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IGCSE PHYSICS 0625 · TOPICAL PAST PAPERS

Transfer of Thermal Energy

Paper 1 — Multiple-Choice Questions (topical compilation)

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2.3 Transfer of thermal energy

PAPER 1

1 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.

5054/11/M/J/12 /Q17

2 How is heat conducted in a metal?

A by movement of electrons through the metal only

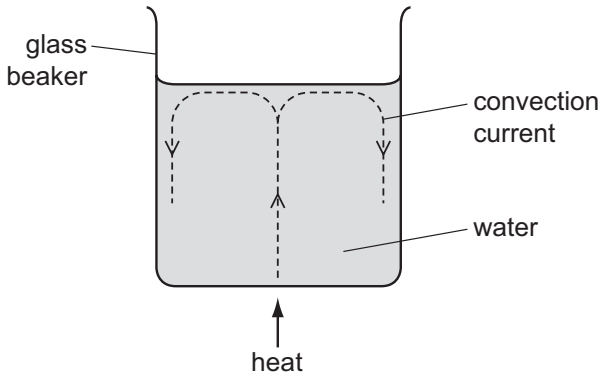
B by movement of atoms through the metal only

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

D by vibration of atoms only

5054/12/M/J/12/Q17

3 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.

5054/11/M/J/13/Q13

4 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

5054/11/M/J/13/Q14

5 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.

5054/11/M/J/15/Q15

6 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.

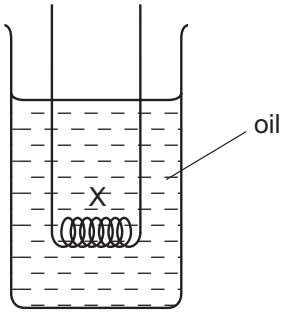
B Black surfaces conduct heat well.

C Black surfaces emit radiation well.

D Black surfaces reflect radiation well.

5054/11/M/J/15/Q16

7 An electrical heater is placed in a beaker of cold oil, as shown.



The heater is switched on.

What happens to the liquid at X?

A It becomes less dense and falls.

B It becomes less dense and rises.

C It becomes more dense and falls.

D It becomes more dense and rises.

5054/12/M/J/15/Q15

8 Which statement about thermal radiation is correct?

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

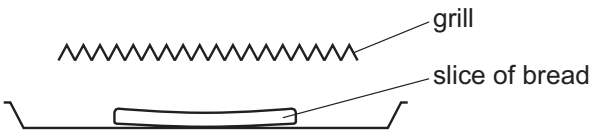
B Thermal radiation is a longitudinal wave.

C Thermal radiation travels as an ultra-violet wave.

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

5054/11/M/J/16/Q18

9 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

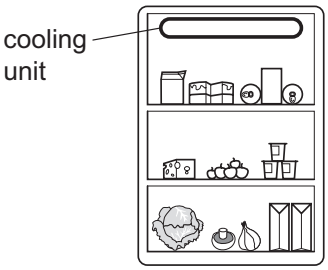
B conduction only

C convection and radiation

D radiation only

5054/12/M/J/16/Q15

10 The diagram shows the inside of a refrigerator.



When the refrigerator is first switched on, what happens to the air near the cooling unit?

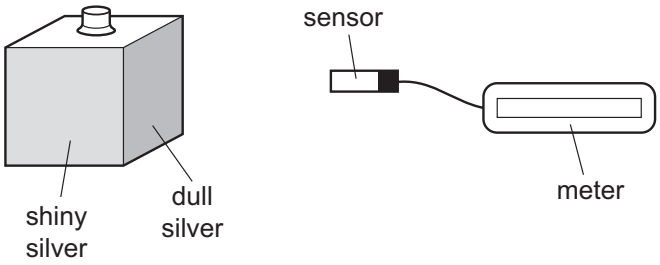
	the particles of this air	the density of this air
A	become smaller	decreases
B	become smaller	increases
C	move closer together	decreases
D	move closer together	increases

5054/12/M/J/16/Q16

11 A metal box has four different surfaces; dull black, shiny black, dull silver and shiny silver.

The box is filled with boiling water so that each surface is at the same temperature.

A sensor measures the amount of radiation from each surface.

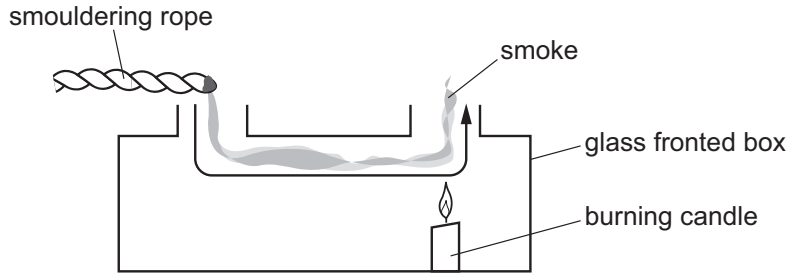


Which surface emits the least radiation and which surface emits the most radiation?

	least	most
A	dull black	shiny silver
B	dull silver	shiny black
C	shiny black	dull silver
D	shiny silver	dull black

5054/12/M/J/17/Q25

12 When a piece of smouldering rope is held at the opening of the box in the diagram, smoke moves in the direction indicated.



What is responsible for the movement of the smoke?

A convection

B movement of free electrons

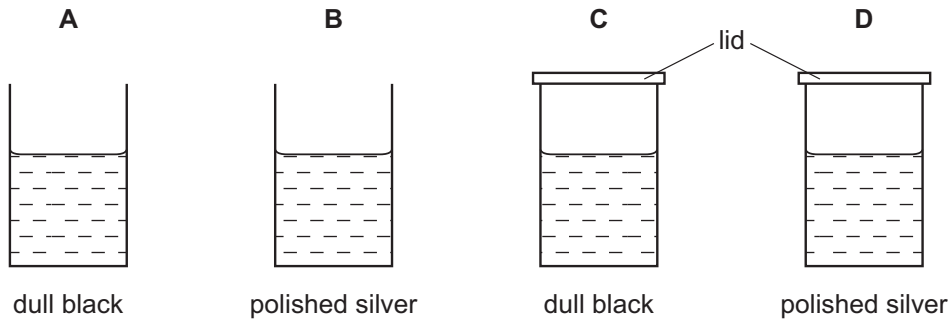
C radiation

D vibration of molecules

5054/11/M/J/18/Q20

13 The diagrams show four identical cans with their outside surfaces either polished silver or painted dull black. 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?



5054/11/M/J/18/Q21

14 Samples of four different materials at room temperature are heated from below and heat is transferred upwards.

In which material is all of the heat transferred by the vibration of molecules?

A air

B mercury

C rubber

D water

5054/12/M/J/18/Q24

15 Which statement is correct?

A Infrared radiation cannot travel in a vacuum.

B Infrared radiation cannot travel in solids or in gases.

C Infrared radiation can only travel in a vacuum.

D Infrared radiation can travel in a vacuum and in gases.

5054/11/M/J/19/Q16

16 Which description of a dull black surface is correct?

A good emitter, good absorber and good reflector of radiation

B good emitter, poor absorber and poor reflector of radiation

C good emitter, good absorber and poor reflector of radiation

D poor emitter, poor absorber and poor reflector of radiation

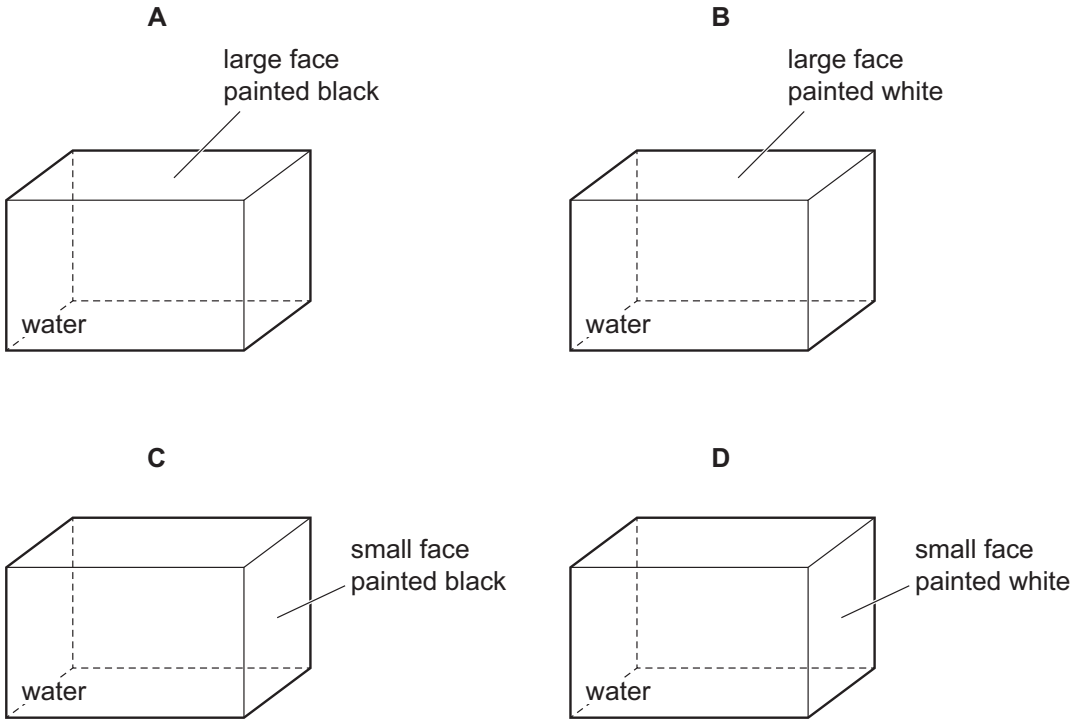
5054/11/M/J/20/Q21

17 Four metal containers, with identical dimensions, are filled with water at 90 °C.

All the faces, except one, of each container are covered in a very good insulator.

The one exposed face on each container is painted either black or white.

In which container does the water cool the fastest?



5054/12/M/J/20/Q23

18 Thermal energy is used to turn water at 100 °C to steam at 100 °C.

Which of the following occurs?

1 The forces between the molecules decrease.

2 The speed of the molecules increases.

3 The separation of the molecules increases.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

5054/12/M/J/20/Q24

19 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.

5054/11/M/J/21/Q15

20 Which heat transfer processes do **not** require a medium?

A conduction only

B convection only

C radiation only

D conduction and radiation

5054/12/M/J/21/Q18

21 A building has walls made from wood and steel.

What describes the way in which thermal energy is transferred through the walls?

A conduction through the wood by movement of molecules through the wood only

B conduction through the metal by both the vibration of particles and movement of electrons through the steel

C conduction through the wood by both the vibration and movement of molecules through the wood

D convection through the metal by movement of electrons through the steel only

5054/11/M/J/22/Q13

22 How is heat energy transferred through the vacuum of space from the Sun to the Moon's surface?

A conduction only

B convection only

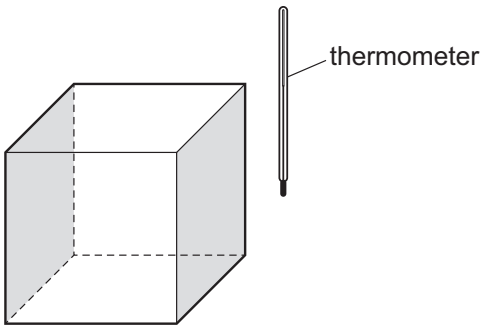
C radiation only

D conduction, convection and radiation

5054/12/M/J/22/Q16

23 A metal cube contains boiling water.

Each vertical face of the cube is painted a different colour or has a different texture.



Identical thermometers are held at equal distances from each vertical face.

Near which face does a thermometer read the greatest temperature?

A dull black

B dull white

C shiny black

D shiny white

5054/12/M/J/22/Q17

24 How does heat transfer through a vacuum take place?

A by conduction, convection and radiation

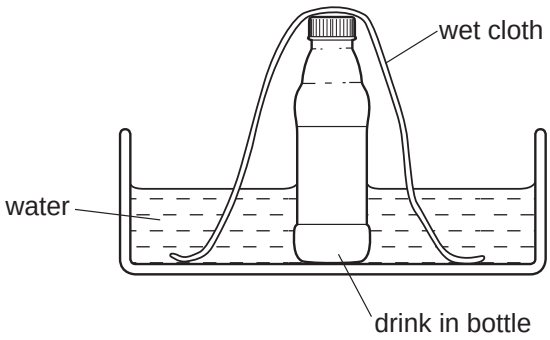
B by conduction only

C by convection only

D by radiation only

5054/11/O/N/11/Q15

25 On a hot day, the drink in a bottle can be kept cool by standing the bottle in a bowl of water and placing a wet cloth over it.



Why is the drink kept cool?

A Hot air cannot escape from the bottle.

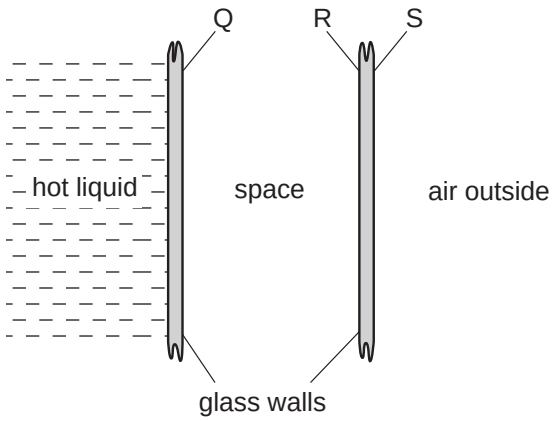
B The cloth conducts heat from the bottle into the water.

C The drink cannot evaporate from the bottle.

D Water evaporating from the cloth cools the drink.

5054/11/O/N/12/Q16

26 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

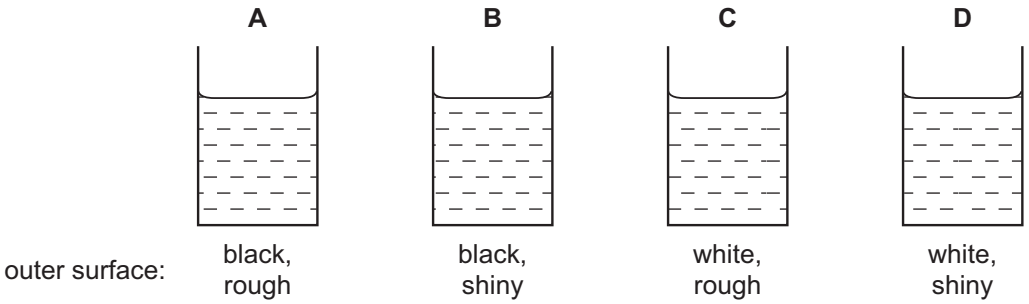
D painting surface S silver

5054/11/O/N/12/Q17

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

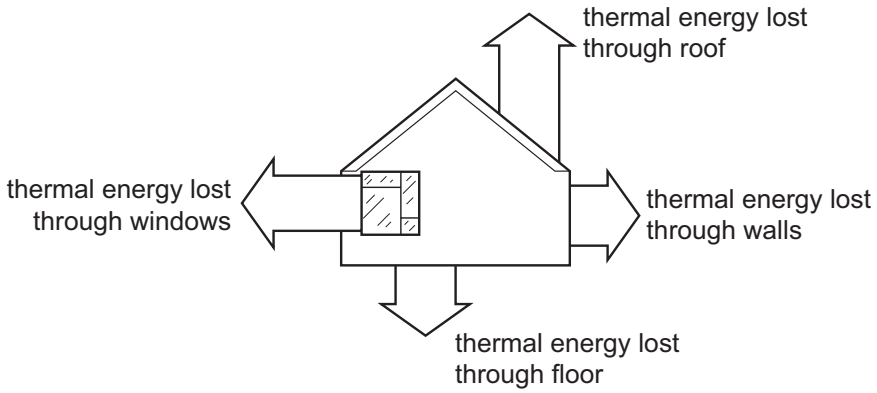
100 cm^3 of water at 70 °C is poured into each can.

Which cools the most rapidly?



5054/12/O/N/12/Q17

28 On a cold afternoon, a house loses 54 MJ of thermal energy (heat) to its surroundings as shown.



The heating system must supply more than 54 MJ of thermal energy to keep the temperature of the house constant.

Which statement explains this?

A The extra thermal energy is lost from the house to the surroundings by other means.

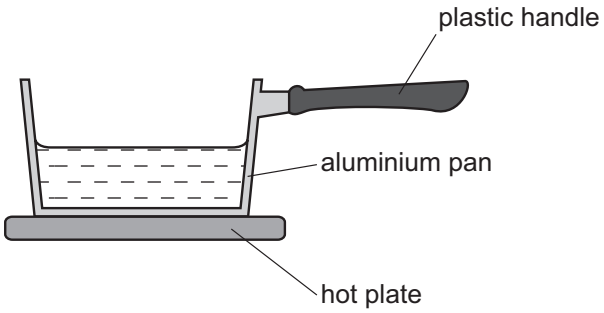
B The extra thermal energy keeps the house warmer than the surroundings.

C The temperature of the surroundings decreases continuously during this period.

D The thermal insulation of the roof is extremely ineffective.

5054/11/O/N/13/Q13

29 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

5054/12/O/N/13/Q15

30 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.

5054/12/O/N/13/Q16

31 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.

5054/11/O/N/14 /Q15

32 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.

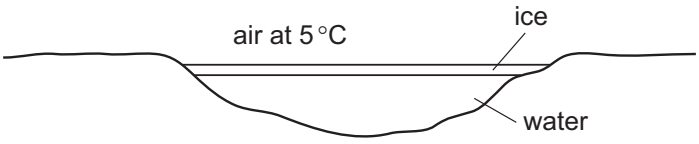
B Atoms move through the copper and pass on kinetic energy.

C There are density changes within the copper.

D There are free electrons in the copper.

5054/12/O/N/14/Q11

33 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

5054/12/O/N/14/Q12

34 Which statement about the transfer of thermal energy is correct?

A Transfer by radiation does not require a medium.

B Transfer is from a region of lower temperature to one of higher temperature.

C Transfer upwards in fluids is mainly through the vibrations of neighbouring particles.

D Transfer in solids is by means of density changes in the material.

5054/11/O/N/16/Q20

35 In which states of matter does convection occur?

A gases, liquids and solids

B gases and liquids only

C gases and solids only

D liquids and solids only

5054/12/O/N/16/Q24

36 In which substance is the conduction of thermal energy mainly due to the movement of electrons?

A air

B ice

C iron

D water

5054/11/O/N/17/Q16

37 Four similar metal plates are the same distance from a heater that emits infra-red radiation.

The plates are painted dull black, dull white, shiny black and shiny white.

Which plate absorbs the most radiation and which plate reflects the most radiation?

	absorbs most radiation	reflects most radiation
A	dull black	dull white
B	dull black	shiny white
C	shiny black	dull black
D	shiny white	dull black

5054/11/O/N/17/Q17

38 A heater is designed to radiate thermal energy.

Which change to the design decreases the thermal energy emitted by radiation?

A a darker coloured surface

B a higher surface temperature

C a larger surface area

D a shinier surface

5054/12/O/N/17/Q18

39 A cold solid is placed on top of a hot solid. Thermal energy flows from the hot solid to the cold one.

What is the explanation for this?

A A hot solid expands, so its molecules will move further apart.

B Energy is passed from one molecule to the next.

C Heat always rises.

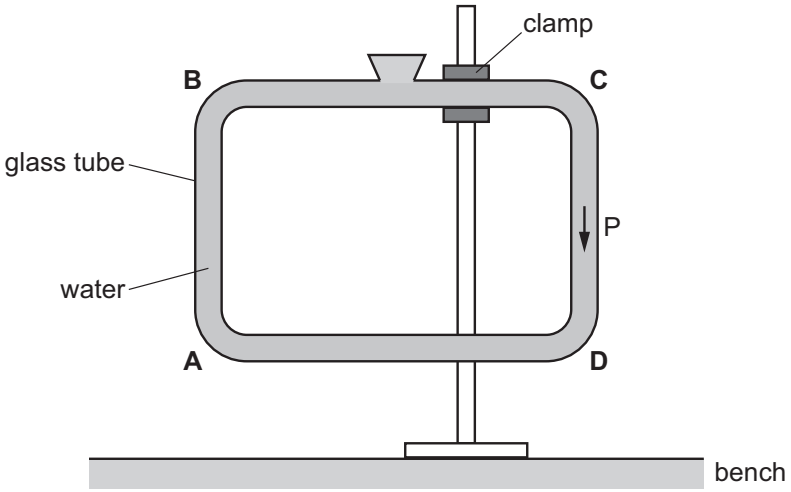
D Molecules are free to move randomly through the solids.

5054/11/O/N/18/Q17

40 The diagram shows a glass tube filled with water and suspended above a bench. The water is free to circulate around the tube.

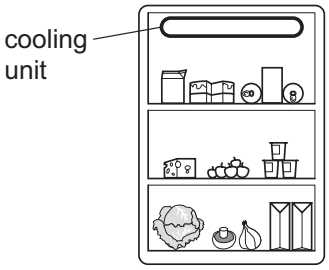
At point P, there is a convection current moving in a downwards direction.

At which point is the tube heated to cause this convection current?



5054/12/O/N/20/Q17

41 The diagram shows the inside of a refrigerator.



When the refrigerator is first switched on, what happens to the air near the cooling unit?

	the molecules of this air	the density of this air
A	become smaller	decreases
B	become smaller	increases
C	move closer together	decreases
D	move closer together	increases

5054/11/O/N/21/Q12

42 What is the colour and what is the texture of a good absorber of infrared radiation?

A black and shiny

B black and dull

C white and shiny

D white and dull

5054/12/O/N/21/Q15