

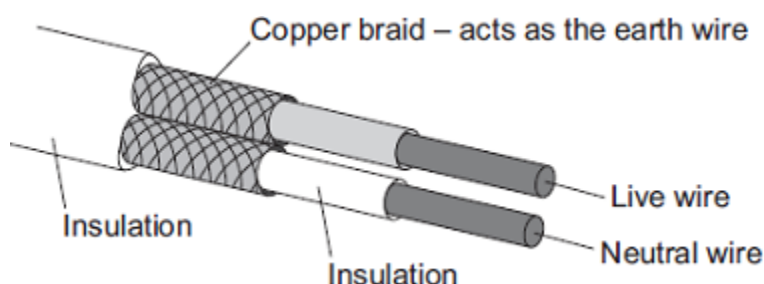
Name of the Student: _____

Max. Marks : 21 Marks

Time : 21 Minutes

Q1.

The diagram shows the structure of a cable. The cable is part of an undersoil heating circuit inside a large greenhouse.



- (a) The cable is connected to the mains electricity supply through a residual current circuit breaker. If the cable is accidentally cut the circuit breaker automatically switches the circuit off.

(i) What is the frequency of the mains electricity supply in the UK?

(1)

(ii) What happens, as the cable is cut, to cause the circuit breaker to switch the circuit off?

(2)

(iii) A circuit can also be switched off by the action of a fuse.

Give **one** advantage of using a circuit breaker to switch off a circuit rather than a fuse.

(1)

- (b) The 230 volt mains electricity supply causes a current of 11 amps to flow through the cable.

(i) Calculate the amount of charge that flows through the cable when the cable is switched on for 2 hours and give the unit.

Charge = _____

(3)

- (ii) Calculate the energy transferred from the cable to the soil in 2 hours.

Energy transferred = _____ J

(2)

- (c) The heating circuit includes a thermistor. The thermistor is buried in the soil and acts as a thermostat to control the increase in the temperature of the soil.

Describe how an **increase** in the temperature of the soil affects the thermistor.

(2)

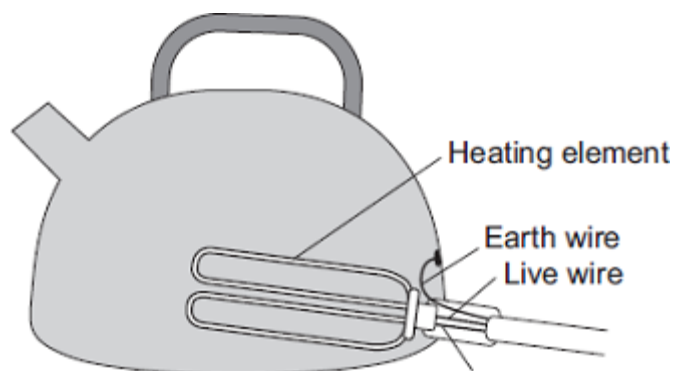
(Total 11 marks)

Q2.

- (a) Describe the difference between an alternating current (a.c.) and a direct current (d.c.).

(2)

- (b) The diagram shows how the electric supply cable is connected to an electric kettle. The earth wire is connected to the metal case of the kettle.



If a fault makes the metal case live, the earth wire and the fuse inside the plug protect anyone using the kettle from an electric shock.

Explain how.

(2)
(Total 4 marks)

Q3.

The table gives data about two types of low energy bulb.

Type of bulb	Power input in watts	Efficiency	Lifetime in hours	Cost of one bulb
Compact Fluorescent Lamp (CFL)	8	20%	10 000	£3.10
Light Emitting Diode (LED)	5		50 000	£29.85

(a) Both types of bulb produce the same useful power output.

(i) Calculate the useful power output of the CFL.

Show clearly how you work out your answer.

Useful power output = _____ W

(2)

(ii) Calculate the efficiency of the LED bulb.

Show clearly how you work out your answer.

Efficiency = _____

(1)

- (b) LED bulbs are expensive. This is because of the large number of individual electronic LED chips needed to produce sufficient light from each bulb.

- (i) Use the data in the table to evaluate the cost-effectiveness of an LED bulb compared to a CFL.

(2)

- (ii) Scientists are developing brighter and more efficient LED chips than those currently used in LED bulbs.

Suggest **one** benefit of developing brighter and more efficient LED chips.

(1)

(Total 6 marks)