Q1.(2018)

a)

Figure 15 shows a coffee machine. The coffee machine uses an electric element to heat water.

Figure 15

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 mark]

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.

[3 marks]

Current = _____ A

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.

[5 marks]

Mass = _____ kg

Q2.(2019)

a)

Light bulbs are labelled with a power input.

What does power input mean?

[1 mark]

Tick (✓) **one** box.

- The charge transferred each second by the bulb. ☐
- The current through the bulb. ☐
- The energy transferred each second to the bulb. ☐
- The potential difference across the bulb. ☐

Q2.b)(2019)

Write down the equation which links current, potential difference and power.

[1 mark]

c)

A light bulb has a power input of 40 W

The mains potential difference is 230 V

Calculate the current in the light bulb.

[3 marks]

Current = _____ A

d)

Table 1 shows information about three different light bulbs.

Table 1

Light bulb	Total power input in watts	Useful power output in watts	Efficiency
P	6.0	5.4	0.90
Q	40	2.0	0.05
R	9.0	**X**	0.30

Write down the equation which links efficiency, total power input and useful power output.

[1 mark]

e)

Calculate the value of **X** in **Table 1**.

[3 marks]

X = _____ W

f)

In addition to power input, light bulbs should also be labelled with the rate at which they emit visible light.

Suggest why.

[2 marks]

Q3.(2019)

a)

Figure 7 shows a person using an electric lawn mower.

Figure 7

The lawn mower is connected to the mains electricity supply.

What is the frequency of the mains electricity supply in the UK?

[2 marks]

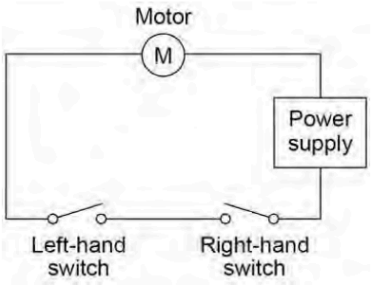
Frequency = _____ Unit _____

b)

The lawn mower has a switch on each side of the handle.

Figure 8 shows the circuit diagram for the lawn mower.

Figure 8



The motor in the lawn mower can only be turned on when the person using it holds the handle of the lawn mower with both hands.

Explain why.

[2 marks]

c)

The power input to the motor is 1.8 kW

The resistance of the motor is 32 Ω

Calculate the current in the motor.

[3 marks]

Current = _____ A

d)

The useful power output from the motor is 1.5 kW

Calculate the time it takes for the motor to transfer 450 000 J of useful energy.

[3 marks]

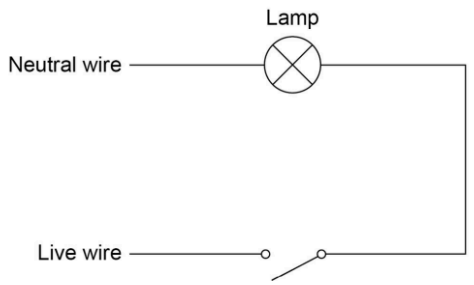
Time = _____ seconds

Q4.(2020)

a)

Figure 13 shows part of a mains electricity lighting circuit in a house.

Figure 13



A fault in the switch caused a householder to receive a mild electric shock before a safety device switched the circuit off.

The mean power transfer to the person was 5.75 W.

The potential difference across the person was 230 V.

Calculate the resistance of the person.

[5 marks]

Resistance = _____ Ω

b)

An electrician replaced the switch.

The electrician would have received an electric shock unless the circuit was disconnected from the mains supply.

Explain why.

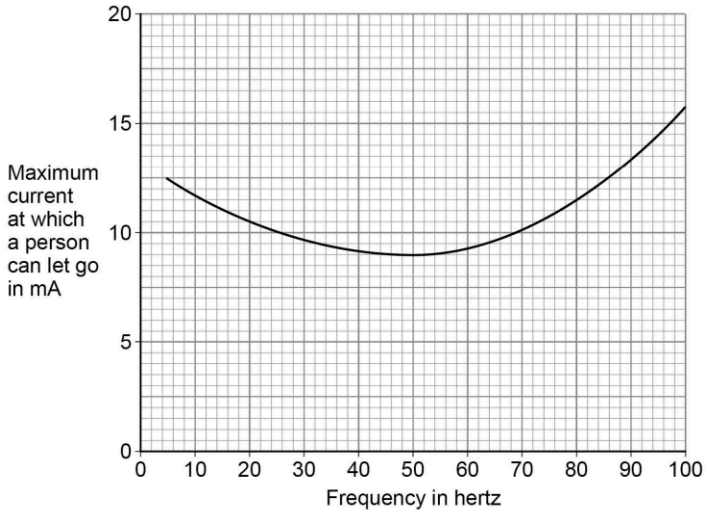
[3 marks]

c)

The current from an electric shock causes a person's muscles to contract. The person cannot let go of the electrical circuit if the current is too high.

Figure 14 shows how the maximum current at which a person can let go depends on the frequency of the electricity supply.

Figure 14



The UK mains frequency is 50 Hz.

Explain why it would be safer if the UK mains frequency was **not** 50 Hz.

[2 marks]

Q5.(2022)

a)

An engineering company has invented pavement tiles that generate electricity as people walk on them.

Figure 3 shows someone walking on the pavement tiles.

Figure 3

Use the Physics Equations Sheet to answer questions **03.1** and **03.2**.

What equation links current (I), potential difference (V) and power (P)?

[1 mark]

Tick (✓) **one** box.

$P = \frac{V}{I}$ ☐

$P = V \times I$ ☐

$I = P \times V$ ☐

$V = I^2 \times P$ ☐

b)

When a person walks on a tile, a potential difference of 40 V is induced across the tile.

The power output of the tile is 4.4 W.

Calculate the current in the tile.

[3 marks]

Current = _____ A

c)

What equation links efficiency, total power input and useful power output?

[1 mark]

Tick (✓) **one** box.

Efficiency = $\frac{\text{useful power output}}{\text{total power input}}$ ☐

Efficiency = $\frac{\text{total power input}}{\text{useful power output}}$ ☐

Efficiency = useful power output × total power input ☐

d)

The tiles are used to power LED lights in the pavement.

An LED light has a total power input of 4.0 W.

The efficiency of the LED light is 0.85

Calculate the useful power output of the LED light.

[3 marks]

Useful power output = _____ W

Q6.(2024)

a)

Figure 7 shows a student putting a coin into a vending machine that sells food.

Figure 7

The vending machine is connected to the mains electricity supply.

What is the frequency and the potential difference of the mains electricity supply in the UK?

[2 marks]

Frequency = _____ Hz

Potential difference = _____ V

b)

The vending machine identifies the value of the coin by measuring the resistance of the coin.

The power dissipated by the coin is 340 mW when the current in the coin is 0.75 A.

Calculate the resistance of the coin.

Use the Physics Equations Sheet.

[4 marks]

c)

Coins that are dirty are **not** recognised by the vending machine.

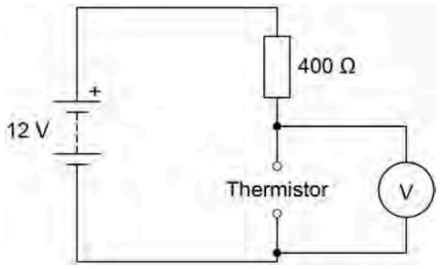
Suggest **one** reason why.

[1 mark]

d)

Figure 8 shows part of a different circuit that is used to monitor the temperature inside the vending machine.

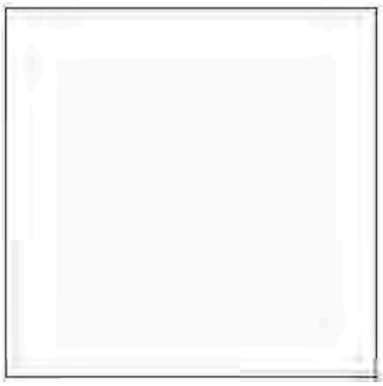
Figure 8



The circuit symbol for a thermistor has not been included.

Draw the circuit symbol for a thermistor in the box below.

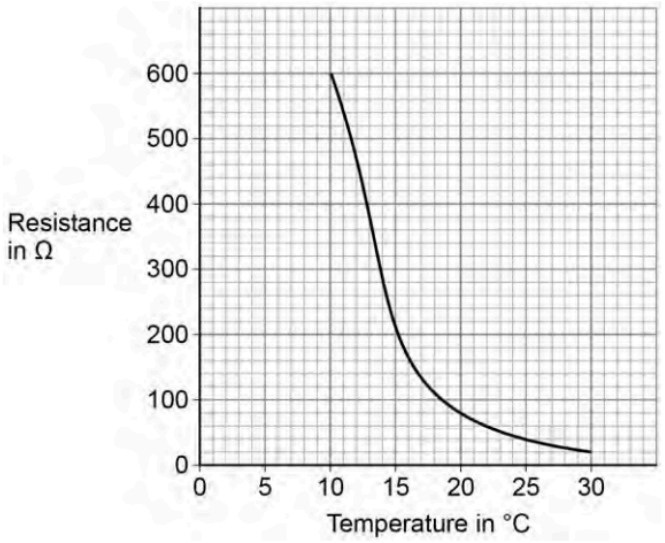
[1 mark]



e)

Figure 9 shows how the resistance of the thermistor varies with temperature.

Figure 9



The cooling system inside the vending machine turns on when the temperature of the thermistor is above 20 °C.

Determine the potential difference across the thermistor when the temperature is 20 °C.

Use the Physics Equations Sheet.

[5 marks]

Potential difference = _____ V

Q7.(2024)

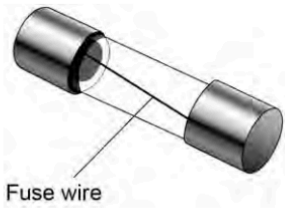
a)

The live wire in a three-core cable is connected to a fuse inside a plug.

A fuse contains a wire that is designed to melt when the current gets too great.

Figure 17 shows a fuse.

Figure 17



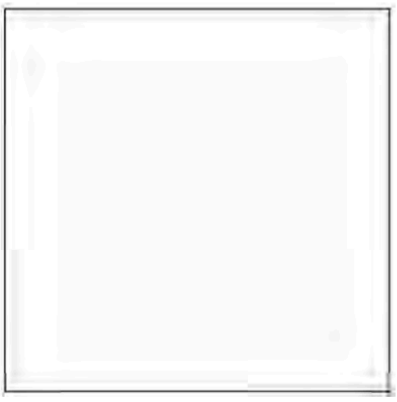
What colour is the insulation covering the live wire in a three-core cable?

[1 mark]

b)

Draw the circuit symbol for a fuse in the box below.

[1 mark]



c)

The fuse wire melts when there is a charge flow of 2.0 C for 400 ms.

Calculate the current in the fuse wire.

Use the Physics Equations Sheet.

[4 marks]

d)

When the fuse wire is at its melting point, the additional energy needed to melt the wire is 1.02 J.

specific latent heat of fuse wire = 60 kJ/kg

Calculate the mass of the fuse wire.

Use the Physics Equations Sheet.

[4 marks]

Mass = _____ kg

e)

The calculation in Question **10.4** assumes there is no energy transferred to the surroundings.

How would the time taken for the wire to melt be affected if some energy was transferred to the surroundings?

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.

Time taken would decrease ☐

Time taken would stay the same ☐

Time taken would increase ☐

Reason _____