

Thermal Physics*(Past Year Topical Questions 2010-2015)*May/June 2010 (11)

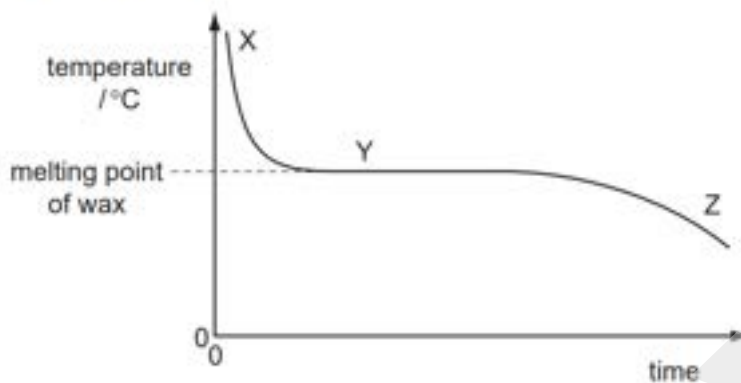
- 14 The diagram represents the molecules of a gas in a closed container of constant volume.



What happens to the molecules when the gas is heated?

- A They expand.
 - B They hit the walls less often.
 - C They move further apart.
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- 15 A liquid is left in an open dish. After several days there is less liquid in the dish.
- Which statement explains this?
- A The least energetic molecules leave the surface and escape into the air.
 - B The least energetic molecules leave the surface and return.
 - C The most energetic molecules leave the surface and escape into the air.
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- 17 A student carries out an experiment to find the melting point of wax. The graph shows how the temperature of the wax changes as it cools.



Which statement is correct?

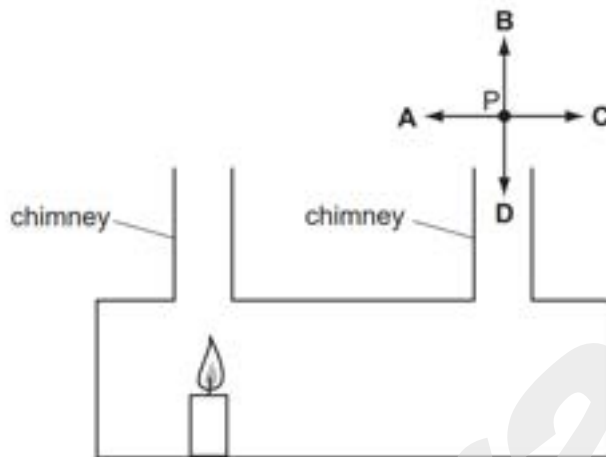
- A At X the temperature drops more slowly than at Z.
 - B At Y all the wax is solid.
 - C At Y thermal energy is being given out by the wax.
 - D At Z the wax molecules are not moving.
- 18 Hot liquid in a vacuum flask cools extremely slowly. This is because some methods of heat transfer cannot take place in a vacuum.

Which methods **cannot** take place in a vacuum?

- A conduction and convection only
- B conduction and radiation only
- C convection and radiation only
- D conduction, convection and radiation

- 19 A teacher demonstrates convection currents using a box with two chimneys and a lighted candle. She holds a smoking taper at point P.

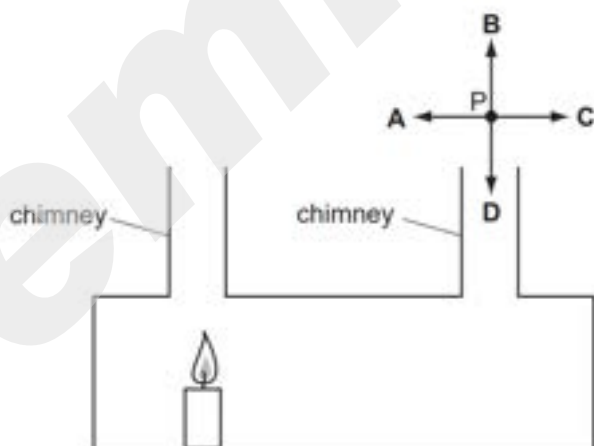
In which direction does the convection current cause the smoke to move?



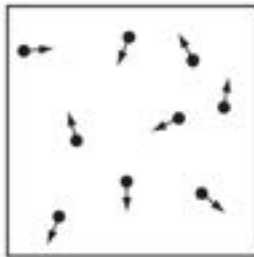
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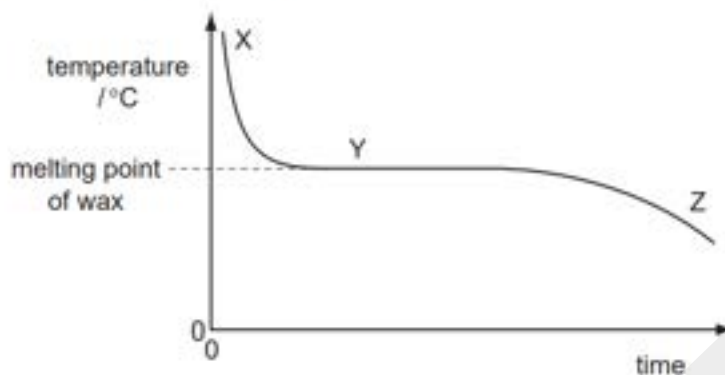
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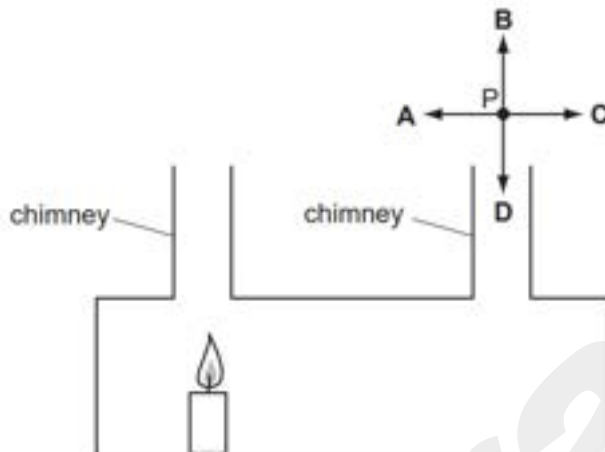
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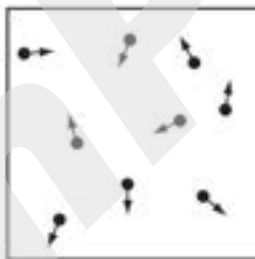
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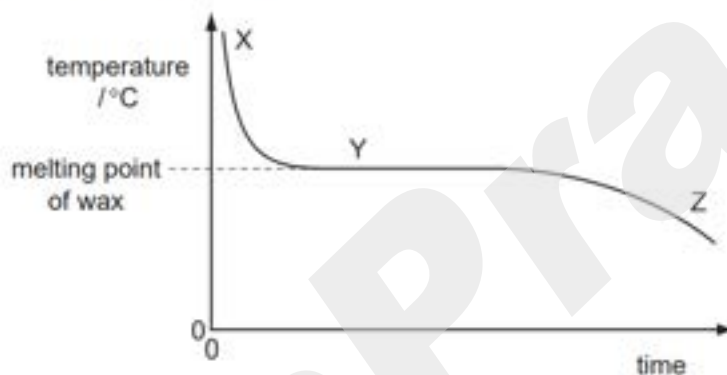
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October/November 2010 (11)

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- 15 A block of ice cream is prevented from melting by wrapping it in newspaper soaked in water. The water evaporates from the newspaper.

Which molecules escape from the water and what happens to the average speed of the water molecules that remain in the newspaper?

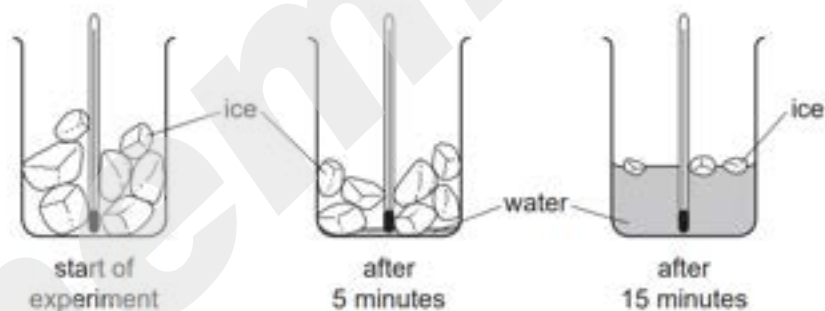
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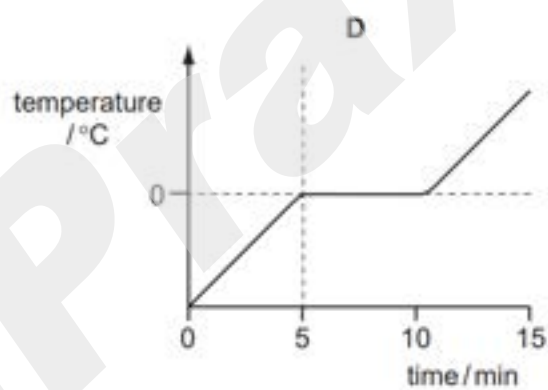
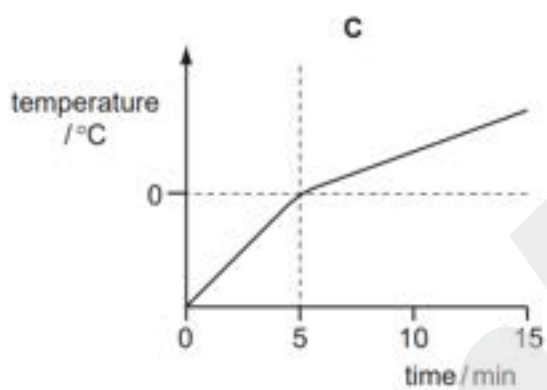
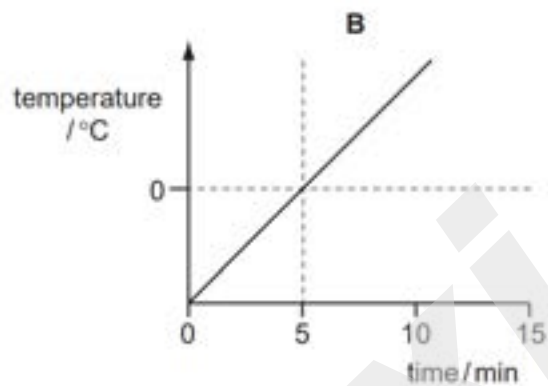
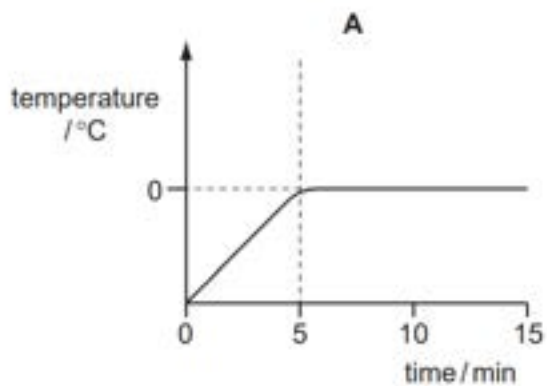


- 17 A beaker containing ice and a thermometer is left in a warm room for 15 minutes.

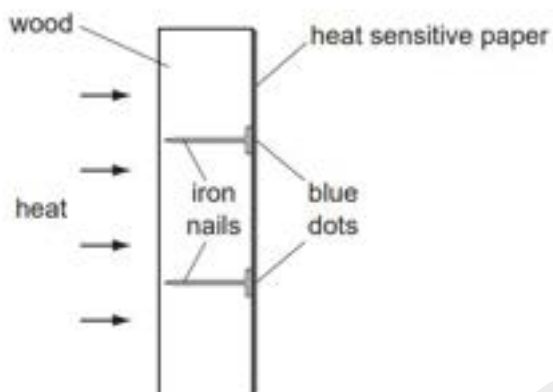
No water is visible in the beaker until 5 minutes has passed. After 15 minutes some ice is still visible.



Which graph shows how the thermometer reading changes?



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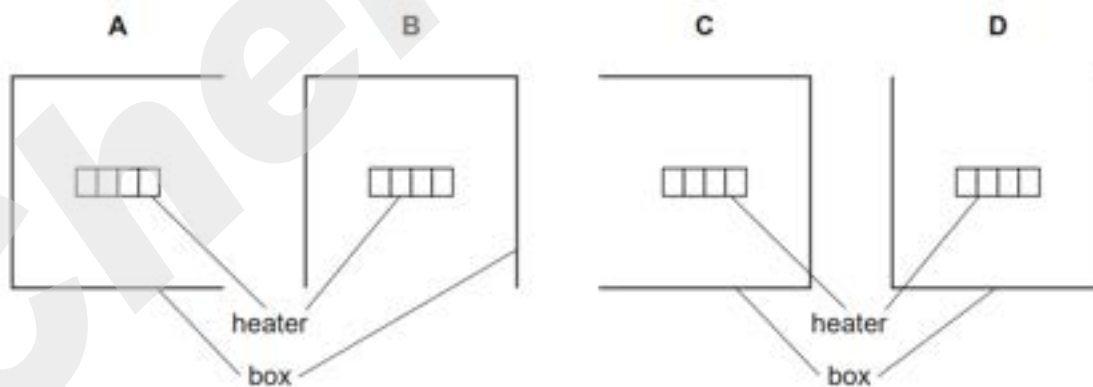


This experiment shows that, compared to wood, iron is a good

- A absorber of heat.
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The heater is switched on for several minutes.

In which position does the box become the hottest?

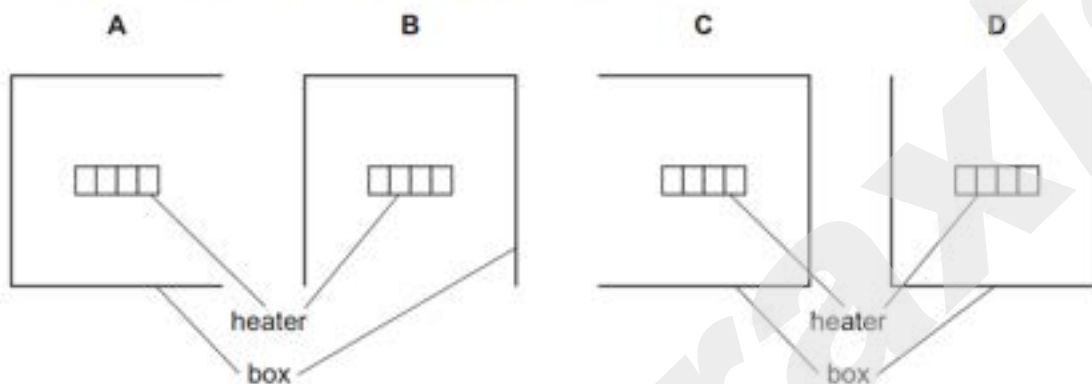


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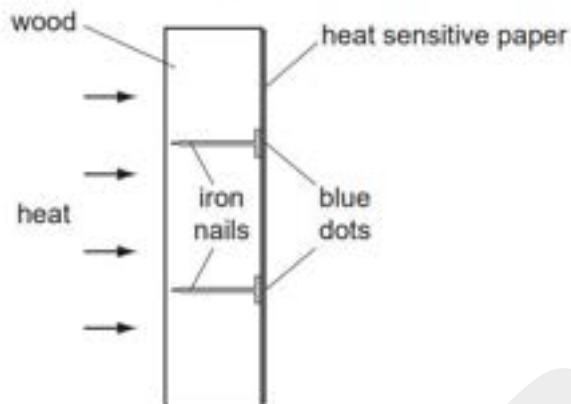


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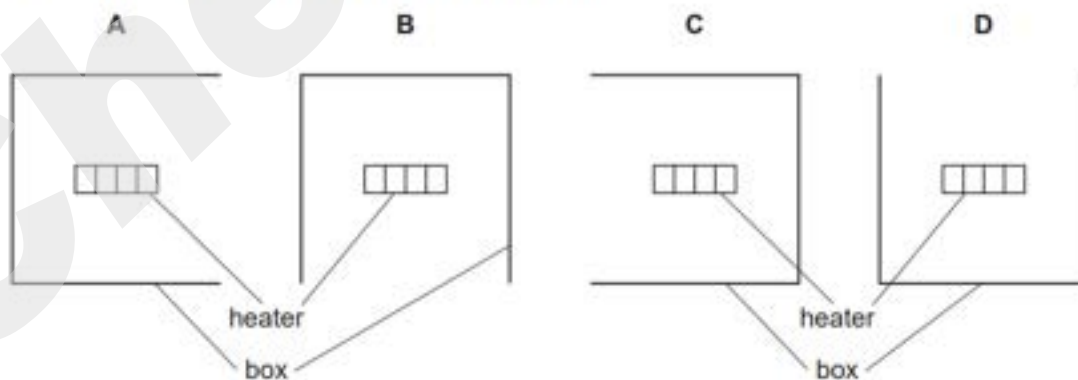
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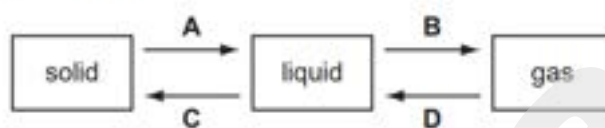


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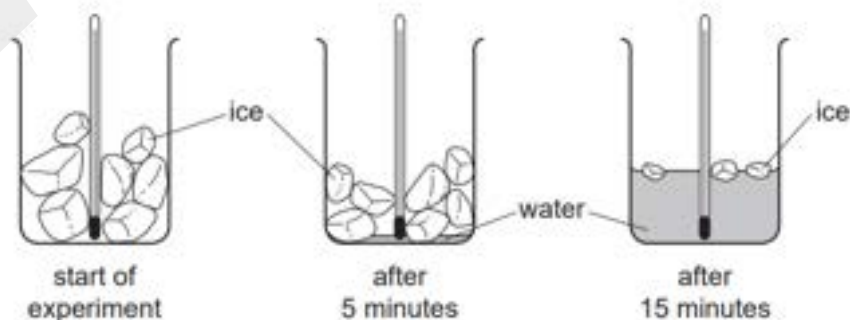
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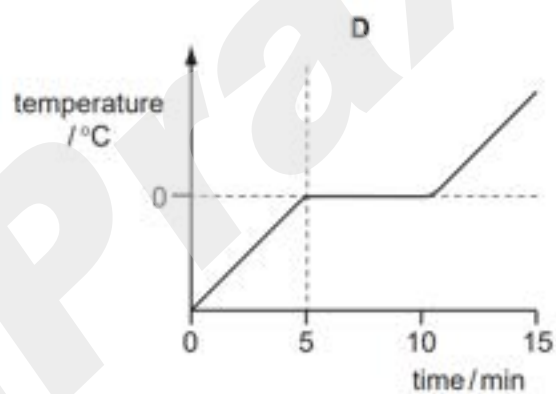
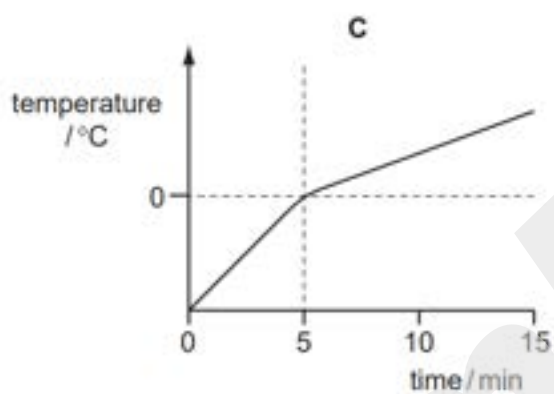
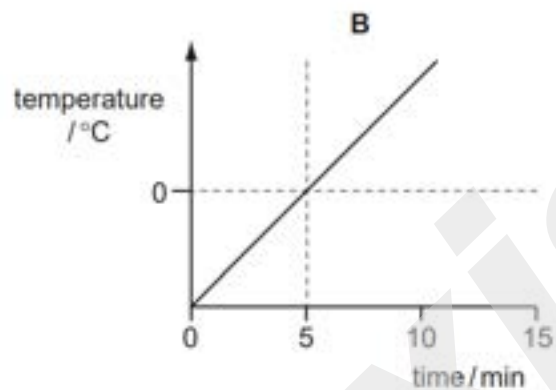
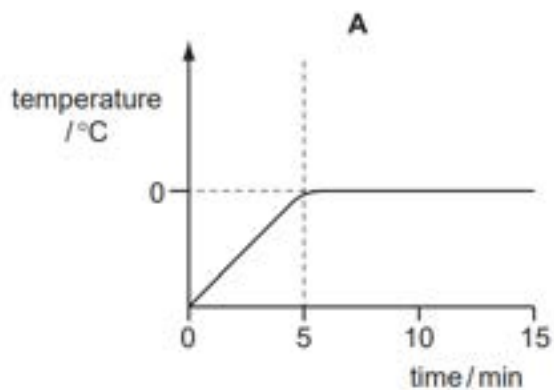
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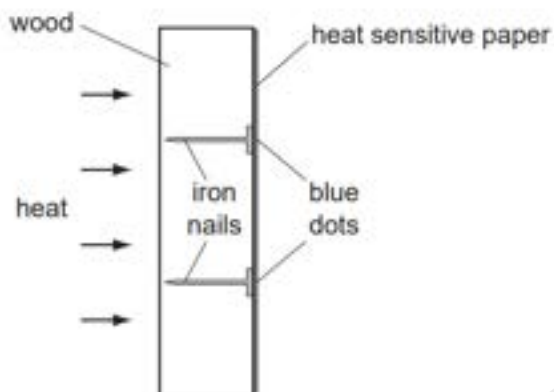
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What happens to the block of metal when its temperature falls by 10°C?

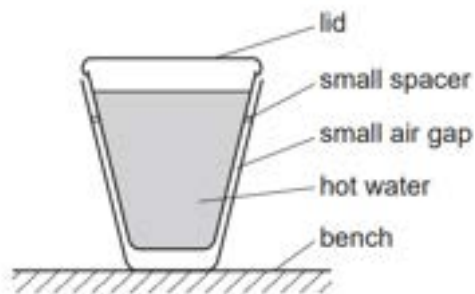
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Which statement is correct?

- A Heat loss by radiation is prevented by the small air gap.
- B No heat passes through the sides of either cup.
- C The bench is heated by convection from the bottom of the outer cup.
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- 4 A metal block is heated until it is completely melted. It is then allowed to solidify.

What happens to the mass of the metal during the changes of state?

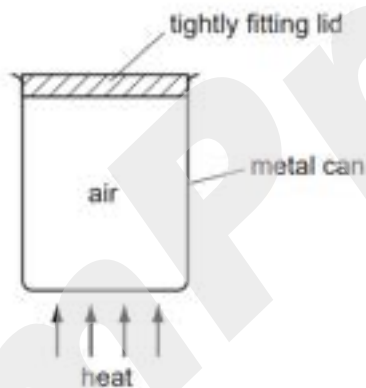
	mass during melting	mass during solidification
A	decreases	increases
B	increases	decreases
C	increases	stays constant
D	stays constant	stays constant

- 13** On a warm day, a swimmer climbs out of a swimming pool into the open air and water evaporates from his skin.

As the water evaporates, which molecules escape into the air first and what happens to the average speed of the remaining water molecules?

	first molecules to escape	average speed of the remaining molecules
A	least energetic	decreases
B	least energetic	increases
C	most energetic	decreases
D	most energetic	increases

- 14** Some air is trapped inside a metal can with a tightly fitting lid.



When the can is heated strongly behind a safety screen, the lid is blown off by the increased pressure inside the can.

What causes the increase in pressure of the air inside the can?

- A** The air molecules expand and take up more room.
- B** The air molecules move more quickly.
- C** The number of molecules inside the can increases.
- D** The volume occupied by the molecules decreases.

15 A solid object has a very large thermal capacity.

What does this mean?

- A A large amount of energy is needed to make the object become hot.
- B A large amount of energy is needed to make the object melt.
- C A small amount of energy is needed to make the object become hot.
- D A small amount of energy is needed to make the object melt.

16 A hot drink is left in a room that is at a temperature of 20°C .

What has happened to the drink after ten minutes?

- A Its density is lower.
- B Its internal energy is lower.
- C Its particles have equal energies.
- D Its particles move more quickly.

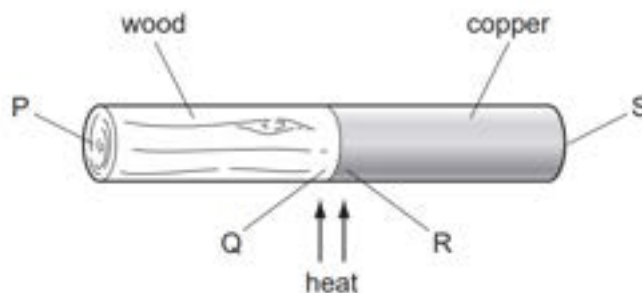
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- C Heat the rod and then place it in the hole.
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18 A rod is made of copper and wood joined together.



The rod is heated at the join in the centre for about a minute.

At which labelled point will the temperature be lowest, and at which point will it be highest?

	lowest temperature	highest temperature
A	P	Q
B	P	R
C	S	P
D	S	R

19 Two plastic cups are placed one inside the other. Hot water is poured into the inner cup and a lid is put on top, as shown.



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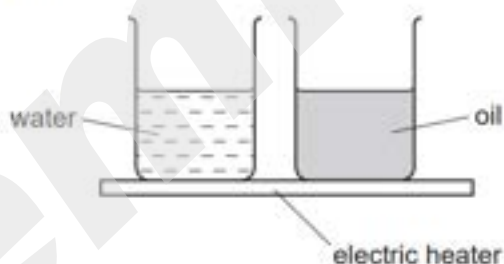
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- B** No heat passes through the sides of either cup.
- C** The bench is heated by convection from the bottom of the outer cup.
- D** The lid is used to reduce heat loss by convection.

October/November 2011 (11)

- 13 Evaporation occurs when molecules escape from a liquid surface into the air above it. During this process the temperature of the liquid falls.

Why does the temperature of the liquid fall?

- A The molecules in the vapour expand because the pressure is less.
 - B The molecules left in the liquid have more space to move around.
 - C The molecules move more slowly when they escape into the air.
 - D The molecules with the highest energies escape into the air.
- 15 To mark the lower fixed point of a Celsius scale on a thermometer, the thermometer should be placed in
- A pure alcohol.
 - B pure distilled water.
 - C pure melting ice.
 - D pure mercury.
- 16 The diagram shows an electric heater being used to heat a beaker of water and an identical beaker of oil for several minutes.

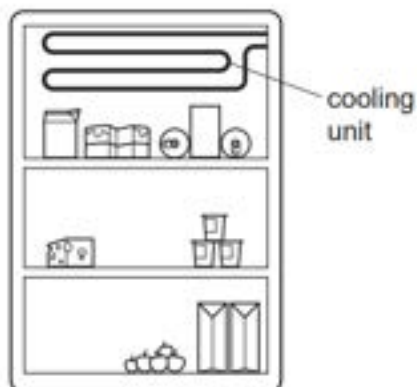


The temperature of the water and the temperature of the oil increase constantly. The rise in temperature of the oil is much greater than that of the water.

Why is this?

- A The oil has a higher boiling point than water.
- B The oil has a higher thermal capacity than water.
- C The oil has a lower boiling point than water.
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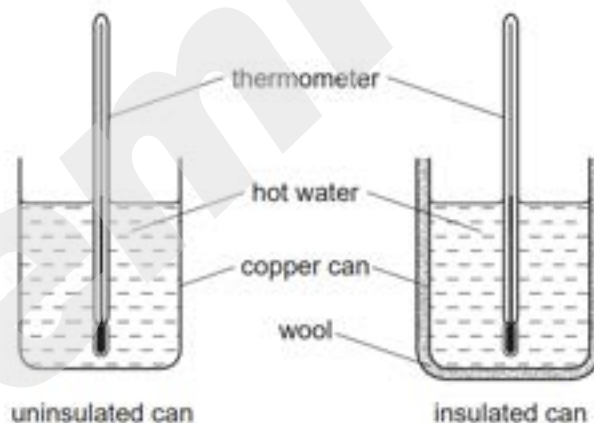
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Why is the cooling unit placed at the top?

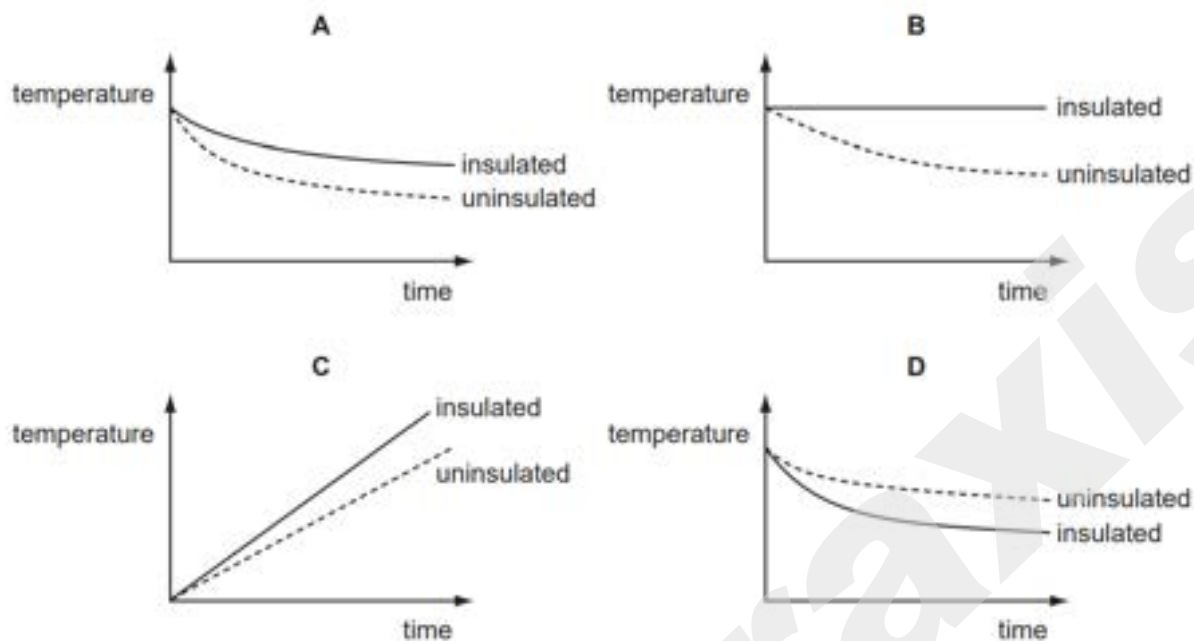
- A Cold air falls and warm air is displaced upwards.
- B Cold air is a bad conductor so heat is not conducted into the refrigerator.
- C Cold air is a good conductor so heat is conducted out of the refrigerator.
- D Cold air remains at the top and so prevents convection.

18 Two identical copper cans are filled with boiling water.



One can is insulated with wool. The temperature of the water in each can is taken every minute for several minutes. Graphs of the results are plotted.

Which graph shows the results obtained?



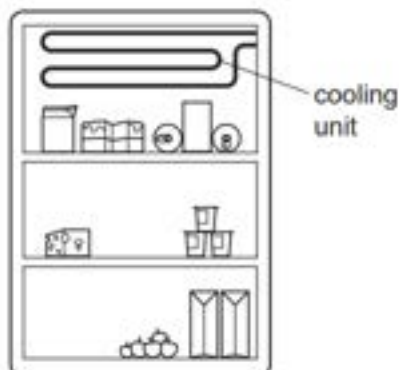
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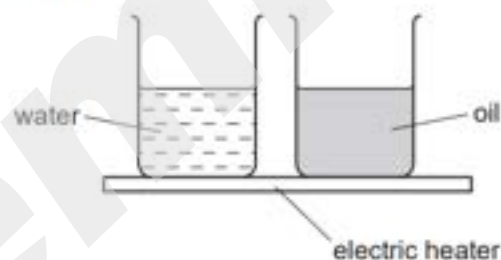
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May/June 2012 (11)

13 Brownian motion is observed when looking at smoke particles in air using a microscope.

What causes the smoke particles to move at random?

- A Smoke particles are hit by air molecules.
- B Smoke particles are moved by convection currents in the air.
- C Smoke particles have different weights and fall at different speeds.
- D Smoke particles hit the walls of the container.

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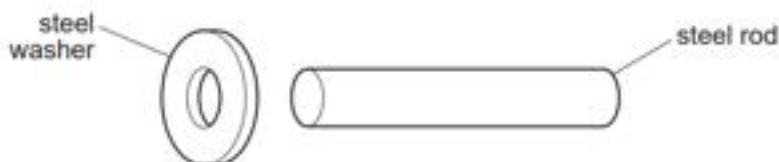
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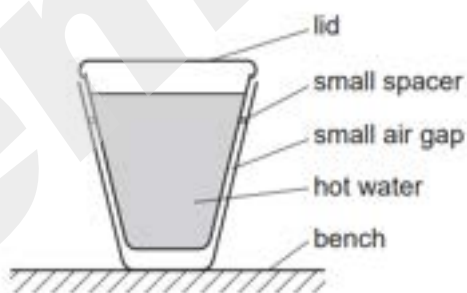
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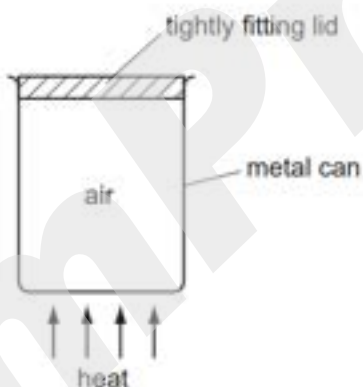
May/June 2012 (12)

- 13 On a warm day, a swimmer climbs out of a swimming pool into the open air and water evaporates from his skin.

As the water evaporates, which molecules escape into the air first and what happens to the average speed of the remaining water molecules?

	first molecules to escape	average speed of the remaining molecules
A	least energetic	decreases
B	least energetic	increases
C	most energetic	decreases
D	most energetic	increases

- 14 Some air is trapped inside a metal can with a tightly fitting lid.



When the can is heated strongly behind a safety screen, the lid is blown off by the increased pressure inside the can.

What causes the increase in pressure of the air inside the can?

- A** The air molecules expand and take up more room.
- B** The air molecules move more quickly.
- C** The number of molecules inside the can increases.
- D** The volume occupied by the molecules decreases.

15 A solid object has a very large thermal capacity.

What does this mean?

- A A large amount of energy is needed to make the object become hot.
- B A large amount of energy is needed to make the object melt.
- C A small amount of energy is needed to make the object become hot.
- D A small amount of energy is needed to make the object melt.

16 A hot drink is left in a room that is at a temperature of 20°C .

What has happened to the drink after ten minutes?

- A Its density is lower.
- B Its internal energy is lower.
- C Its particles have equal energies.
- D Its particles move more quickly.

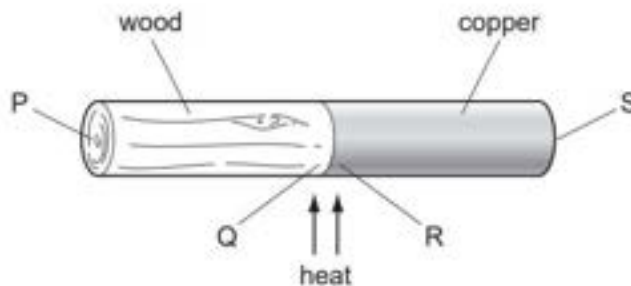
17 An engineer wants to fix a steel washer on to a steel rod. The rod is just too big to fit into the hole of the washer.



How can the engineer fit the washer on to the rod?

- A Cool the washer and put it over the rod.
- B Cool the washer and rod to the same temperature and push them together.
- C Heat the rod and then place it in the hole.
- D Heat the washer and then place it over the rod.

- 18 A rod is made of copper and wood joined together.

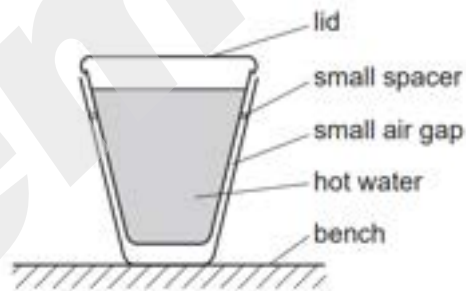


The rod is heated at the join in the centre for about a minute.

At which labelled point will the temperature be lowest, and at which point will it be highest?

	lowest temperature	highest temperature
A	P	Q
B	P	R
C	S	P
D	S	R

- 19 Two plastic cups are placed one inside the other. Hot water is poured into the inner cup and a lid is put on top, as shown.



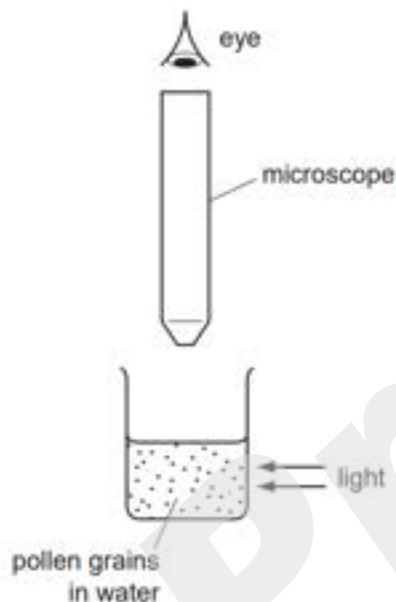
Which statement is correct?

- A** Heat loss by radiation is prevented by the small air gap.
- B** No heat passes through the sides of either cup.
- C** The bench is heated by convection from the bottom of the outer cup.
- D** The lid is used to reduce heat loss by convection.

October/November 2012 (11)

14 Very small pollen grains are suspended in water. A bright light shines from the side.

Looking through a microscope, small specks of light are seen to be moving in a random, jerky manner.



What are the moving specks of light?

- A pollen grains being hit by other pollen grains
- B pollen grains being hit by water molecules
- C water molecules being hit by other water molecules
- D water molecules being hit by pollen grains

15 A swimmer feels cold after leaving warm water on a warm, windy day.

Why does she feel cold even though the air is warm?

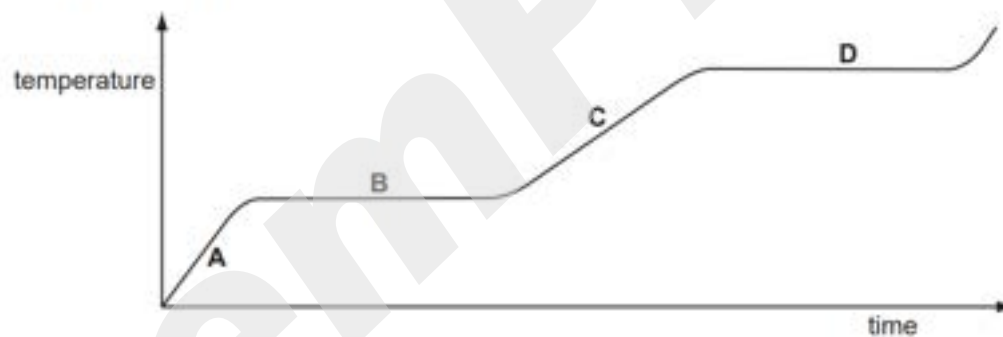
- A The less energetic water molecules on her skin escape quickly.
- B The more energetic water molecules on her skin do not escape quickly.
- C The water on her skin does not evaporate quickly enough to keep her warm.
- D The water on her skin evaporates quickly and cools her skin.

16 Which physical property is used to measure temperature in a liquid-in-glass thermometer?

- A the length of the thermometer
- B the thickness of the glass bulb
- C the volume of the glass bulb
- D the volume of the liquid

17 The graph shows the temperature of a substance as it is heated steadily.

In which part of the graph is the substance boiling?



- 18 A night storage heater contains a large block of material that is heated electrically during the night. During the day the block cools down, releasing thermal energy into the room.



Which thermal capacity and which night-time temperature increase will cause the most energy to be stored by the block?

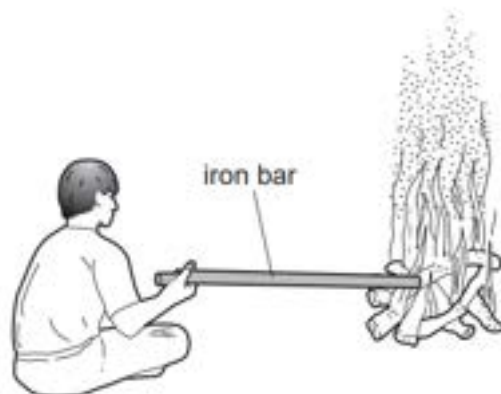
	thermal capacity of block	night-time temperature increase
A	large	large
B	large	small
C	small	large
D	small	small

- 19 After a sheep has its wool cut off, it is harder for it to stay warm when the air temperature falls.

How does the wool help the sheep to stay warm?

- A** Air can circulate between the wool fibres and heat up the skin by convection.
- B** Air trapped by the wool fibres reduces heat losses from the skin by convection.
- C** The wool fibres are curly so it takes longer for heat to be conducted away from the skin.
- D** The wool fibres conduct heat to the skin from the air outside.

20 A boy sits near a campfire. He pokes the fire with an iron bar. His hand becomes hot.



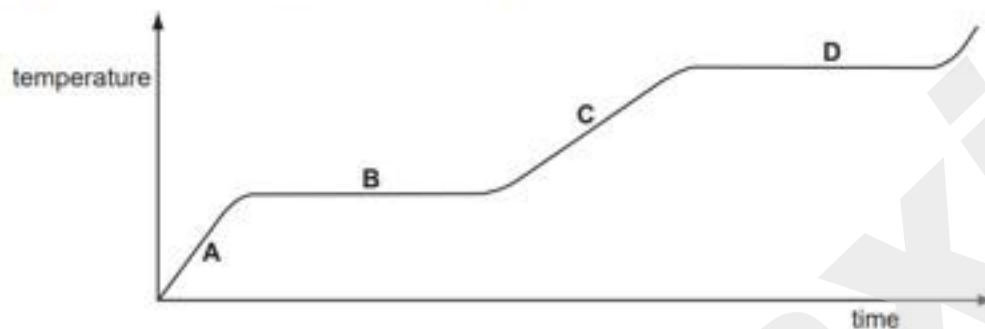
In which ways does thermal energy (heat) from the fire reach his hand?

- A conduction and convection only
- B conduction and radiation only
- C convection and radiation only
- D conduction, convection and radiation

October/November 2012 (12)

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- 20 A night storage heater contains a large block of material that is heated electrically during the night. During the day the block cools down, releasing thermal energy into the room.



Which thermal capacity and which night-time temperature increase will cause the most energy to be stored by the block?

	thermal capacity of block	night-time temperature increase
A	large	large
B	large	small
C	small	large
D	small	small

October/November 2012 (13)

- 15 The table lists the melting points and the boiling points of four different substances.

Which substance is a liquid at 0°C?

	melting point/°C	boiling point/°C
A	-219	-183
B	-7	58
C	98	890
D	1083	2582

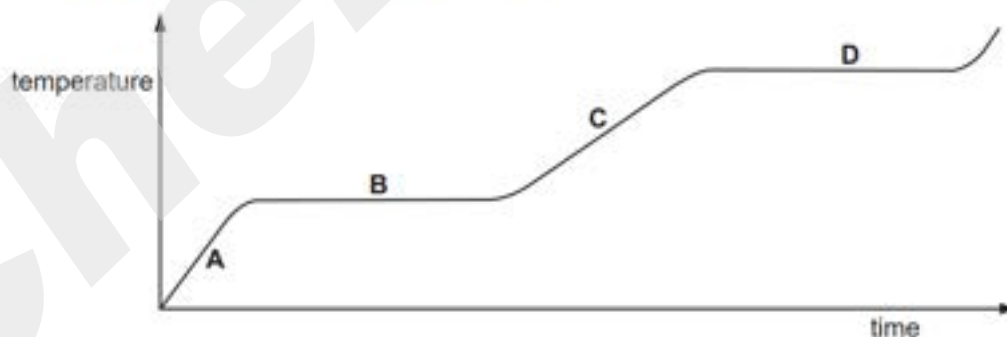
- 16 A student wishes to calibrate a mercury-in-glass thermometer with a °C scale.

Which values should she use for the lower fixed point and for the upper fixed point?

	lower fixed point	upper fixed point
A	freezing point of mercury	boiling point of mercury
B	freezing point of mercury	boiling point of water
C	freezing point of water	boiling point of mercury
D	freezing point of water	boiling point of water

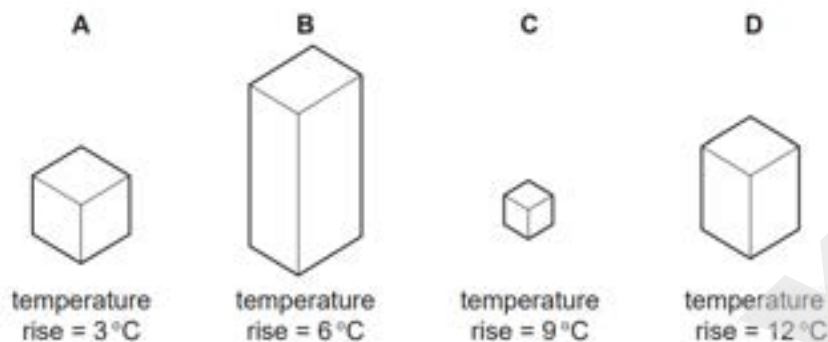
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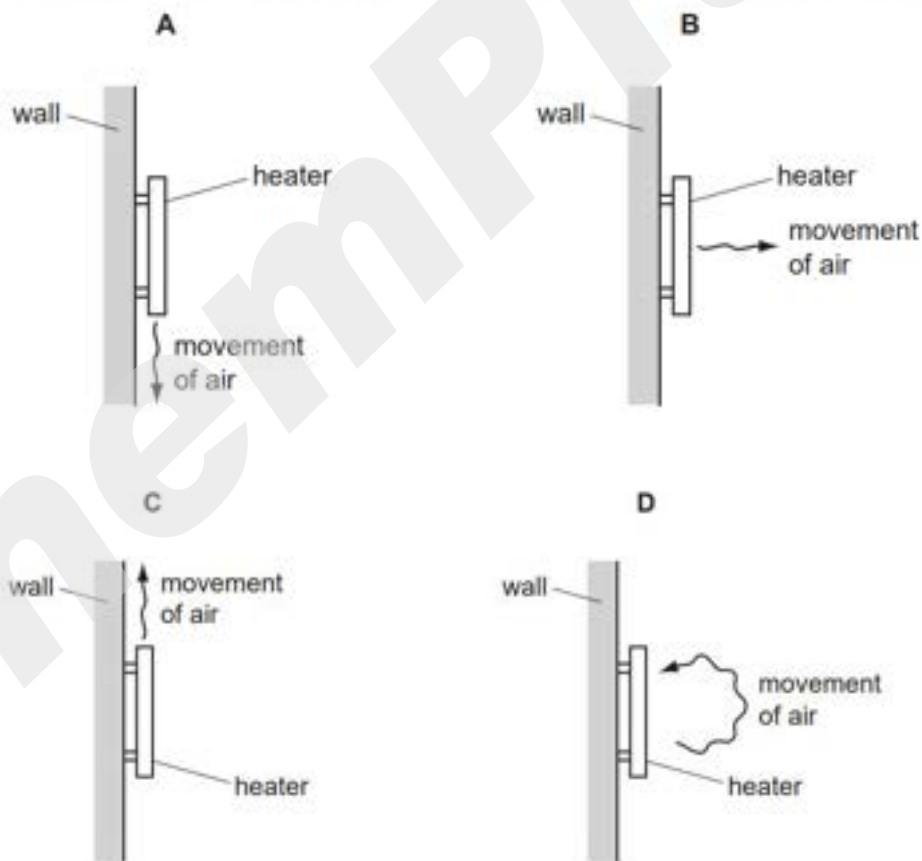
- 18 Four blocks, made from different materials, are each heated so that they have the same increase in internal energy.

Which block has the smallest thermal capacity?



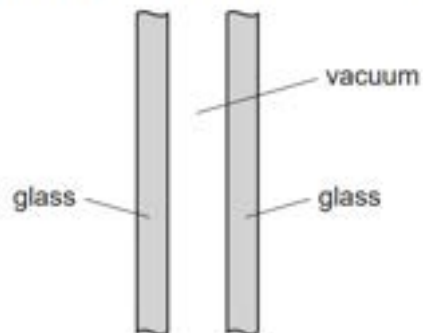
- 19 A convector heater is fixed to a wall.

Which diagram shows how warm air near the heater moves because of convection in the air?



20 A double-glazed window consists of two panes of glass with a vacuum between them.

The vacuum reduces the amount of thermal energy transferred through the window.



Which row shows how much thermal energy is transferred through the vacuum by conduction, by convection and by radiation?

	conduction	convection	radiation
A	none	none	some
B	none	some	some
C	some	none	none
D	some	some	none