Energy Transfers

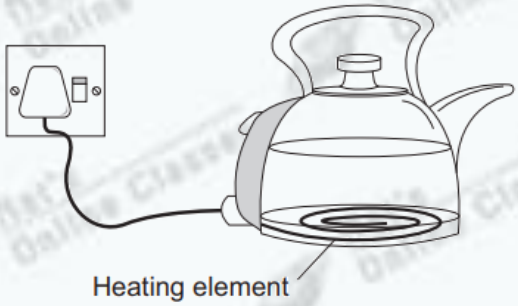
(Conduction, Convection & Radiation)

Total Mark – 15

Question: 1

5 **Figure 8** shows an electric kettle being used to heat some water.

Figure 8



5 (a) Complete the following sentences to describe how the water in the kettle is warmed by convection.

[4 marks]

When the kettle is switched on, the temperature of the water near the heating element increases.

As the temperature of the water increases, the water _____ and

becomes less _____ .

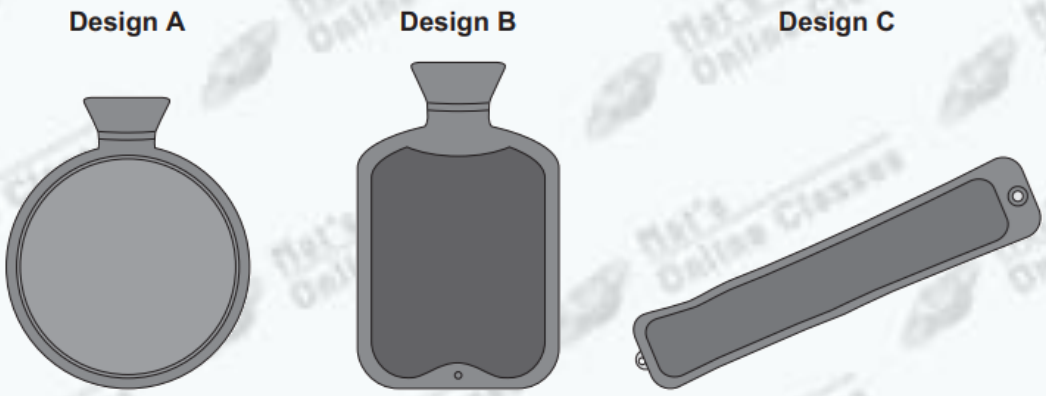
The heated water _____ towards the top of the kettle.

The movement of the water sets up a convection _____ .

5 (b) Three different designs of hot water bottle are each filled with water at 90 °C from the kettle.

Figure 9 shows the three different designs. Each hot water bottle is made from a different material but holds the same amount of water.

Figure 9



State **two** factors that would affect the time it would take the hot water bottles to cool down to room temperature.

[2 marks]

1 _____

2 _____

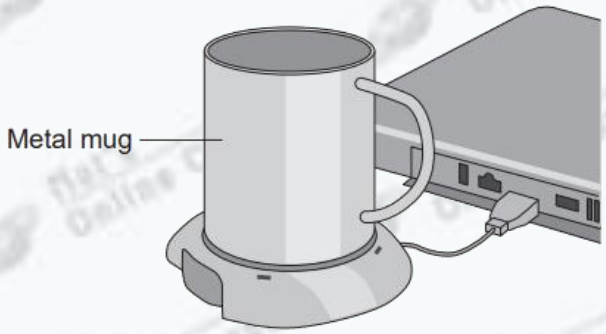
Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	expands	accept rises	1	AO1 1.1.3a
	dense		1	
	rises	accept moves	1	
	current		1	
		an answer of rises scores only once for either the first or third blank		
5(b)	any **two** from: • shape • surface area • room temperature • (surface) colour • thickness of material • how good an insulator it is	ignore temperature of water ignore size accept if it has a cover	2	AO1 AO3 1.1.3c
Total			**6**	

Question: 2

5 A heater uses energy from a laptop computer to keep a drink hot.

Figure 9 shows a metal mug on the heater.

Figure 9



5 (a) The laptop computer is operating on battery power.
How would connecting the heater affect the amount of time the laptop computer would operate for, before needing to be recharged?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
it would decrease the time	
it would not affect the time	
it would increase the time	

5 (b) The power output from the heater is 12 W.

Calculate the energy transferred to the metal mug in 60 seconds.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

Energy = _____ joules

5 (c) The heater causes a convection current in the liquid inside the mug.

Complete the sentences to explain how.

[3 marks]

The liquid at the bottom of the mug heats up and becomes less _____ .

The hot liquid _____ and the cooler liquid at the top of the mug _____ .

5 (d) **Table 2** lists changes that may affect the energy transfer per second from the heater to the liquid.

Tick (✓) **one** box to show the effect of **each** change.

[3 marks]

Table 2

Change	Energy transfer per second to the liquid		
	increases	**decreases**	**does not change**
use a mug with a smaller base			
use a lower power heater			
use a plastic mug instead of a metal mug			

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	it would decrease the time		1	AO3 1.2.1a
5(b)	720 (J)	allow **1** mark for correct substitution ie 12 x 60 provided no subsequent step	2	AO2 1.3.1c
5(c)	dense rises falls	 accept equivalent words accept equivalent words	1 1 1	AO1 1.1.3a
5(d)	 decreases decreases decreases	more than one tick in any row negates the mark	 1 1 1	AO3 1.1.3c 1.1.3d
Total			**9**	