Transfer of Thermal Energy

Question Paper

Level	O Level
Subject	Physics
Exam Board	Cambridge International Examinations
Unit	Energy & Thermal Physics
Topic	Transfer of Thermal Energy
Booklet	Question Paper

Time Allowed: **42 minutes**

Score: **/35**

Percentage: **/100**

Grade Boundaries:

1 Which statement about thermal radiation is correct?

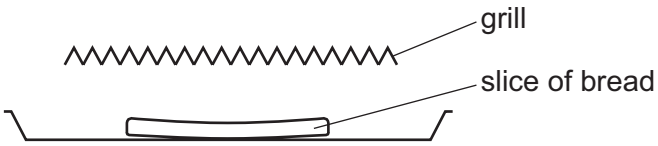
A In a vacuum, thermal radiation travels at the speed of light.

B Thermal radiation is a longitudinal wave.

C Thermal radiation travels as an ultra-violet wave.

D White surfaces are better emitters of thermal radiation than black surfaces.

2 A slice of bread is placed under a red-hot electric grill to make toast.



How does heat energy reach the bread?

A conduction and convection

B conduction only

C convection and radiation

D radiation only

3 A solid bar is heated at one end.

How is thermal energy transferred to the other end of the bar?

A Heated molecules move along the bar, carrying energy to the other end.

B Heated molecules move along the bar, giving energy to others along the bar.

C Heated molecules stay completely still, but give energy to other molecules.

D Heated molecules vibrate more rapidly and pass energy to other molecules.

4 The tubes inside solar heating panels use the Sun's radiation to warm water.

Why are the tubes painted black?

A Black surfaces absorb radiation well.

B Black surfaces conduct heat well.

C Black surfaces emit radiation well.

D Black surfaces reflect radiation well.

5 A copper rod is heated at one end.

Which statement describes how heat transfer occurs in the copper?

A Energetic copper molecules move from the cooler end to the hotter end.

B Energetic copper molecules move from the hotter end to the cooler end.

C Energetic free electrons move from the cooler end to the hotter end.

D Energetic free electrons move from the hotter end to the cooler end.

6 Which statement about copper explains why it is a better conductor of heat than glass?

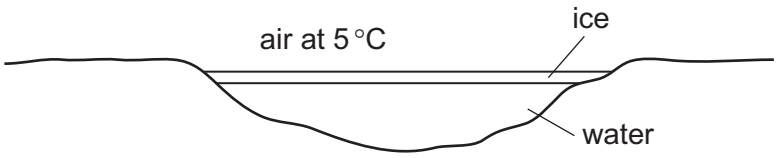
A Atomic vibration is passed on to neighbouring copper atoms quickly.

B Atoms move through the copper and pass on kinetic energy.

C There are density changes within the copper.

D There are free electrons in the copper.

7 The diagram shows a frozen pond with the surface of the ice slowly melting as heat is transferred from the warmer air above it.



By which processes is heat transferred from the air to the ice?

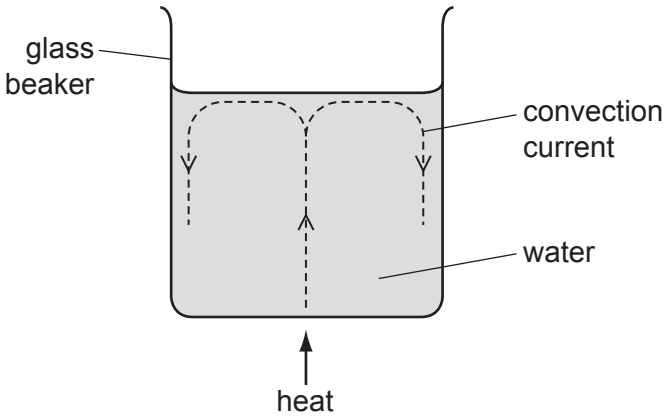
A conduction, convection and radiation

B conduction and convection only

C convection and radiation only

D radiation and conduction only

8 A glass beaker contains water. When the centre of the base of the beaker is heated, a convection current is set up.



Which statement explains this?

A The evaporation of water causes water molecules to rise to the surface.

B The expansion of water molecules causes them to rise to the surface.

C The water above the heat source rises because it becomes less dense.

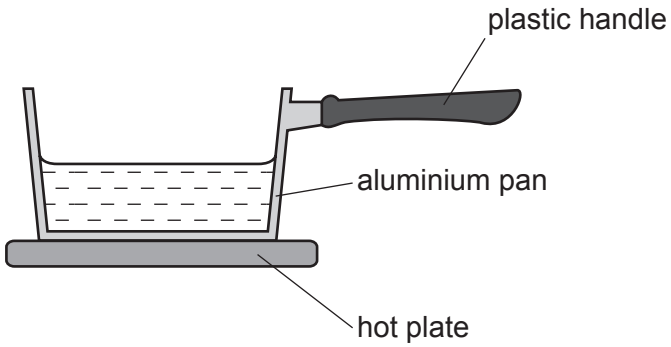
D The water at the sides sinks because it becomes less dense.

9 Two identical metal plates are painted, one matt (dull) white and the other matt black. These are placed at equal distances from a radiant heater as shown. The heater is turned on for five minutes.

Which metal plate absorbs more energy and which plate emits more energy in this time?

	absorbs more	emits more
A	black	black
B	black	white
C	white	black
D	white	white

10 A saucepan is used to heat up some water.



How is heat transferred through the aluminium pan and through the plastic handle?

	heat is transferred through the aluminium pan by	heat is transferred through the plastic handle by
A	the movement of free electrons and the vibration of atoms	the movement of free electrons and the vibration of molecules
B	the movement of free electrons and the vibration of atoms	the vibration of molecules only
C	the movement of free electrons only	the movement of free electrons and the vibration of molecules
D	the movement of free electrons only	the vibration of molecules only

11 A silver cup is filled with boiling water from a kettle.

A man touches the outside surface of the cup and finds that it is extremely hot.

Why is the surface so hot?

A Convection takes place in the boiling water.

B Silver is a good conductor of heat.

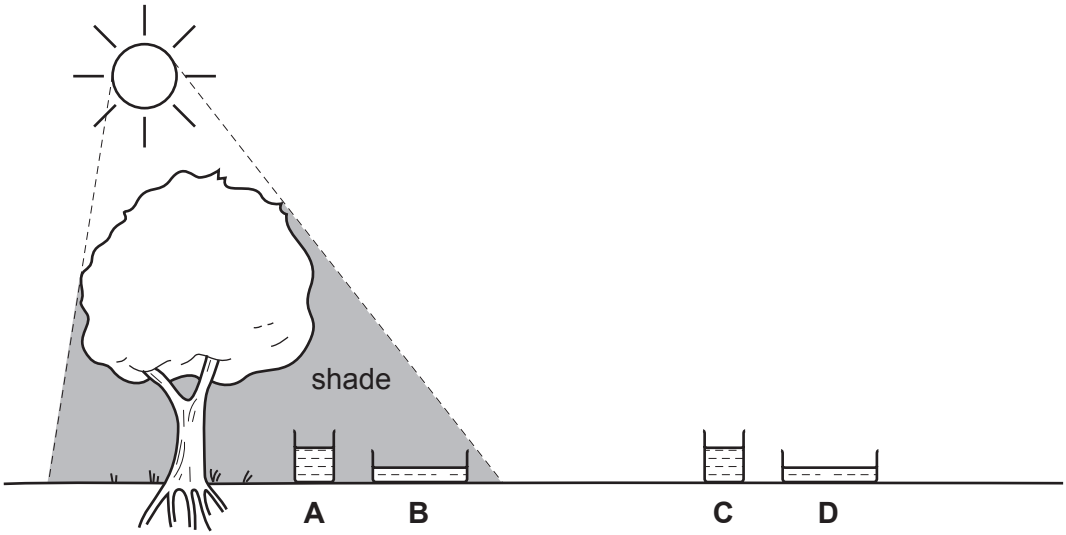
C The boiling water gives out latent heat.

D The shiny surface is a good emitter of infra-red radiation.

12 Four containers are filled with equal volumes of water at the same temperature.

Containers **A** and **B** are shaded by a tree. Sunlight falls on containers **C** and **D**.

From which container does all the water evaporate first?



13 A rod of metal is heated at one end.

Which statement best describes the conduction of heat through the metal?

A Atoms move from the hot end and hit electrons at the cold end.

B Atoms vibrate and hit atoms at the cold end.

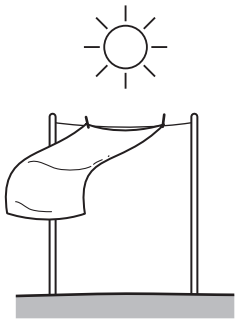
C Free electrons move from the hot end and hit atoms further along the rod.

D Free electrons vibrate and pass energy to free electrons further along the rod.

14 Four wet towels are hung out to dry as shown.

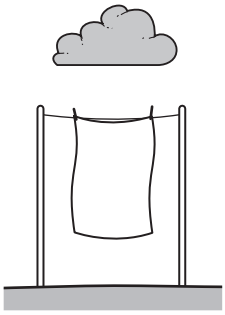
Which towel dries most quickly?

A



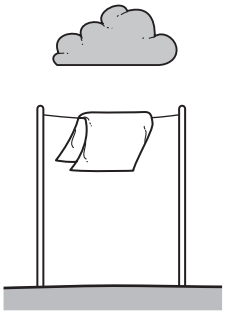
sunny
windy
towel unfolded

B



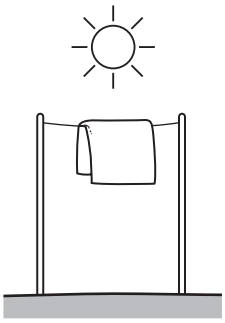
cloudy
no wind
towel unfolded

C



cloudy
windy
towel folded

D



sunny
no wind
towel folded

15 How is heat conducted in a metal?

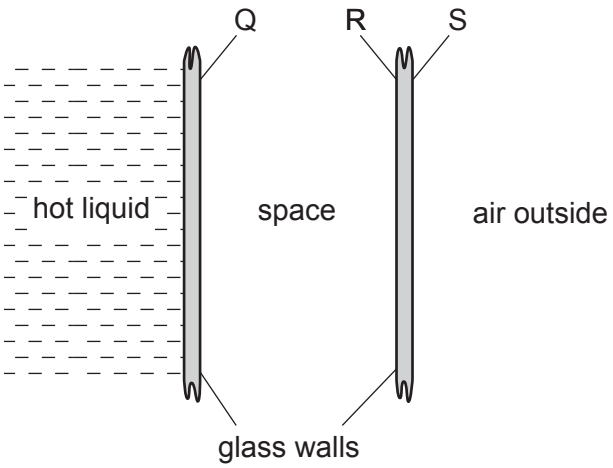
A by movement of electrons through the metal only

B by movement of atoms through the metal only

C by vibration of atoms and movement of electrons through the metal

D by vibration of atoms only

16 A student uses a double-walled glass vessel to contain a hot liquid.



What reduces the heat loss by radiation?

A a vacuum in the space between the walls

B painting surface Q black

C painting surface R black

D painting surface S silver

17 In hot weather, people use electric fans to keep cool.

Why do the fans make them feel cool?

A They change one form of energy into another.

B They cool the air in the room.

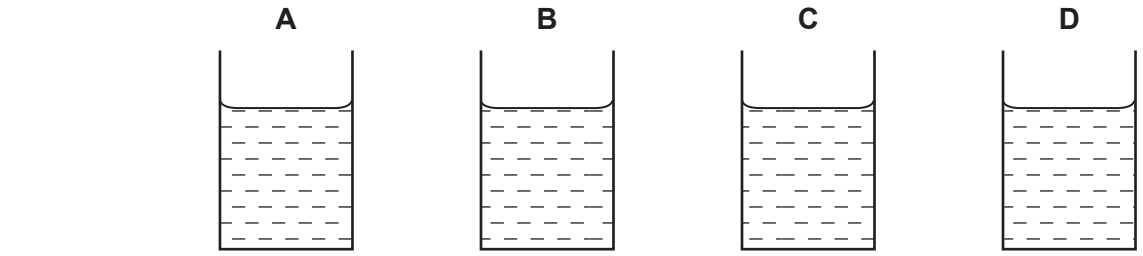
C They increase the rate of evaporation from the skin.

D They speed up the vibration of air molecules.

18 Four metal cans are identical except for the colour and the texture of their outer surfaces.

100 cm^3 of water at 70 °C is poured into each can.

Which cools the most rapidly?



19 How does heat transfer through a vacuum take place?

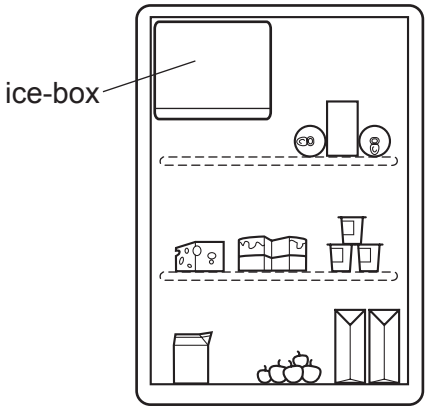
A by conduction, convection and radiation

B by conduction only

C by convection only

D by radiation only

20 When a refrigerator is switched on for the first time, the air surrounding the ice-box is cooled.

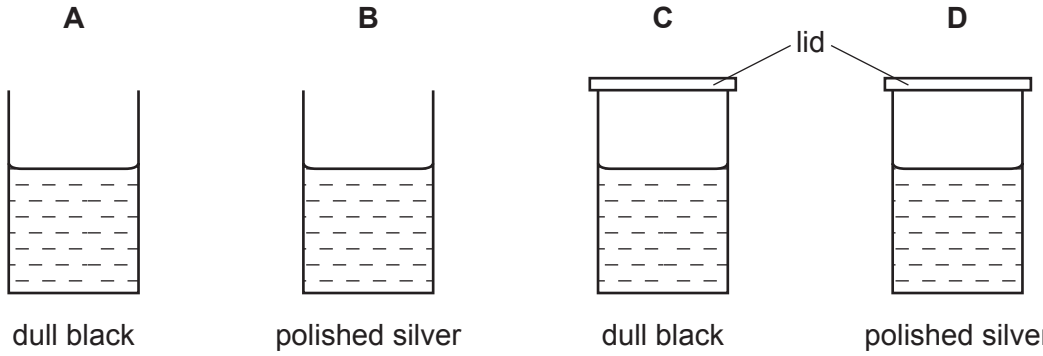


What happens to the density of this air and to its position inside the refrigerator?

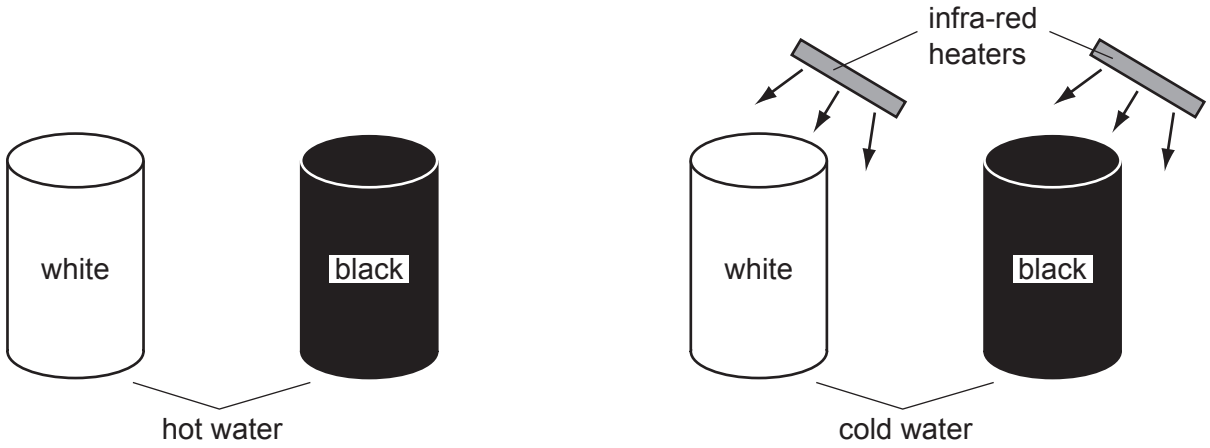
	density	position of the air
A	decreases	sinks to the bottom
B	decreases	stays at the top
C	increases	sinks to the bottom
D	increases	stays at the top

21 The diagrams show four identical cans with their outside surfaces painted either dull black or polished silver. Each can contains the same volume of water, initially at 80 °C.

After five minutes in a cool room, which can contains the **coolest** water?



22 The diagrams show four cans in a cool room. They are painted as shown. One pair is filled with hot water and left to cool down. The other pair is filled with cold water and placed near infra-red heaters.



The hot water in the black can cools more quickly than the hot water in the white can. The cold water in the black can heats up more quickly than the cold water in the white can.

Which row shows the reasons for this?

	better emitter of infra-red	better absorber of infra-red
A	black	black
B	black	white
C	white	black
D	white	white

23 In a vacuum flask, which methods of heat transfer are prevented by the vacuum?

A conduction only

B convection only

C conduction and convection only

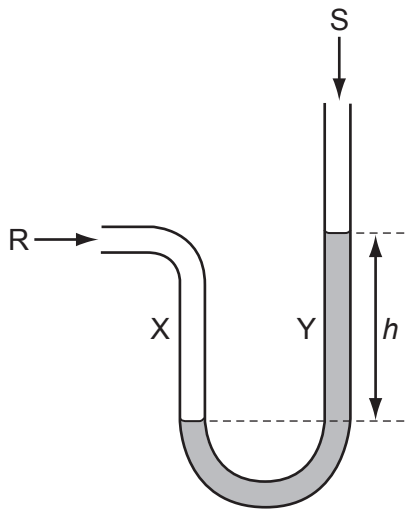
D conduction, convection, and radiation

24 Ice is taken from a freezer and left in a room. The ice melts and eventually the water reaches room temperature.

Which energy transfers take place?

	energy transfer **during** melting	energy transfer **after** melting
A	from ice to room	from water to room
B	from ice to room	from room to water
C	from room to ice	from room to water
D	from room to ice	from water to room

25 The diagram shows a simple manometer.



Side X is connected to a gas supply. Side Y is open to the atmosphere.

What pressure is the length *h* used to measure?

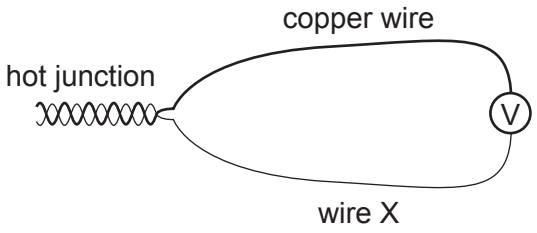
A the atmospheric pressure S

B the difference between the gas pressure R and the atmospheric pressure S

C the gas pressure R

D the sum of the gas pressure R and the atmospheric pressure S

26 A thermocouple thermometer is made from two wires connected to a voltmeter.

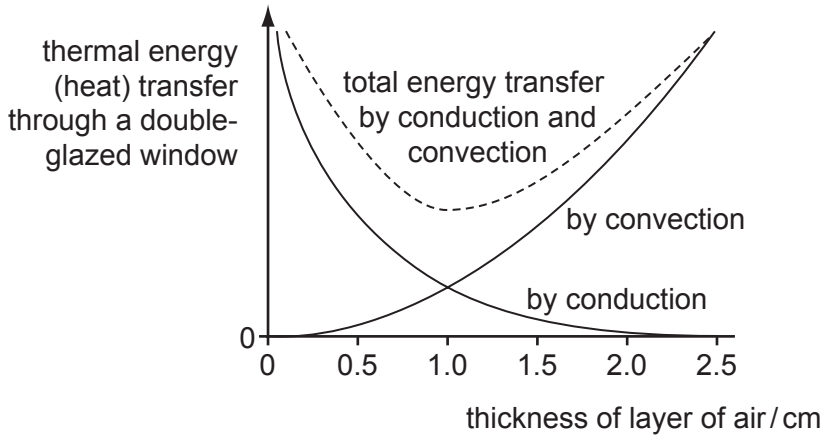


Which arrangement gives a reading on the voltmeter?

	temperature of voltmeter	wire X
A	colder than hot junction	copper
B	colder than hot junction	iron
C	same as hot junction	copper
D	same as hot junction	iron

27 A double-glazed window has two sheets of glass separated by a layer of air.

Thermal energy is conducted and convected through the layer of air. The amount of conduction and convection varies with the thickness of the layer of air, as shown in the graph.



Which thickness of air produces the smallest energy transfer, and why?

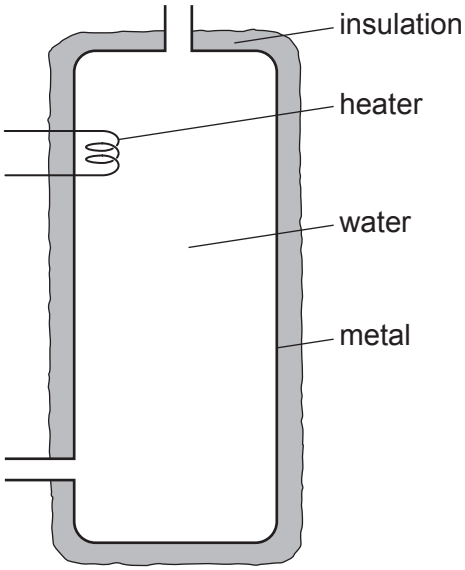
A 0.5 cm because there is little convection

B 1.0 cm because the total thermal energy transfer is least

C 1.5 cm because the total thermal energy transfer is small and conduction is low

D 2.0 cm because there is little conduction

28 Water at the top of a hot-water tank is heated and the water becomes hot. No water enters or leaves the tank.



Water at the bottom of the tank stays cold for some time.

Why is this?

A Cold water at the top of the tank falls to the bottom.

B Hot water at the bottom of the tank rises to the top.

C Water is a poor conductor of heat.

D The insulation is a poor conductor of heat.

29 Density changes are responsible for which method of thermal energy transfer?

A conduction only

B convection only

C radiation only

D conduction, convection and radiation

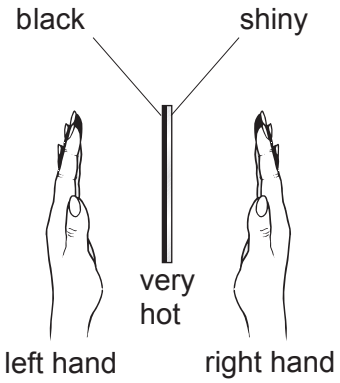
30 The heat from the hot water in a metal radiator passes through the metal and then spreads around the room.

What are the main processes by which the heat is transferred through the radiator and then spread around the room?

	through the metal radiator	around the room
A	conduction	conduction
B	conduction	convection
C	radiation	conduction
D	radiation	convection

31 The diagram shows a thick copper plate that is very hot. One side is black, the other is shiny.

A student places her hands the same distance from each side as shown.



Her left hand feels warmer than her right hand.

Which statement is the correct conclusion from the experiment?

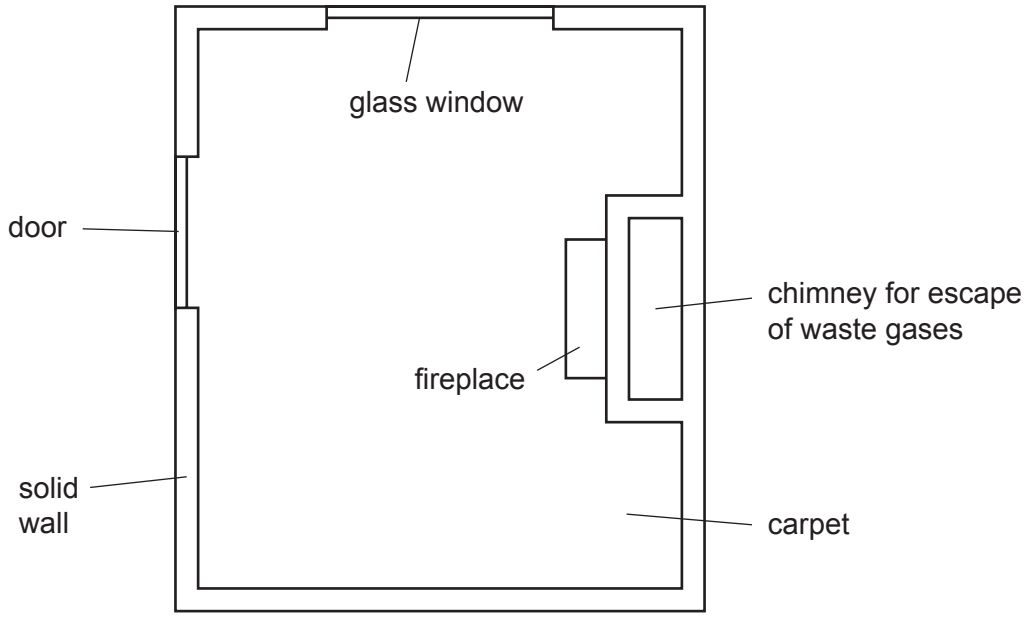
A The black side is hotter than the shiny one.

B The black side radiates more heat.

C The shiny side radiates more heat.

D The shiny side is cooling down faster than the black side.

32 The diagram shows a room seen from above. It is cold outside the room. The room is heated by a small fire in the fireplace.



Where is most heat lost by convection?

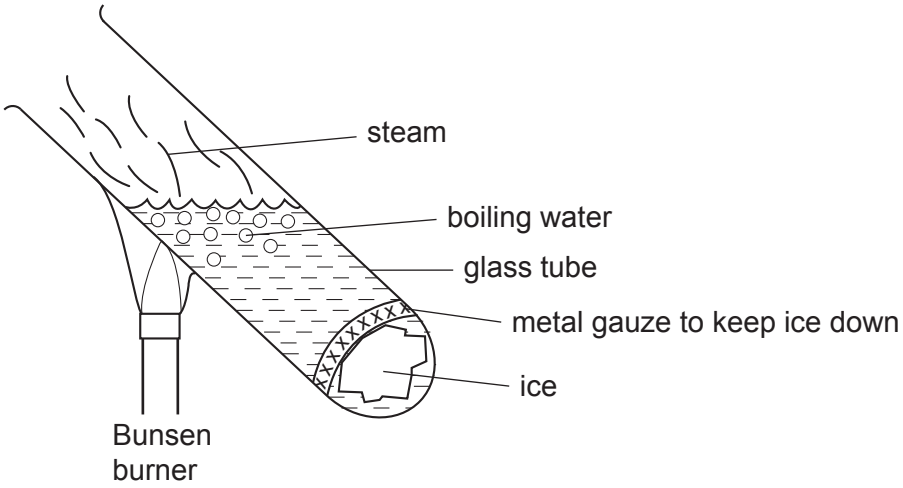
A carpet

B chimney

C glass window

D solid wall

33 An experiment is carried out as shown in the diagram.



Why does the ice take a long time to melt, even though the water at the top of the tube is boiling?

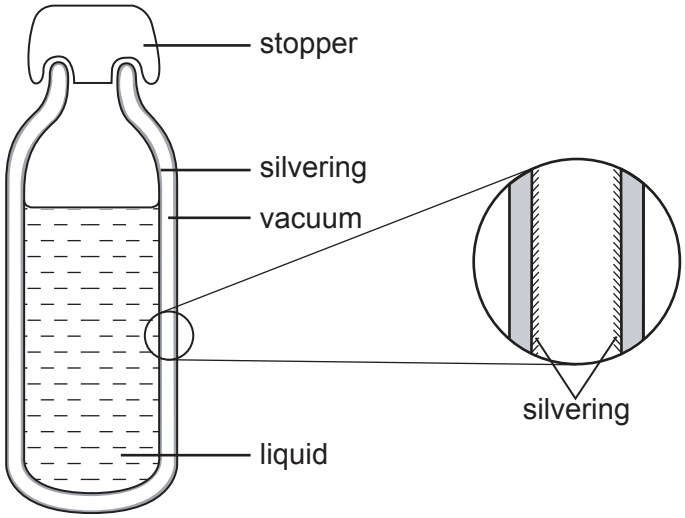
A Convection never occurs in water.

B Ice is a poor conductor of heat.

C The gauze prevents the energy reaching the ice.

D Water is a poor conductor of heat.

34 The diagram shows a vacuum flask and an enlarged view of a section through the flask wall.



The main reason for the silvering is to reduce heat transfer by

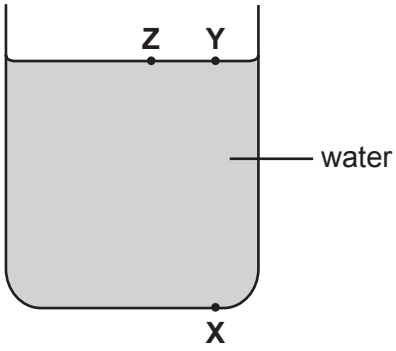
A conduction only.

B radiation only.

C conduction and convection.

D convection and radiation.

35 A teacher has a large tank of water in which he wants to set up a convection current.



Which of the following arrangements would do this?

A cooling at **X**

B cooling at **Y**

C heating at **Y**

D heating at **Z**