Name ..... Class ..... Date .....

Are you energy smart?

Specification references:

- P2.4.2 Energy transfers in everyday appliances
- WS3b; WS3c; WS3e; WS4a

Aims

You will be learning how to calculate energy usage of household appliances and how to be more energy efficient in their use.

Learning outcomes

After completing this worksheet, you should be able to:

- convert minutes into seconds
- use measurements of volume confidently
- calculate energy and power from given data.

Setting the scene

Electrical appliances are a great help to families in carrying out their daily chores and have made life a lot easier. However, with growing economies across the world and increasing demand, global energy consumption has grown and continues to grow dramatically. This calls for the common responsibility of each citizen to use energy responsibly. Every family can take very simple but effective steps to reduce their energy consumption. Knowing how to operate appliances efficiently is one of the steps everyone can and should take to use less energy in their households.

Worked example

Jason wants to know how much energy his 2.4 kW kettle uses to boil enough water for a cup of tea. So, he measures how much water a cup can hold and finds out the volume of his cup is about 300 ml. Then, he pours 300 ml of water in his kettle and times how long it takes to boil the water. The time taken for 300 ml of water to boil is 1:20 min.

Jason calculates the energy transferred to the water using the power equation

$$E = Pt = 2400 \times 80 = 192000 \text{ J}$$

Notice how Jason converted 2.4 kW into 2400 W and 1:20 min into 80 s to calculate the energy transferred in J.

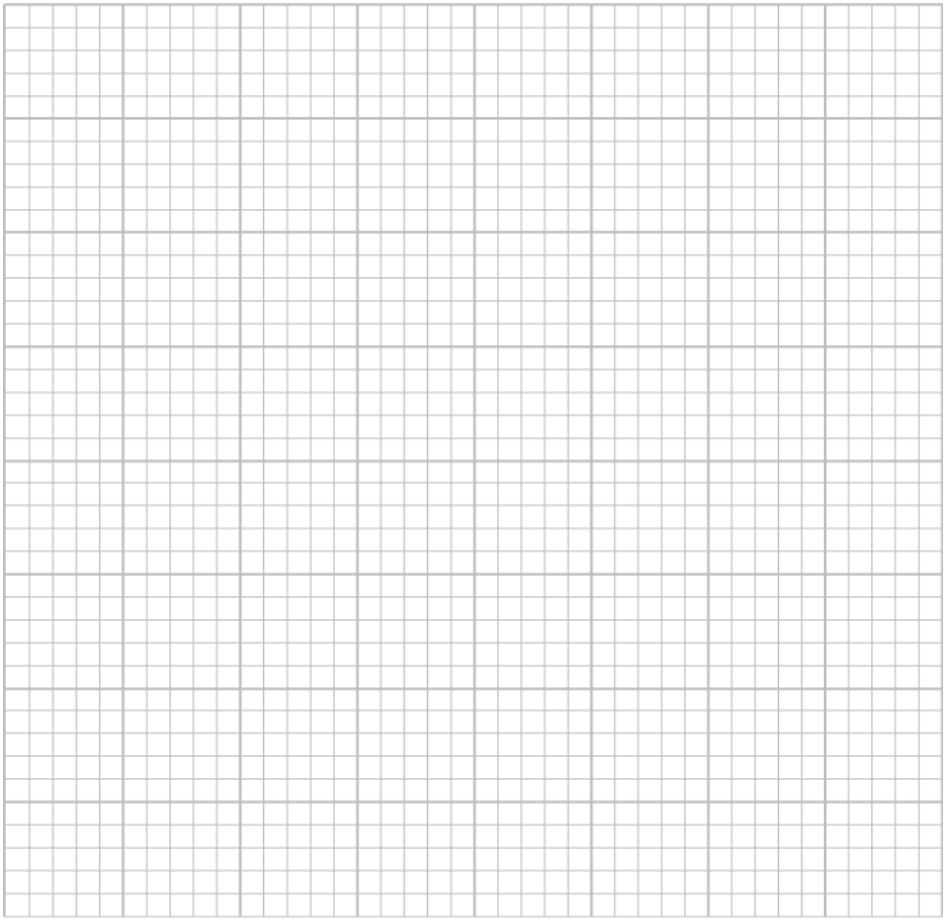
Name ..... Class ..... Date .....

Task

Jason took other measurements by adding 300 ml of water every time. He also ensured the heating element in the kettle cooled down before starting a new measurement. Complete Jason's table of results and draw a graph of energy transferred against volume of water.

Volume in ml	Time in min	Time in s	Energy transferred in J
300	1:20	80	192 000
600	2:08	128	
900	3:06		
1200	3:56		
1500	4:53		

Please draw your graph below.



Name ..... Class ..... Date .....

Questions

1 Look at the table of results in the task and answer the following questions.

a Describe how the energy transferred by the electric kettle changes when the volume of water is increased from 600 ml to 1200 ml.

.....

.....

.....

.....

.....

..... (*3 marks*)

b Estimate the time it would take to boil 1800 ml of water with this kettle.

.....

..... (*1 mark*)

c Estimate how long it might take to boil 750 ml of water with this kettle. Explain how you worked this out.

.....

.....

.....

.....

..... (*2 marks*)

2 Look at the graph you drew in the task above and answer the following questions.

a Jason takes another measurement of time taken to boil 200 ml of water and he finds that the kettle took 1:03 min. Plot this additional point on your graph. (*2 marks*)

b Is the plot you added to your graph at 200 ml following the trend you expected? Explain your answer.

.....

.....

Name ..... Class ..... Date .....

..... (*2 marks*)

c Some people often fill their kettle to the top before boiling water for a single cup of tea. How would you use your graph to convince them to change their behaviour?

.....

.....

.....

.....

.....

.....

.....

..... (*3 marks*)

3 Use the data from your table of results to answer the following question.
The cost to run Jason's electric kettle is about 19p per hour. Estimate how much it costs in pence to make 3 cups of tea.

.....

.....

.....

.....

.....

.....

..... (*4 marks*)