Topic 9 Transfer of Thermal Energy

PAPER 1

MULTIPLE-CHOICE QUESTIONS

For each question, there are four possible answers. Choose the one you consider correct and record your choice (A, B, C or D) in the brackets provided.

1. A thin plastic blanket, with a shiny metallic surface, is wrapped around a walker who has collapsed after a steep climb.

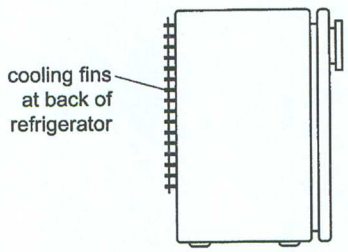
   Which type of heat loss is the shiny surface intended to reduce? (2011/P1/Q10)

   A conduction
   B convection
   C evaporation
   D radiation ( )

2. Objects are sometimes painted black to assist heat loss by (2012/P1/Q12)

   A conduction.
   B convection.
   C evaporation.
   D radiation. ( )

3. This diagram shows part of a refrigerator.

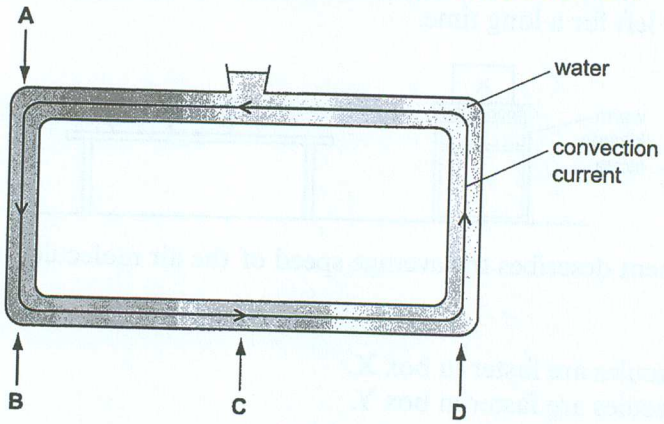


   The cooling fins are painted black because black surfaces are (2013/P1/Q10)

   A good absorbers of heat.
   B poor absorbers of heat.
   C good emitters of heat.
   D poor emitters of heat. ( )

4. The diagram shows a convection current produced when water in a container is heated.

Where is the container heated to produce the convection current? (2014/P1/Q11)



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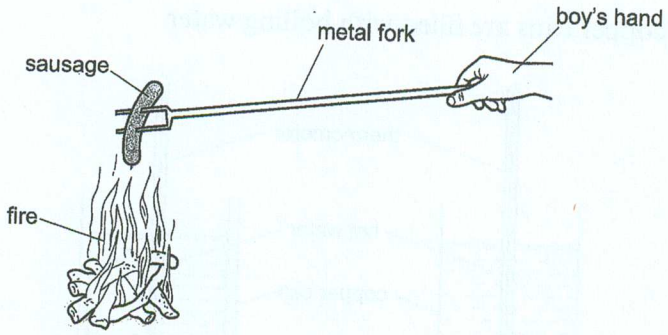
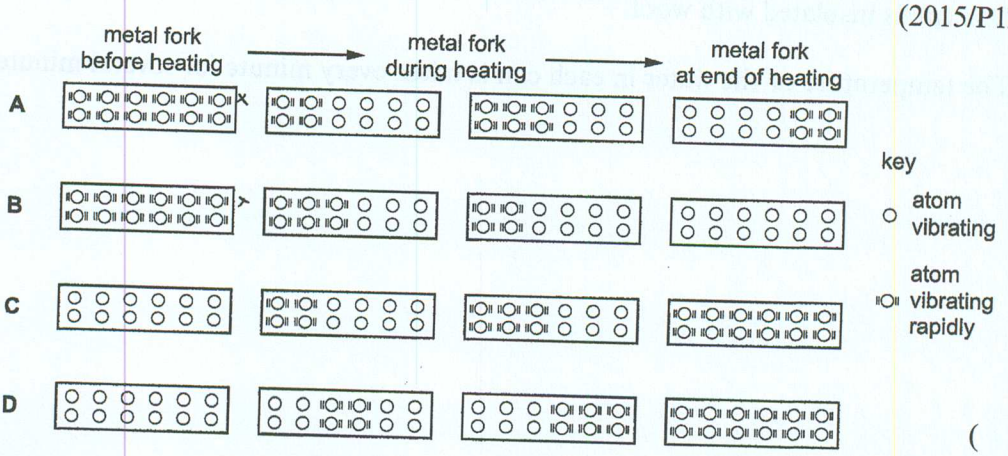
5. A boy cooks a sausage on a metal fork. He holds the sausage and the fork in a fire.



Within a short time, the fork is too hot to hold.

Which set of diagrams represents how heat is conducted to the boy's hand?
(2015/P1/Q12)



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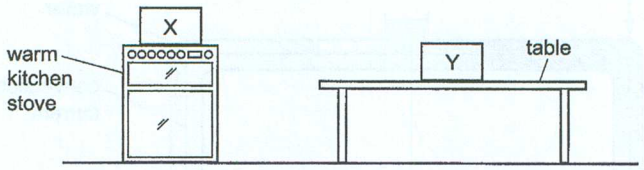
6. Two metal boxes X and Y contain air.

Box X is on top of a warm kitchen stove that is turned on. Box Y is on a table.

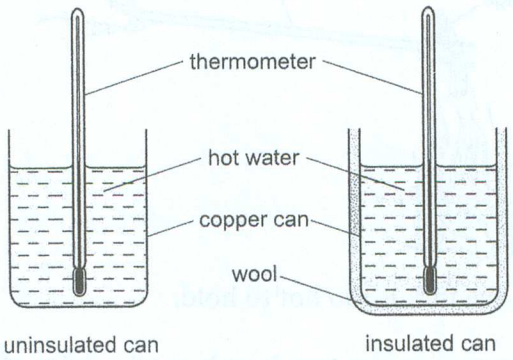
The boxes are left for a long time.



Which statement describes the average speed of the air molecules in the boxes?
(2016/P1/Q11)

A The molecules are faster in box X.
B The molecules are faster in box Y.
C The molecules in box Y are not moving.
D The molecules in the boxes are moving at the same speed. ( )

7. Two identical copper cans are filled with boiling water.

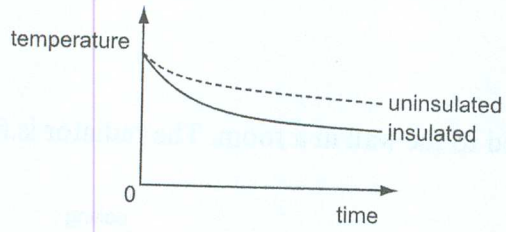


One can is insulated with wool.

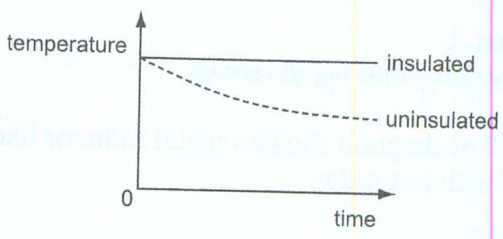
The temperature of the water in each can is taken every minute for several minutes.

Which graph shows the results obtained? (2017/P1/Q12)

A



B



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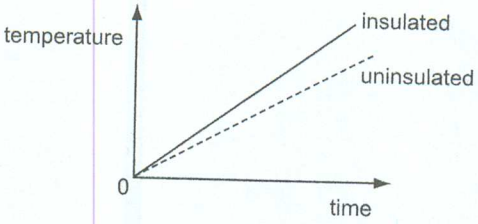
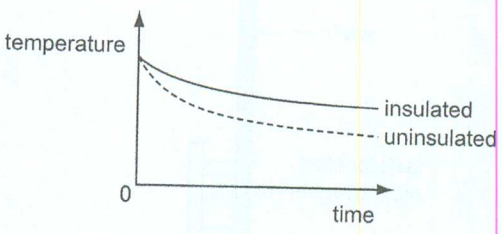


D



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8. A thin plastic blanket, with a shiny metallic surface, is wrapped around a hiker who has collapsed after a steep climb.

Which is the main type of heat loss that the **shiny surface** is designed to reduce? (2018/P1/Q12)

A conduction
B convection
C evaporation
D radiation

( )

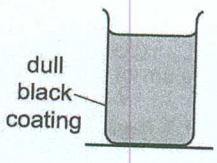
9. Four identical copper containers are coated and set up as shown in the diagrams.

They have equal volumes of water at 80°C.

They are left in a room which is at 20°C.

After five minutes, which container will have the coolest water? (2019/P1/Q11)

A



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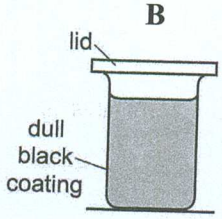

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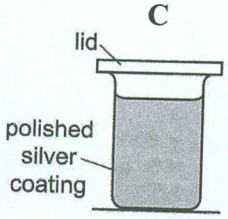

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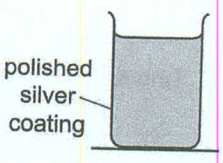

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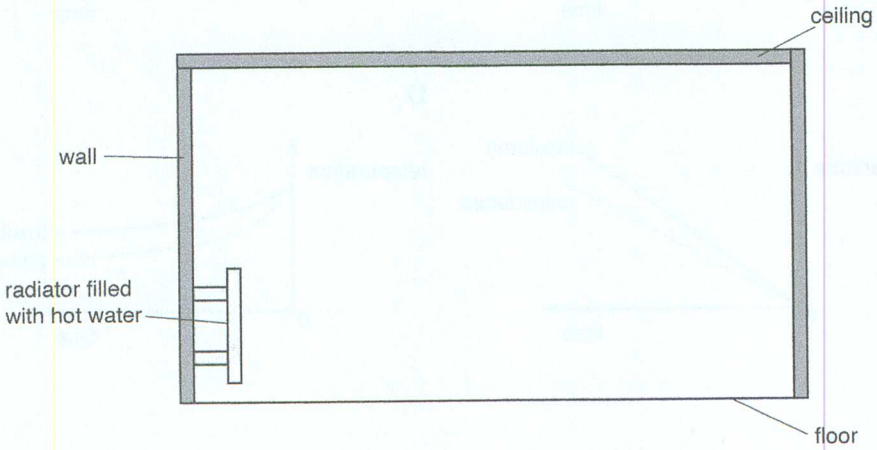
PAPER 2

STRUCTURED QUESTIONS

Section A

Answer the following questions.

1. The diagram shows a metal radiator fixed to the wall in a room. The radiator is filled with hot water.



(a) Name the main process by which heat travels through the metal of the radiator.[1]

(b) Air in the room is heated by the radiator.

(i) Name the process by which this heated air eventually warms the rest of the room. [1]

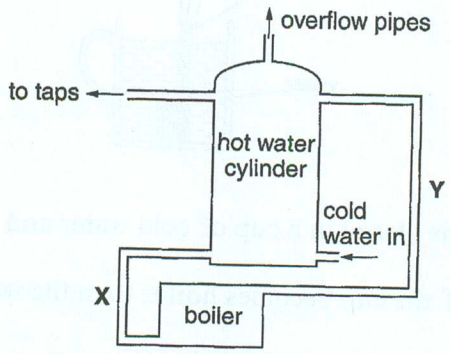
(ii) Explain how this process works. You can use the space inside the diagram of the room to help you answer the question. [2]

(2017/P2/A4)

Section B

Answer the following questions.

1. The following diagram shows a simplified domestic hot water system. The boiler heats the water. The hot water then flows, without pumping, to the hot water cylinder.



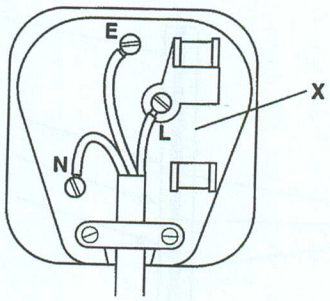
(a) On the diagram, use arrows to show the direction of water flow in pipes **X** and **Y**. [1]

(b) Name the process in (a). [1]

(c) Only one process is involved in the transfer of thermal energy from the Sun to the Earth.
Name this process and give a reason for your answer. [2]

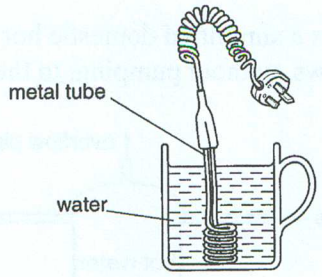
(2012/P2/B5a, c)

2. The diagram shows the wiring of a three-pin mains plug.



The plug is attached to a small electric immersion heater. The heating element of the immersion heater is enclosed inside a metal tube. Thermal energy is generated when an electric current passes through the heating element.

The immersion heater can be used to heat water in a cup as shown.



The immersion heater is placed in a cup of cold water and switched on.

The water at the top of the cup becomes hotter than the water at the bottom.

Name and explain the process by which this occurs.

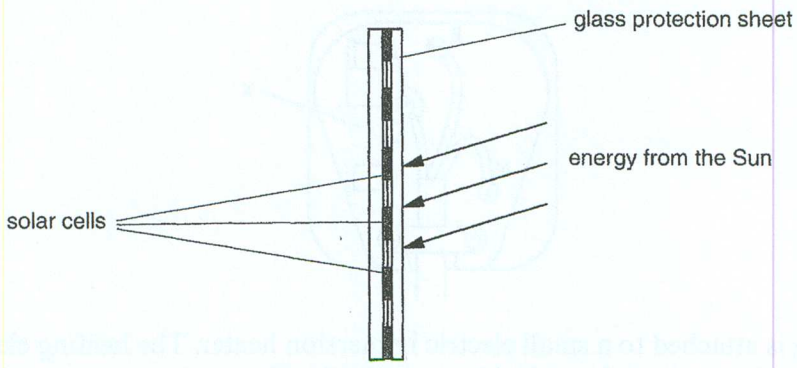
process [1]

explanation [2]

(2013/P2/B5bii)

3. Solar panels are found on many buildings. They convert energy from sunlight into electrical energy.

The diagram shows a simplified side view of a solar panel.

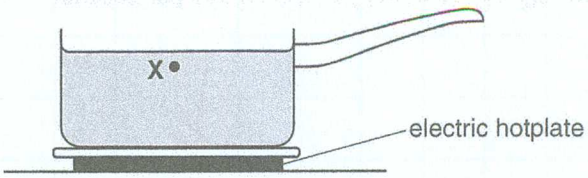


By which process is energy transferred from the Sun to the solar panels?

Give a reason for your answer. [2]

(2015/P2/B7ai)

4. An electric hotplate is used to heat water in a saucepan. The temperature of the water is measured and recorded every minute.



The results obtained are shown in the table.

time / min	0	1	2	3	4	5	6
temp / °C	15	36	50	61	72	80	88

(a) (i) Plot a graph of temperature against time, marking each point with a cross (×). [1]

(ii) Draw a curved line of best fit taking into account all the plotted points. [1]

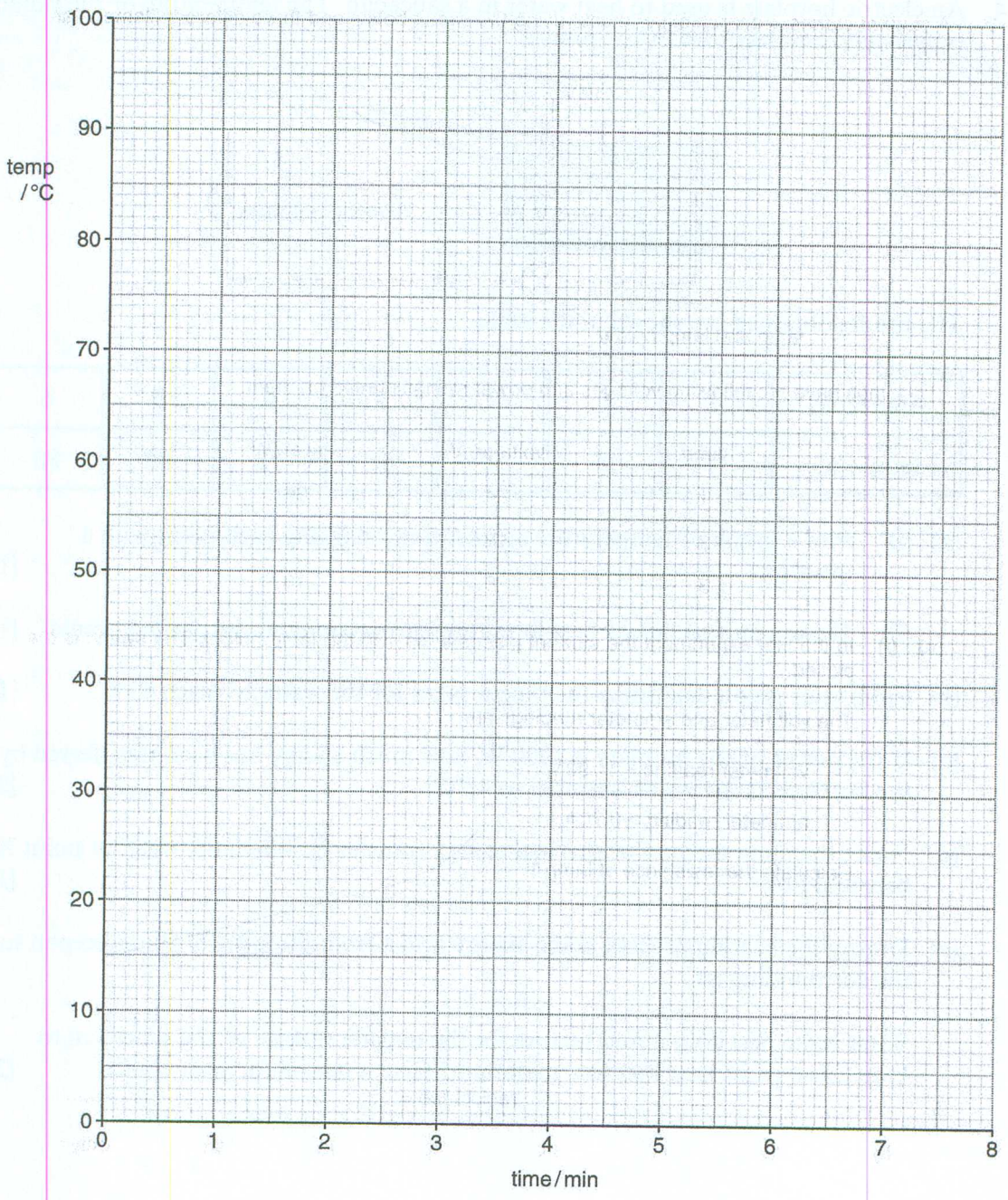
(b) From your graph determine the time it takes for the water to reach 45°C. [1]

(c) If the power of the hotplate is 1000 W, how much energy has been transferred by the hotplate as the water is heated to 45°C? [2]

(d) Name the main method of thermal energy transfer by which the water at point **X** becomes hot. [1]

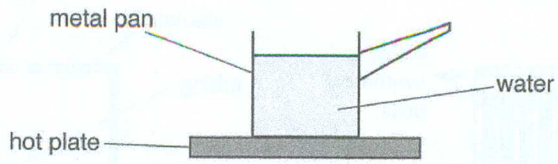
(e) During the heating process, some energy is lost from the sides of the saucepan to the surrounding air.

What is the best colour and texture for the outside surface of the saucepan to keep this type of heat loss to a minimum? Give a reason for your choice. [2]



(2016/P2/B6)

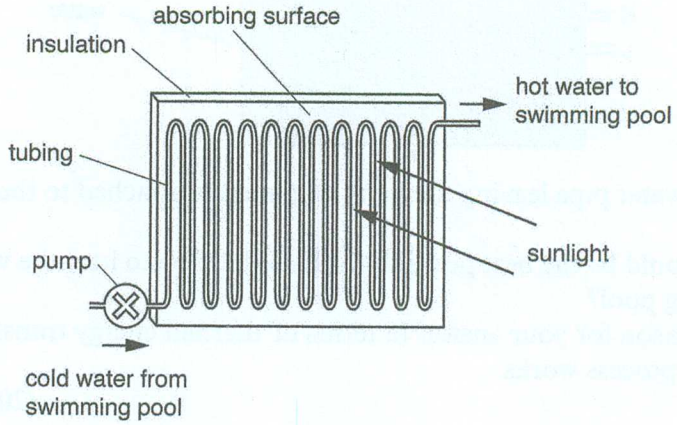
5. The diagram shows a metal pan containing water standing on a hot plate.



Explain how the processes of conduction and convection are involved in heating the water in the metal pan. [2]
(2018/P2/B6d)

6. Water in a swimming pool is heated by solar powered pool heater panels.

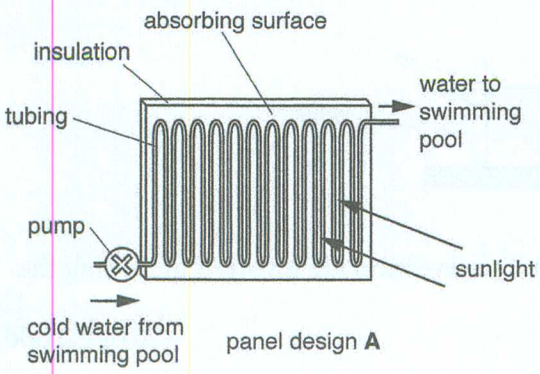
The structure of one of the panels is shown.

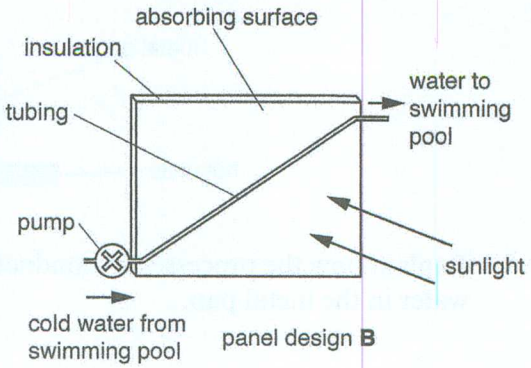


(a) Name the method of thermal energy transfer that takes place between the sun and the panel. [1]

(b) State the colour that the absorbing surface should be painted. Explain your choice of colour. [1]

(c) Explain why panel design A is used rather than panel design B. [1]





(d) The diagram shows the side view of the swimming pool with four possible inlet pipe positions K, L, M and N.

The hot water pipe leaving the bank of panels is attached to the inlet pipe.

Which would be the best position for the inlet pipe to heat the water in the swimming pool?
Give a reason for your answer in terms of thermal energy transfer and explain how this process works. [2]

(2019/P2/B6a, b, c, d)