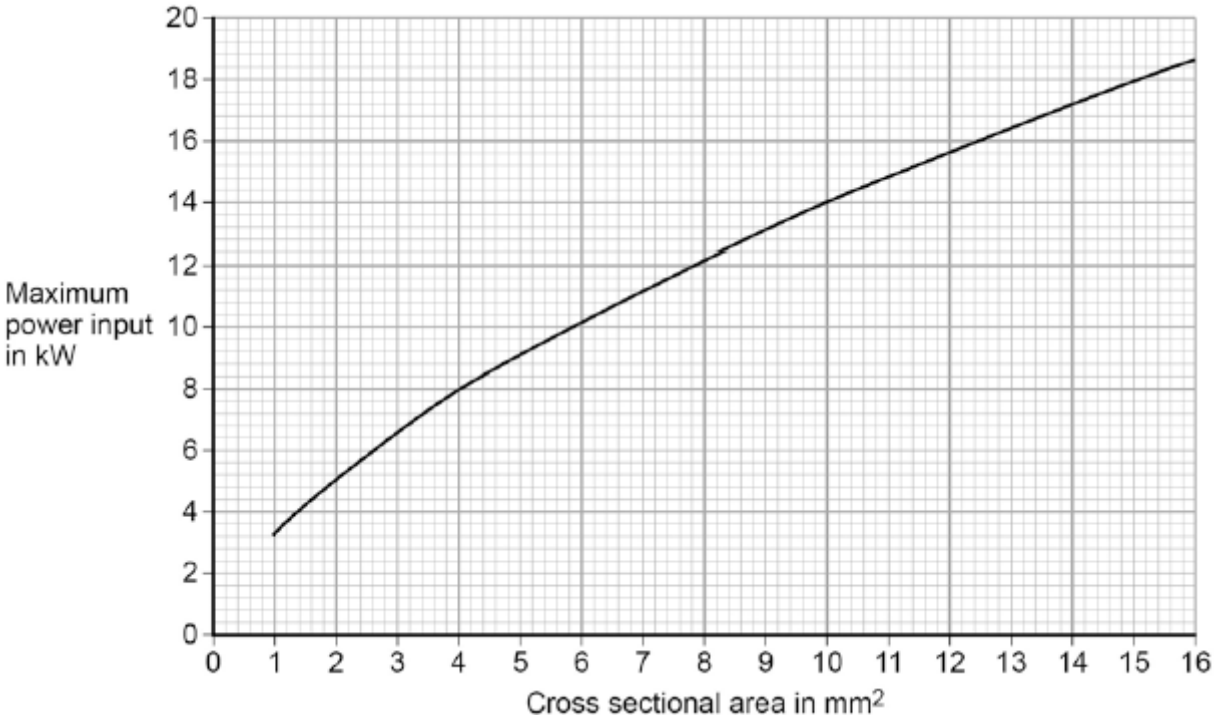
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**(4)**

(b) Different electrical wires need to have a cross-sectional area that is suitable for the power output.

**Figure 2** shows the recommended maximum power input to wires of different cross-sectional areas.

**Figure 2**




The new electric shower has a power input of 13.8 kW.

Determine the minimum **diameter** of wire that should be used for the new shower.

The diameter, d, can be calculated using the equation:

$$d = \sqrt{\frac{4A}{\pi}}$$

A is the cross-sectional area of the wire.

_____

_____

Minimum diameter = _____ mm

**(2)**

(c) The charge that flows through the new shower in 300 seconds is 18 000 C.
The new electric shower has a power of 13.8 kW.

Calculate the resistance of the heating element in the new shower.

Write down any equations you use.

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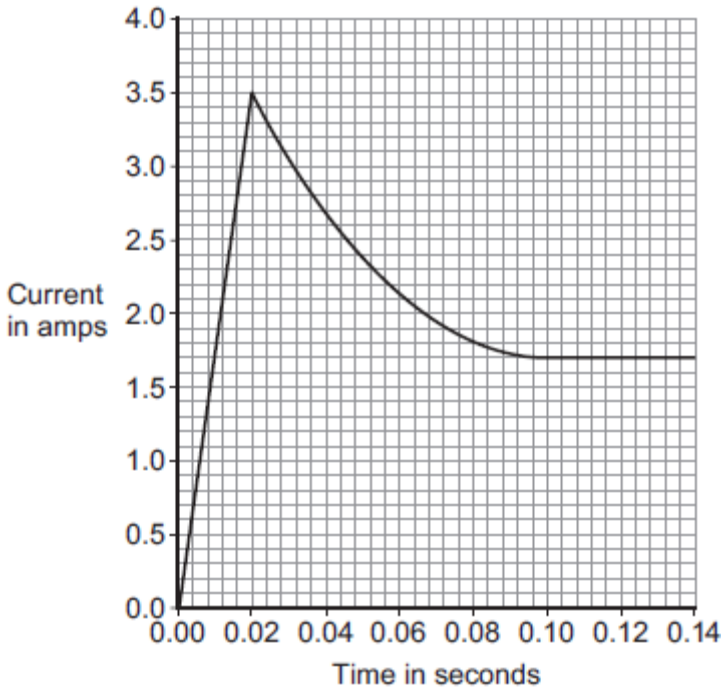
Resistance = _____ Ω

**(5)**

**(Total 11 marks)**

## Q2.

A 12 V filament bulb is connected to a 12 V power supply.
The graph shows how the current changes after the bulb is switched on.




(a) (i) After 0.10 seconds, the bulb works at its normal brightness.

What is the current through the bulb when it is working at normal brightness?

Current = _____ A

**(1)**

(ii) The bulb works at normal brightness for 30 seconds before it is switched off.

Calculate the charge that flows through the bulb in the 30 seconds before it is switched off. Give the unit.

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Charge = _____ unit _____

**(3)**

(iii) Calculate the energy transferred by the 12 V bulb when it is working at normal brightness for 30 seconds.

_____

_____

Energy transferred = _____ J

**(2)**

(b) Between 0.02 seconds and 0.08 seconds, there is an increase in both the resistance and the temperature of the metal filament inside the bulb.

Explain, in terms of the electrons and ions inside the filament, why both the temperature and the resistance increase.

_____

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**(2)**

**(Total 8 marks)**

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