

# Conduction and Convection 1 MCQs

**Q:1** A student investigated the question: Does the type of surface affect how an object loses or gains heat? She carried out two experiments.

In her first experiment, she filled two cans with boiling water. One can had a dull, black surface.

The other can had a shiny, silver surface. Later, she measured the temperature of the water in each can.

These are her results.

	Starting temperature of the water	Temperature of the water 15 minutes later
Can with dull, black surface	100 °C	74 °C
Can with shiny, silver surface	100 °C	93 °C

**a)** The student wanted her experiment to be a fair test.

Which row of the table is most likely to give a fair test?

	Volume of cans	Volume of water	Metal of the cans	Shape of cans
<b>1</b>	same	different	same	same
<b>2</b>	same	same	different	same
<b>3</b>	same	same	same	different
<b>4</b>	same	same	same	same

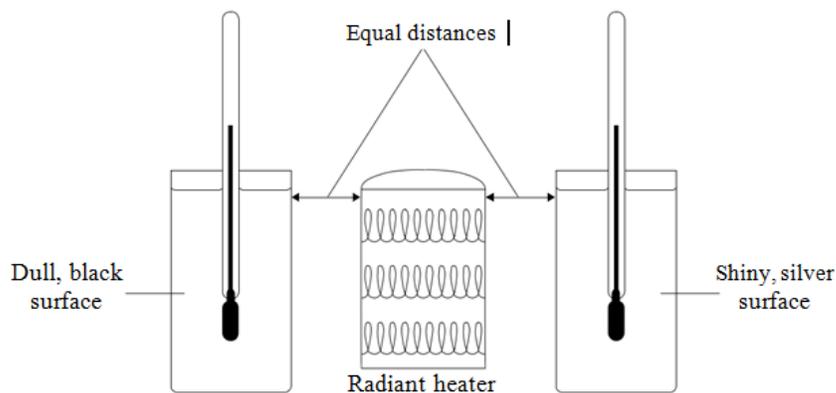
**b)** If her results are reliable, the experiment shows that, compared with a shiny, silver surface, a dull, black surface is a . . .

**1)** better absorber of thermal radiation.

**2)** better conductor of thermal radiation.

3) better emitter of thermal radiation.

4) better reflector of thermal radiation.



In her second experiment, the student put cold water in each can. She put a heater (which is a source of thermal radiation) between the cans. She switched the heater on and, ten minutes later, she measured the temperature of the water in each can.

These are the results of her second experiment.

	Starting temperature of the water	Temperature of the water 10 minutes later
Can with dull, black surface	16 °C	37 °C
Can with shiny, silver surface	16 °C	23 °C

C If her results are reliable, the second experiment shows that, compared with a shiny, silver surface, a dull, black surface is a . . .

1) better absorber of thermal radiation.

2) better conductor of thermal radiation.

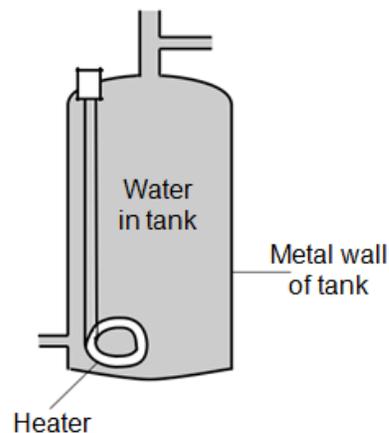
3) better emitter of thermal radiation.

4) better reflector of thermal radiation.

**D** What was the average (mean) rate of the rise in temperature of the water in the can with a dull, black surface?

- 1) 0.9 °C per minute
- 2) 2.1 °C per minute
- 3) 9 °C per minute
- 4) 21 °C per minute

**Q:2** Many homes have hot-water tanks. An electric heater is used to heat the water. Some heat (thermal energy) is lost through the metal walls to the surroundings.



**A)** The energy spreads through the water by . . .

- 1) heated water contracting and falling.
- 2) heated water expanding and rising.
- 3) heat rising.
- 4) the movement of free electrons.

**B)** The energy is transferred through the metal walls by . . .

- 1) heated water expanding and rising.

2)infra red waves passing through the metal.

3)the atoms gaining energy and moving faster through the metal.

4)the movement of free electrons.

C) The metal walls of the tank transfer energy to the surroundings by . . .

1)heated air contracting and falling.

2)infra red waves passing through the air.

3)metal atoms gaining energy and escaping into the air.

4)the movement of free electrons.

D) The air in contact with the outside of the metal walls . . .

1)contracts and falls due to decreased density.

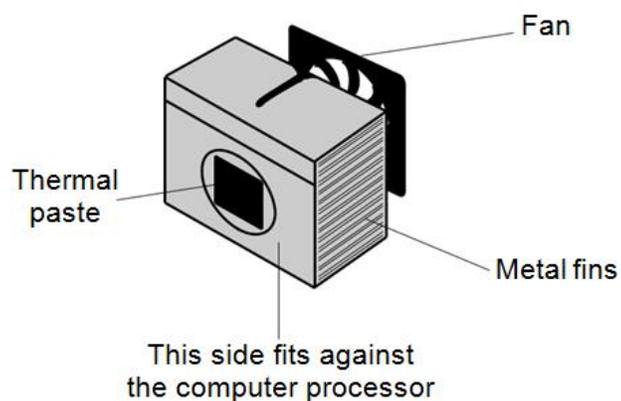
2)contracts and falls due to increased density.

3)expands and rises due to decreased density.

4)expands and rises due to increased density.

Q:3 The diagram shows a fan-assisted cooler designed to be fitted inside a computer.

The thermal paste ensures that heat can transfer easily from the computer's processor.



**A** The metal fins are painted black to . . .

- 1) increase heat transfer by conduction.
- 2) increase heat transfer by radiation.
- 3) reduce heat transfer by conduction.
- 4) reduce heat transfer by radiation.

**B** The thermal paste is there to . . .

- 1) decrease the transfer of heat by conduction.
- 2) decrease the transfer of heat by radiation.
- 3) increase the transfer of heat by conduction.
- 4) increase the transfer of heat by radiation.

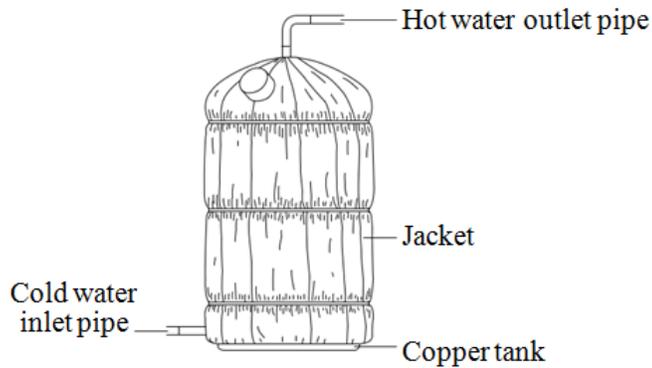
**C** Which process or processes is/are aided by the fan?

- 1) conduction only
- 2) convection and conduction
- 3) conduction and radiation
- 4) radiation only

**D** Which one of the following causes the heat transfer through the metal fins?

- 1) electrons which collide with both ions and other electrons
- 2) electrons which do not collide with either ions or other electrons
- 3) ions which collide with both electrons and other ions
- 4) ions which do not collide with either electrons or other ions

**Q:4** The diagram shows a hot water cylinder. The cylinder contains an electric heater.



**A** A jacket is wrapped round the cylinder to keep the water warm. The jacket contains trapped air.

Trapped air reduces heat loss by . . .

- 1) conduction only.
- 2) conduction and radiation.
- 3) conduction and convection.
- 4) conduction, convection and radiation.

**B** If a jacket is not fitted, it would be best to have a shiny surface for the cylinder rather than a dark matt one.

This is because dark matt surfaces are . . .

- 1) good conductors.
- 2) poor conductors.
- 3) good radiators.
- 4) poor radiators.

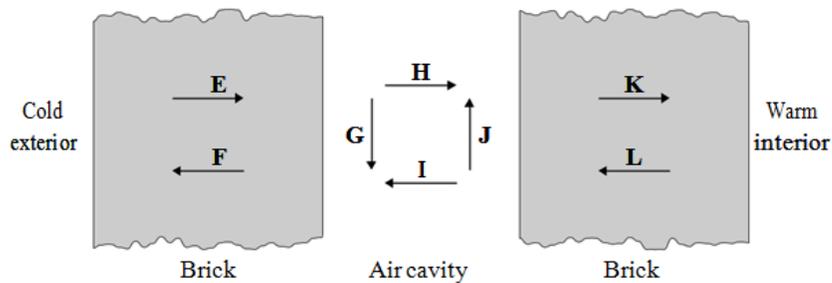
**C** The heater has a power of 3000 W. The heater is switched on for 6 hours.

$$\begin{array}{ccccccc} \text{energy transferred} & = & \text{power} & \times & \text{time} \\ \text{(kilowatt-hour, kWh)} & & \text{(kilowatt, kW)} & & \text{(hour, h)} \end{array}$$

How many kilowatt-hours of energy does the heater use?

- 1) 0.5
- 2) 18
- 3) 500
- 4) 18 000

**Q:5** The diagram shows a section through the cavity wall of a house. The arrows indicate the directions by which heat transfer might take place



**A** Which arrows represent the process of heat transfer called conduction?

- 1) E, H and K
- 2) H and I
- 3) L, I and F
- 4) J and G

**B** Conduction in metals is the transfer of heat by . . .

- 1) the movement of free electrons.
- 2) the heated substance expanding and rising.
- 3) the heated substance contracting and rising.
- 4) the heated substance expanding and falling.

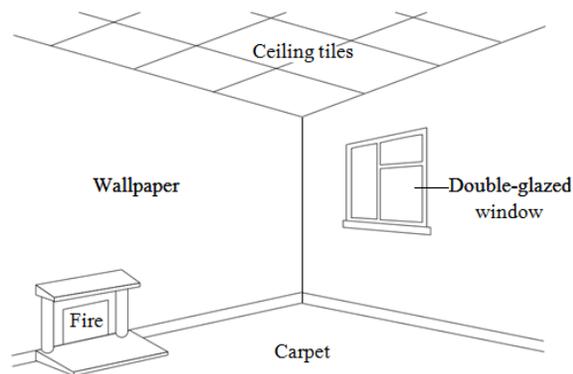
**C** Which arrows represent the process of heat transfer called convection?

- 1) E, H and K
- 2) H and I
- 3) L, I and F
- 4) J and G

**D** Convection is the transfer of heat by . . .

- 1) the movement of free electrons.
- 2) the heated substance expanding and rising.
- 3) the heated substance contracting and rising.
- 4) the heated substance expanding and falling.

**Q:6** The diagram shows a room which is heated by an electric fire.



**A** How does the thermal energy spread through the room? The particles of air become . . .

- 1) closer together, making the heated air denser so that it falls.
- 2) closer together, making the heated air denser so that it rises.
- 3) further apart, making the heated air less dense so that it falls.
- 4) further apart, making the heated air less dense so that it rises.

**B** Thermal energy is transferred through the glass of the windows mainly by . . .

- 1) convection of the air in contact with the glass.
- 2) infra red electromagnetic waves.
- 3) convection currents in the glass.
- 4) vibration of particles within the glass.

**C** The double glazing involves trapped air. Trapped air reduces heat loss because . . .

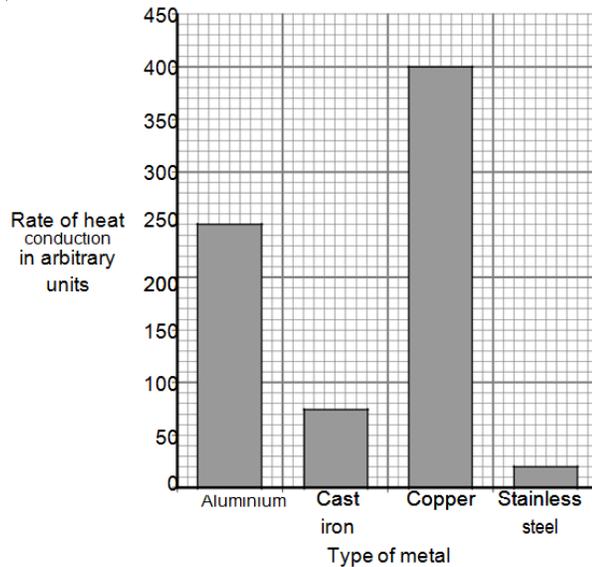
- 1) air is a good conductor and the trapped air cannot move far.
- 2) air is a poor conductor and trapped air cannot move far.
- 3) air molecules are close together.
- 4) air molecules have free electrons.

**D** The table gives temperatures inside and outside the room. Which row in the table gives the greatest rate of heat loss from the room?

	Temperature inside in °C	Temperature outside in °C
1	16	-2
2	16	0
3	16	16
4	16	36

**Q:7** A manufacturer tested four different metals to find out how good the metals are at conducting heat.

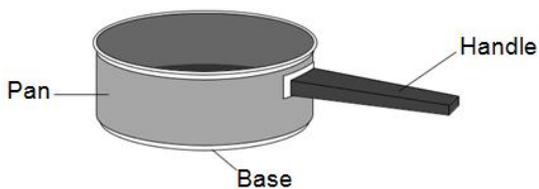
The bar chart shows the results.



**A** Why are the results shown on a bar chart rather than a line graph?

- 1)The rate of heat conduction is a categoric variable.
- 2)The rate of heat conduction is a continuous variable.
- 3)The type of metal is a categoric variable.
- 4)The type of metal is a continuous variable.

The diagram shows the main parts of a saucepan.



**B** In terms of conducting heat, which metal would be best for making the base of the saucepan?

- 1)aluminium
- 2)cast iron
- 3)copper
- 4)stainless steel

**C** The pan and the handle of some saucepans are made from the same metal. The user of the saucepan does not want to burn their hand when they pick up the hot saucepan.

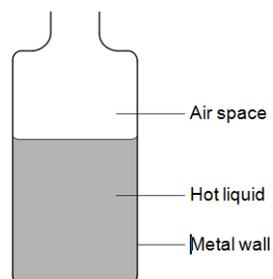
Which metal would be best to use for this type of saucepan?

- 1)aluminium
- 2)cast iron
- 3)copper
- 4)stainless steel

**D** How is heat conducted through the handle?

- 1)Atoms move from one end of the handle to the other.
- 2)Conduction currents pass along the handle.
- 3)Energy is passed from atom to atom.
- 4)Waves of radiation pass along the handle.

**Q:8** The diagram shows a flask containing a hot liquid.



**A** Heat is transferred through the air space above the hot liquid.

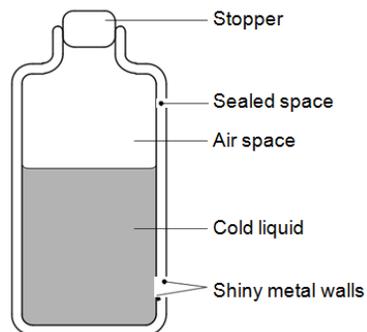
The air particles just above the hot liquid . . .

- 1) contract to become smaller.
- 2) expand to become bigger.
- 3) move further apart, making the air less dense.
- 4) move closer together, making the air denser.

**B** Heat is transferred through the metal wall because . . .

- 1) convection currents are set up in the metal.
- 2) the metal contains electrons that are free to move within the metal.
- 3) the particles in the liquid vibrate and collide with their neighbours.
- 4) the shiny metal is a good emitter of radiation.

The diagram shows another flask containing a cold liquid. This flask has two shiny metal walls with a sealed space between them.



**C** What should the sealed space contain in order to keep the liquid cold for the longest time?

- 1) some air
- 2) some polystyrene
- 3) a vacuum
- 4) some water

**D** The shiny metal walls help to keep the liquid cold for a long time.

This is because shiny surfaces are good . . .

- 1) absorbers of infra red radiation.
- 2) emitters of infra red radiation.
- 3) reflectors of infra red radiation.
- 4) transmitters of infra red radiation

**Q:9** A student carried out a test to compare two kettles, P and Q. The kettles had the same power rating.



He heated one litre of water in each kettle until the water boiled.

Every 30 seconds, he measured:

- ☐ the total energy input to each kettle
- ☐ the temperature of the water.

These are the results for kettle P.

<b>Time in s</b>	0	30	60	90	120	150
<b>Total energy input in kJ</b>	0	45	90	135	180	225
<b>Water temperature in °C</b>	16	44	65	81	92	100

**A** From these results, which of the following is directly proportional to the time?

- 1) total energy input
- 2) water temperature
- 3) both total energy input and water temperature
- 4) neither total energy input or water temperature

**B** The water in kettle Q took a shorter time to boil than the water in kettle P.

This was because . . .

- 1) less energy was lost from kettle Q, making it less efficient than kettle P.
- 2) less energy was lost from kettle Q, making it more efficient than kettle P.
- 3) more energy was lost from kettle Q, making it less efficient than kettle P.
- 4) more energy was lost from kettle Q, making it more efficient than kettle P.

**C** In kettles, heat is transferred through the water by convection currents.

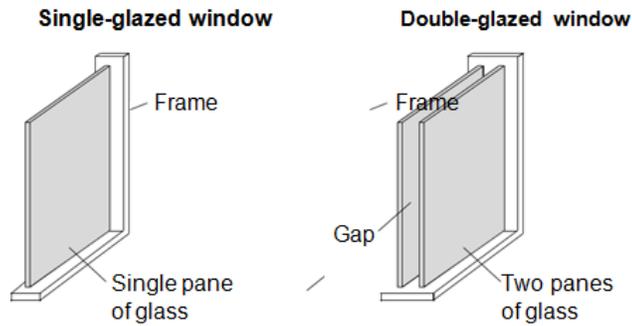
In convection, the water around the heating element . . .

- 1) contracts, becomes less dense and falls.
- 2) contracts, becomes more dense and rises.
- 3) expands, becomes less dense and falls.
- 4) expands, becomes less dense and rises.

**D** The metal case is better than the plastic case at transferring thermal energy. This is because . . .

- 1) convection currents are harder to set up in plastics than in metals.
- 2) there are free electrons in metals but not in plastics.
- 3) infra red radiation can pass through metals more easily than through plastics.
- 4) atoms can move more easily through metals than through plastics.

**Q:10** The diagrams show two types of window



**A** A double-glazed window consists of two panes of glass with a gap between.

The gap between the two panes of glass helps to reduce the rate of heat loss by . . .

- 1) conduction and radiation.
- 2) conduction and convection.
- 3) convection and radiation.
- 4) conduction, convection and radiation.

**B** The rate of heat loss from a double-glazed window depends on . . .

- 1) the area of the pane of glass only.
- 2) the thickness of glass only.
- 3) the width of the gap only.
- 4) all of the above.

**C** The average rate of heat loss from a single-glazed window is 500 W.

Replacing this window with a double-glazed window reduces the average rate of heat loss to 300 W.

What is the percentage reduction in heat loss when this is done?

- 1) 33 %
- 2) 40 %

3)60 %

4)67 %

**Q:11** The diagram shows a saucepan on a hotplate. The saucepan contains soup.

Some heat (thermal energy) is lost through the metal walls of the saucepan to the surroundings.



**A** The energy spreads through the soup by . . .

- 1) free electrons colliding with ions.
- 2) heat rising.
- 3) the soup contracting and falling as it is heated.
- 4) the soup expanding and rising as it is heated.

**B** The energy is transferred through the metal walls of the saucepan by . . .

- 1) free electrons colliding with ions.
- 2) heated metal expanding and rising.
- 3) infra red waves passing through the metal.
- 4) the atoms gaining energy and moving faster through the metal.

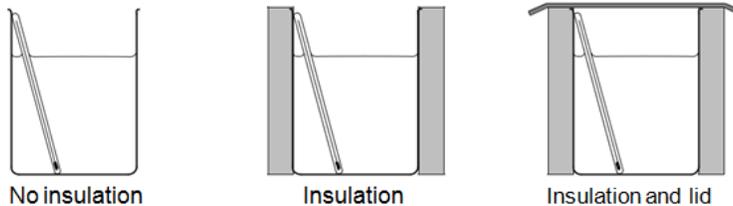
**C** The outer walls of the saucepan transfer energy to the surroundings by . . .

- 1) free electrons colliding with ions.
- 2) the air contracting and falling as it is heated.
- 3) infra red waves passing through the air.
- 4) metal atoms gaining energy and escaping into the air.

**D** The air in contact with the outer walls of the saucepan . . .

- 1) contracts and falls due to decreased density.
- 2) contracts and falls due to increased density.
- 3) expands and rises due to decreased density.
- 4) expands and rises due to increased density

**Q:12** A student investigated the cooling of a hot liquid. She used three identical beakers that contained equal volumes of water. Two of the beakers were insulated and one beaker also had a lid. The water temperature in each beaker started at 90 °C.



She recorded the temperature decrease of the water in each beaker after 10 minutes.

Her results are shown in the table

Method of insulation	Temperature decrease in °C
no insulation	30
insulation	25
insulation and lid	10

**A** The method of insulation is a . . .

- 1) categorical variable.
- 2) continuous variable.
- 3) control variable.
- 4) ordered variable.

**B** The best way to display the results in the table would be a . . .

- 1) bar chart.
- 2) line graph.
- 3) pie chart.
- 4) scattergram.

**C** She repeated the experiment with a starting temperature of 70 °C instead of 90 °C.

The temperature decrease after 10 minutes was smaller than before in . . .

- 1) only the beaker with no insulation.
- 2) only the beaker with insulation.
- 3) only the beaker with insulation and lid.
- 4) all three beakers.

**D** The lid stopped hot air rising.

This reduced heat loss by . . .

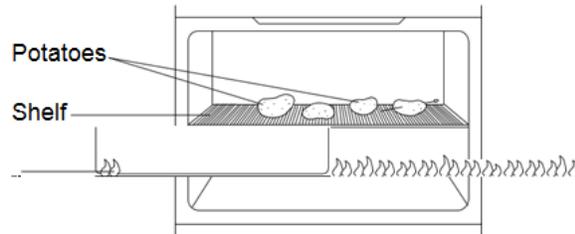
1) conduction only.

2) convection only.

3) radiation only.

4) conduction, convection and radiation.

**Q:13** The diagram shows some potatoes cooking on a shelf in a gas oven.



**A** Heat is transferred from the gas flames to the potatoes.

The air particles just above the gas flames . . .

1) contract to become smaller.

2) expand to become bigger.

3) move apart, making the air less dense.

4) move together, making the air denser.

**B** One of the potatoes has a metal skewer through it. This potato cooks fastest because heat is transferred through the skewer to the potato.

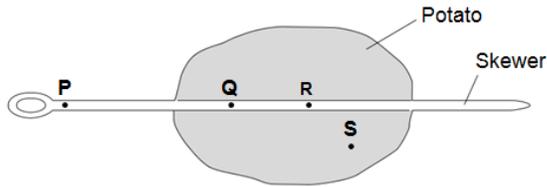
This heat transfer takes place because . . .

1) convection currents are set up in the metal.

2) the metal contains electrons that are free to move within the metal.

- 3)the metal expands when heated.
- 4)the metal is a good emitter of radiation.

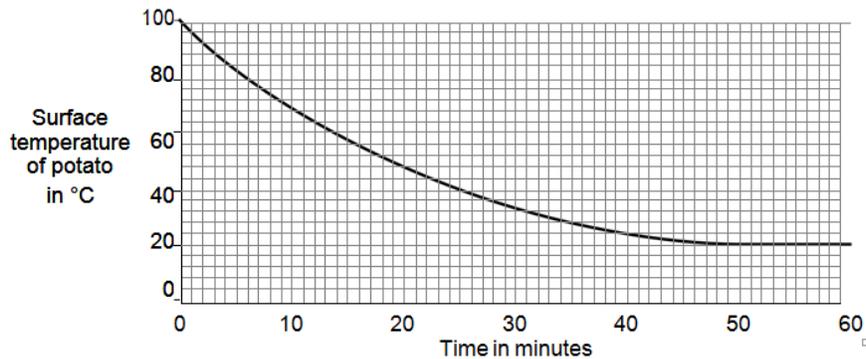
C The diagram shows the potato and skewer one minute after the potato is put into the oven.



Which of the four points, P, Q, R and S, will be the coolest?

- 1)P
- 2)Q
- 3)R
- 4)S

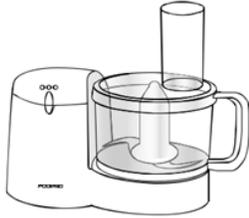
D The cooked potatoes are taken out of the oven and left to cool. The graph shows how the surface temperature of one potato changes as it cools.



At which of the following times is heat transferred from the potato at the fastest rate?

- 1)10 minutes
- 2)20 minutes
- 3)30 minutes
- 4)40 minutes

**Q:14** A food mixer and a hand-held blender can both be used for making soup. The ingredients are cooked and then processed to produce a smooth soup. Processing is done by metal blades spinning in the soup

	Food mixer	Hand-held blender
		
<b>Power rating</b>	500 W	300 W
<b>Volume of soup</b>	300–500 cm <sup>3</sup>	Up to 2000 cm <sup>3</sup>
<b>Feature</b>	Lid	No lid

**A** Which one of the following describes advantages of using the hand-held blender rather than the food mixer for making soup?

- 1) The hand-held blender can mix smaller volumes of soup and does not splash.
- 2) The hand-held blender uses more power and may splash hot soup on the user.
- 3) The hand-held blender can mix larger volumes of soup and does not splash.
- 4) The hand-held blender uses less power and can mix larger volumes of soup.

**B** As the soup is being processed, it cools down. Which soup will probably cool down the quickest?

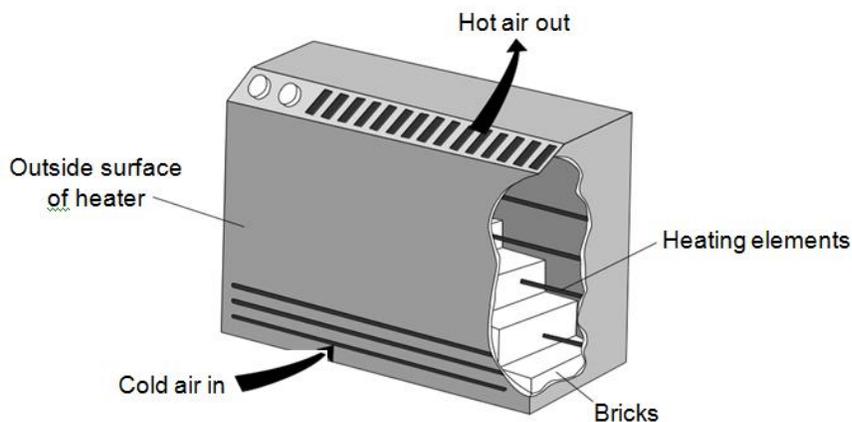
- 1) the soup processed by the food mixer, because it has a lid that stops convection
- 2) the soup processed by the food mixer, because the container is made of plastic
- 3) the soup processed by the hand-held blender, because there is no lid to stop convection
- 4) the soup processed by the hand-held blender, because the soup is not as hot

**C** The processed soup is put into a saucepan and reheated.

Heat is transferred through the soup because the soup at the bottom of the saucepan . . .

- 1) contracts, becomes less dense and falls.
- 2) expands, becomes more dense and falls.
- 3) contracts, becomes more dense and rises.
- 4) expands, becomes less dense and rises.

**Q:15** The diagram shows the construction of one type of heater. The bricks inside the heater warm up during the night when electricity is cheaper. The bricks then emit heat (thermal energy) during the day.



**A** The bricks warm up because they . . .

- 1) absorb heat.
- 2) insulate heat.
- 3) radiate heat.
- 4) reflect heat.

**B** The diagram shows the main thermal energy transfer of the heater as it warms the room.

By what process does this heater transfer most of its energy to all parts of a room?

- 1)conduction from the bricks
- 2)conduction from the outside surface of the heater
- 3)convection currents in the air
- 4)radiation from the outside surface of the heater

**C** To give out the most heat by radiation, what would be the best outside surface for the heater?

- 1)dark, matt
- 2)dark, shiny
- 3)light, shiny
- 4)light, matt

**TOTAL MARKS=56**