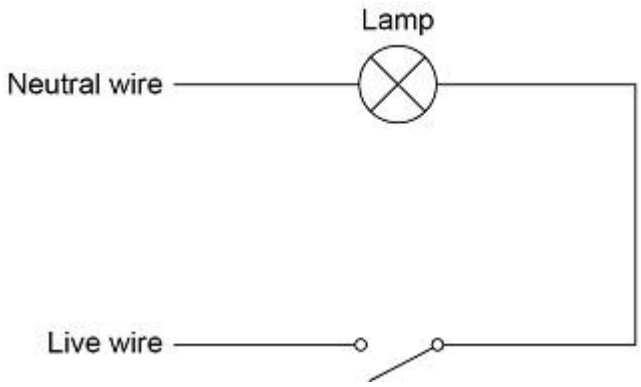
P5 Electricity – In the home, task 1

Foundation Questions

Q1.

The diagram shows part of a lighting circuit in a house.



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

Tick (✓) **one** box.

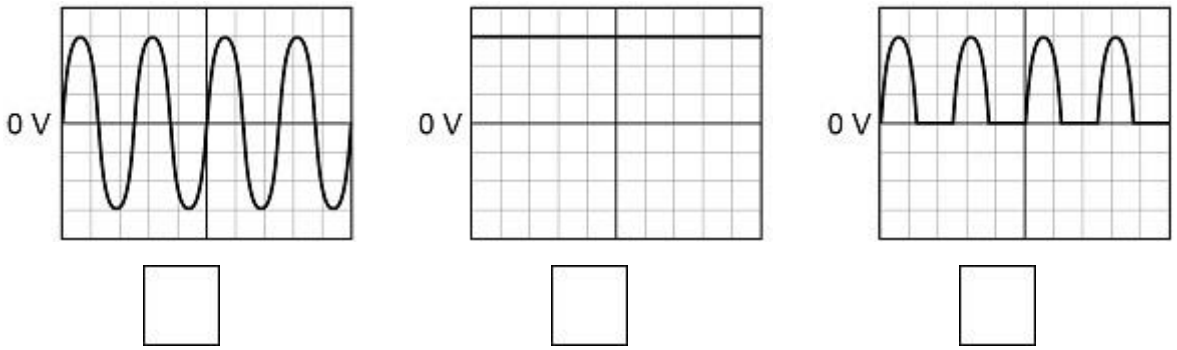
20 Hz ☐ 50 Hz ☐ 60 Hz ☐ 100 Hz ☐

(1)

(b) The mains electricity supply has an alternating potential difference.

Which diagram shows an alternating potential difference?

Tick (✓) **one** box.



☐ ☐ ☐

(1)

(c) The potential difference across the lamp is 230 V.

The current in the lamp is 0.020 A.

Calculate the power output of the lamp.

Use the equation:

power = potential difference × current

Power = _____ W

(2)

(d) The potential difference across the lamp is 230 V.

Calculate the energy transferred by the lamp when 180 C of charge flows through the lamp.

Use the equation:

energy transferred = charge flow × potential difference

Energy transferred = _____ J

(2)

(e) An electrician needs to replace the light switch in the diagram above.

Describe the possible hazard and the risk to the electrician of changing the light switch.

Hazard

Risk

(2)

(Total 8 marks)

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Q2.

Most electric kettles use the ac mains electricity supply.

(a) Complete the sentence.

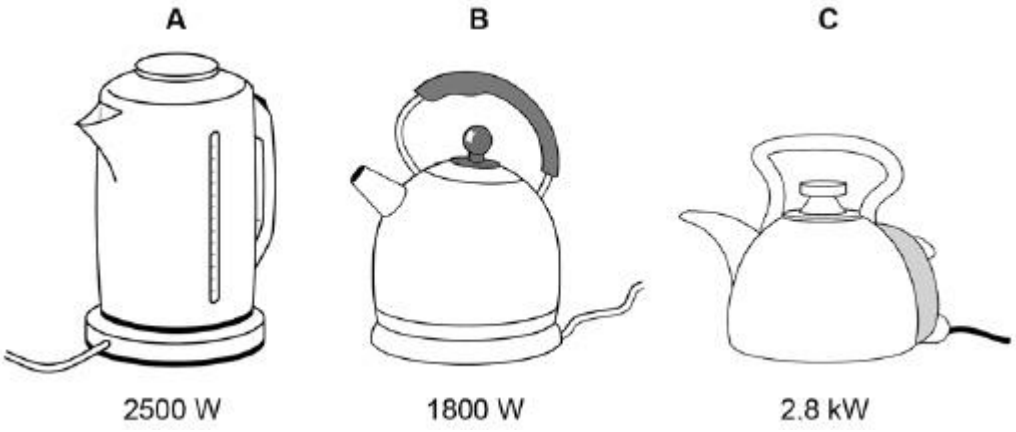
The ac mains supply has a potential difference that continuously

_____ polarity

(1)

Figure 1 gives the power output of three electric kettles.

Figure 1



A student investigated how the power output of a kettle affected the time taken to boil a fixed volume of water. The water in all three kettles had an initial temperature of 25 °C.

(b) What type of variable was the time?

Tick **one** box.

Control ☐

Dependent ☐

Independent ☐

(1)

(c) Which kettle will boil the water in the shortest time?

Give a reason for your answer.

Kettle _____

Reason _____

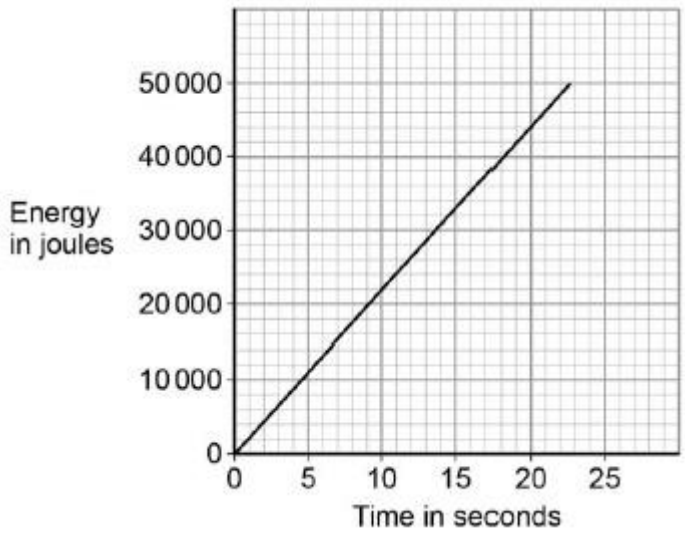
_____

_____

(2)

(d) **Figure 2** shows how the amount of energy transferred by a kettle varies with time.

Figure 2



The power output of the kettle is given by the gradient of the graph.

Calculate the power output of the kettle.

_____

_____

Power output = _____ W

(2)

(e) Write down the equation that links charge flow, current and time.

_____

(1)

(f) Calculate the current through the kettle when 2400 coulombs of charge flows in 250 seconds.

_____

_____

_____

Current = _____ A

(3)

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(Total 10 marks)

Higher Questions

Q3.

The photograph below shows a coffee machine. The coffee machine uses an electric element to heat water.

(a) The coffee machine has a metal case.

Why would it be dangerous for the live wire of the electric cable to touch the metal case?

_____

_____

(1)

(b) The power output of the coffee machine is 2.53 kW.

The mains potential difference is 230 V.

Calculate the current in the coffee machine.

_____

_____

_____

_____

Current = _____ A

(3)

(c) The coffee machine heats water from 20 °C to 90 °C.

The power output of the coffee machine is 2.53 kW.

The specific heat capacity of water is 4200 J/kg °C.

Calculate the mass of water that the coffee machine can heat in 14 seconds.

_____

_____

_____

_____

_____

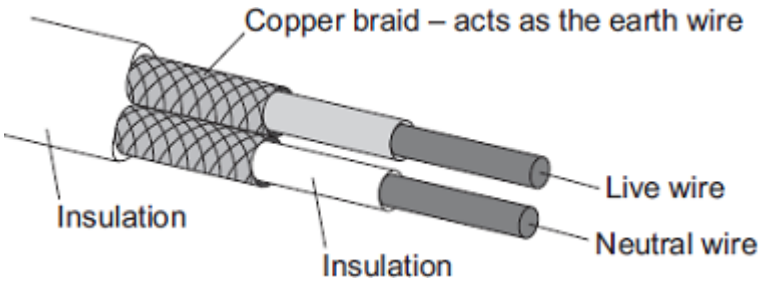
Mass = _____ kg

(5)

(Total 9 marks)

Q4.

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)**