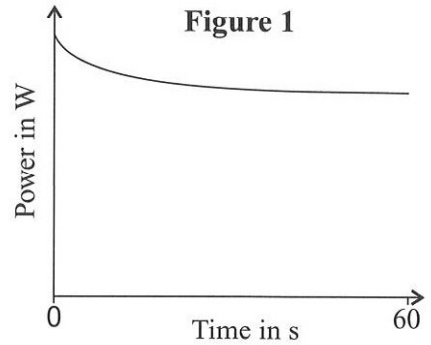


Electrical Appliances

- 1 An engineer is testing a new type of heating element for use in a kettle.

She produces a graph showing how the power output of the heating element changes during the first 60 seconds after current starts flowing.

A sketch of the engineer's graph is shown in **Figure 1**.



- a)* Discuss the change in the power output of the heating element during the first 60 seconds after the current starts flowing.

You should include an explanation of how the heating effect is produced.

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[6]

- b) i) The engineer decides to construct her own battery-operated water heater. She connects a heating element in series with a 9.0 V cell. The heating element she uses has a constant resistance of 1.7Ω . The engineer calculates that 8400 J of energy must be transferred to raise the temperature of 100 ml of water by 20 °C. Calculate how long the engineer's heater will take to transfer this amount of energy.

[5]

- ii) The engineer modifies the design of her heater so that it now contains two identical heating elements connected in parallel to the cell. State and explain how the time taken to transfer 8400 J of energy to the water will change.

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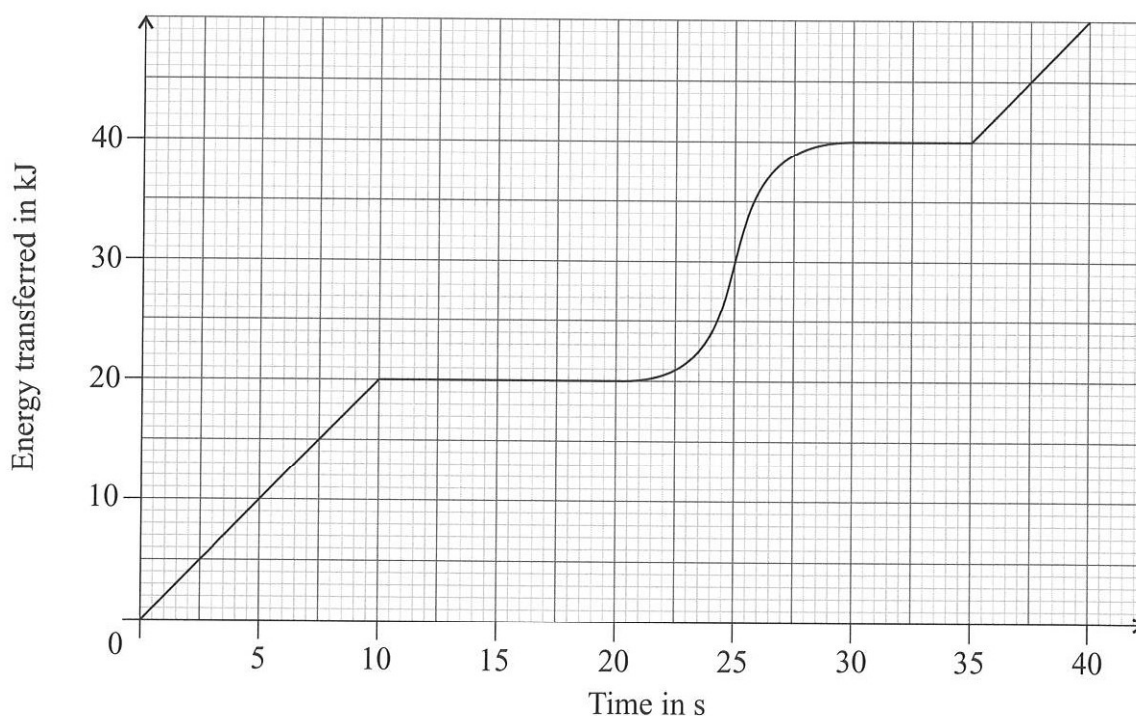
[3]

[Total 14 marks]

- 2 A rollercoaster uses an electric motor to push each car round an uneven section of track.

A joulemeter is connected to a data logger and used to monitor the energy transferred by the motor. **Figure 2** shows the graph produced by the data logger.

Figure 2



- a) Using **Figure 2**, calculate the maximum instantaneous power supplied by the motor.

Power = W
[3]

- b) Between 20 s and 30 s, a total of 12 C of charge passes through the motor.
Using **Figure 2**, calculate the average potential difference across the motor during this time.
Give your answer to two significant figures.

Average potential difference = V
[5]

- c) i) In the supply cable that connects the motor to the electricity supply, the average power wasted due to heating is 36 W. The resistance of the cable is 250 mΩ.
Calculate the average current through the cable.

Average current = A
[3]

- ii) The owner of the rollercoaster buys electricity in units. Each unit supplies 3.6×10^6 J of energy.
In a month, the supply cable wastes 7.56 units worth of energy due to heating.
Calculate the number of hours the rollercoaster is used for in a month.

Time = hours
[5]

[Total 16 marks]

Exam Practice Tip

Sometimes you might need to combine two or more related ideas in your answer to pick up all the marks for an extended response question. It's a good idea to read the question again carefully before you start writing and jot down the points you think you'll need to cover to answer fully.

Score:

30