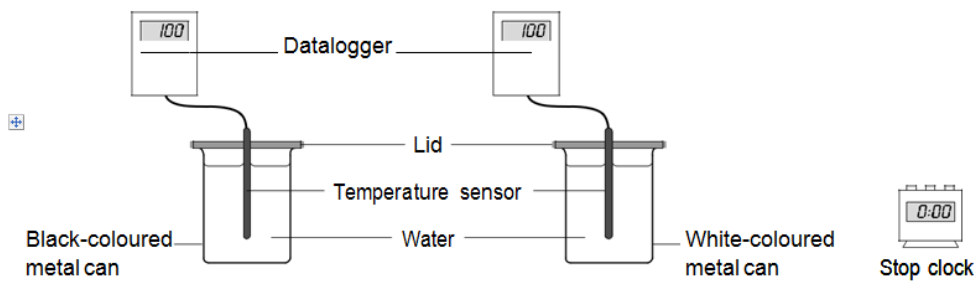


Conduction and Convection 4

Q:1 The diagram shows the equipment a student used to investigate how the colour of a surface affects how fast it emits (gives out) heat.



An equal volume of boiling water was poured into each metal can. The student then recorded the temperature of the water in each can every minute for ten minutes.

(a) (i) Which of the following was a control variable in this investigation?

Put a tick (☑) in the box next to your answer.

The volume of boiling water.

The decrease in temperature of the water.

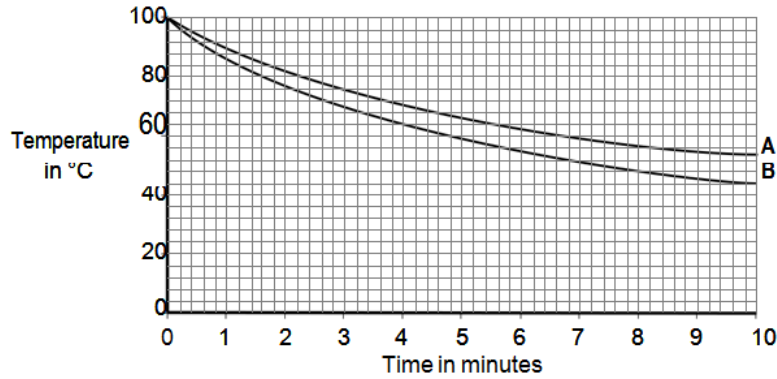
The outside colour of the metal can.

(1 mark)

(a) (ii) Give one advantage of using a temperature sensor and datalogger rather than a thermometer to measure the temperature of the water.

(1 mark)

(b) The student's results for both cans are plotted on the graph.



Which line, A or B, shows how the temperature of the water inside the black-coloured metal can changed?

Draw a ring around your answer. A B

Explain the reason for your answer.

(2 marks)

(c) Some gardeners make soil darker by digging black soot into the soil. Other gardeners use straw to protect plants from the cold.

(c) (i) Complete the following sentence by drawing a ring around the correct line in the box.

On a warm day, the temperature of darker coloured soil will increase

slower than	the temperature of lighter coloured soil.
as fast as	
faster than	

(1 mark)

(c) (ii) Give a reason for your answer to part (c)(i).

(1 mark)

(c) (iii) The statement in the box is false.

Straw keeps plants warm by trapping air.

This is because air is a good conductor.

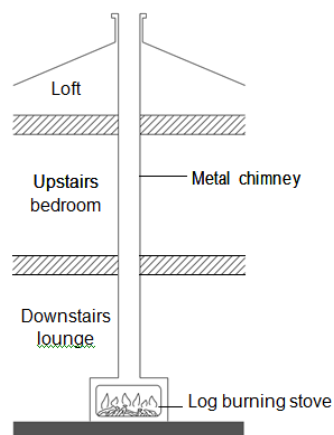
Change one word in the statement to make the statement true.

Write down your new statement. The answer has been started for you.

This is because air is a _____

(1 mark)

Q:2 The diagram shows how the metal chimney from a log-burning stove passes through the inside of a house.



(a) Explain how heat is transferred by the process of convection from the inside of the stove to the top of the chimney.

(2 marks)

(b) Although the outside of the chimney becomes very hot, there is no insulating material around the chimney.

(b) (i) Explain, in terms of the particles in a metal, how heat is transferred by conduction from the inside to the outside of the metal chimney.

(2 marks)

(b) (ii) Suggest one advantage of having no insulation around the chimney.

(1 mark)

Q:3(a) In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

The diagram shows the structure of a vacuum flask.

(b) Arctic foxes live in a very cold environment.

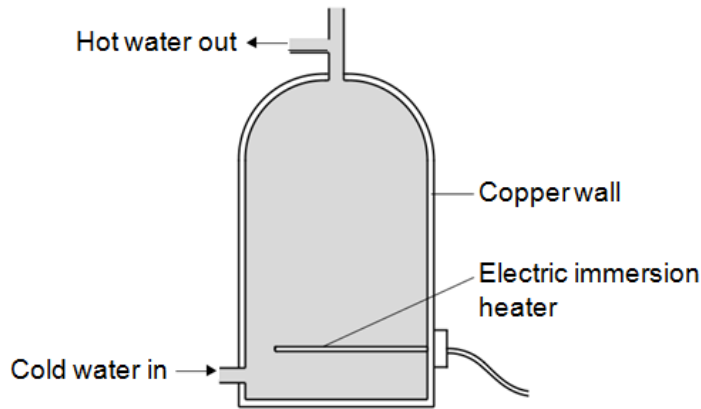


Arctic foxes have small ears.

How does the size of the ears help to keep the fox warm in a cold environment?

(2 marks)

Q:4 An electric immersion heater is used to heat the water in a domestic hot water tank. When the immersion heater is switched on the water at the bottom of the tank gets hot.



(a) Energy is transferred by the process of convection from the hot water at the bottom of the tank to the cooler water at the top.

Explain how.

(4 marks)

(b) Complete the following sentence.

The main way the energy is transferred through the copper wall of the water tank is by the process of _____

(1 mark)

Q:5 Energy can be transferred through some materials by convection.

(a) Use the correct answer from the box to complete the sentence.

gas liquid solid

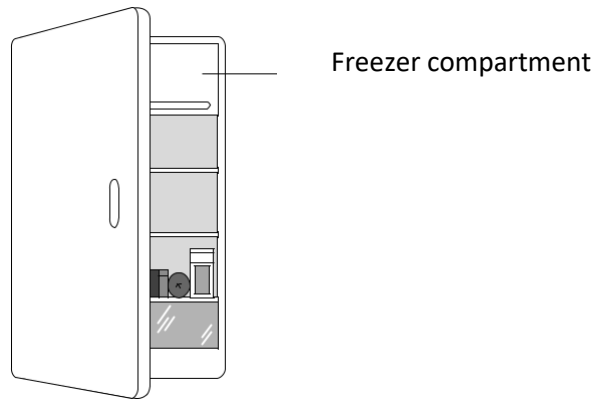
Energy cannot be transferred by convection through a _____

[1 mark]

(b) Figure 4 shows a fridge with a freezer compartment.

The temperature of the air inside the freezer compartment is $-5\text{ }^{\circ}\text{C}$.

Figure 4



Use the correct answer from the box to complete each sentence. Each answer may be used once, more than once or not at all.

decreased unchanged increased

When the air near the freezer compartment is cooled, the energy of the air particles is

The spaces between the air particles are _____

The density of the air is _____

[3 marks]

(c) Table 1 shows some information about three fridges, A, B and C. The efficiency of each fridge is the same.

Table 1

Fridge	Volume in litres	Energy used in one year in kWh
A	232	292
B	382	409
C	622	524

(c) (i) Which fridge, A, B or C, would cost the least to use for 1 year?

Give one reason for your answer.

[2 mark]

(c) (ii) A householder looks at the data in Table 1.

What should she conclude about the pattern linking the volume of the fridge and the energy it uses in one year?

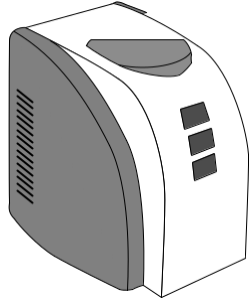
[1 mark]

(c) (iii) The householder could not be certain that her conclusion is correct for all fridges. Suggest one reason why not.

[1 mark]

Q:6 A 'can-chiller' is used to make a can of drink colder. Figure 7 shows a can-chiller.

Figure 7



(a) Energy is transferred through the metal walls of the can of drink by conduction. Explain how.

[4 marks]

(b) The energy from the can of drink is transferred to the air around the can-chiller.

A convection current is set up around the can-chiller. Explain how.

[3 marks]

(c) The can-chiller has metal cooling fins that are designed to transfer energy quickly to the surroundings.

Give two features that would help the metal cooling fins to transfer energy quickly to the surroundings.

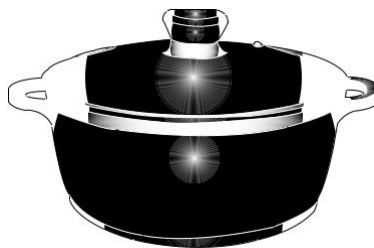
1 _____

2 _____

[2 marks]

Q:7 Figure 4 shows a black metal casserole dish that is put inside a hot oven. Food is cooked inside the casserole dish.

Figure 4



(a) Energy is transferred quickly from the inside of the hot oven, through the metal casserole dish to the food.

(a) (i) Why are metals good conductors of energy? Tick (☑) one box.

because they contain free atoms

because they contain free electrons

because they contain free ions

[1 mark]

(a) (ii) Why do black surfaces become hot quickly? Tick (☑) one box.

Because they are good absorbers of infrared radiation.

Because they are good absorbers of ultraviolet radiation.

Because they are good absorbers of visible light.

[1 mark]

(b) Figure 5 shows a person removing a hot casserole dish from an oven, using oven gloves.

Figure 5



(b) (i) Use the correct answer from the box to complete the sentence.

conductors insulators radiators

The oven gloves are good _____

(b) (ii) How would wearing oven gloves affect the rate of energy transfer to a person's hands compared with not wearing oven gloves?

Tick (☑) one box.

The rate of energy transfer would be higher.

The rate of energy transfer would be lower.

The rate of energy transfer would stay the same.

[1 mark]

(c) What two factors determine the amount of energy transferred by an electric oven?

1 _____

2 _____

[2 marks]

(d) A company has invented an 'app' that allows householders to control the electric oven in their home using their mobile phone.

The mobile phone can be used to switch the electric oven on and off.

Suggest one benefit of using a mobile phone to switch an electric oven on and off.

[1 mark]

TOTAL MARKS=49