

O Level Combined Physics Structured

Thermal Transfer Test 2.0

Q1

- (a) Delivery bags are designed to ensure food that is delivered remain hot. Fig.10.1 shows a delivery bag.

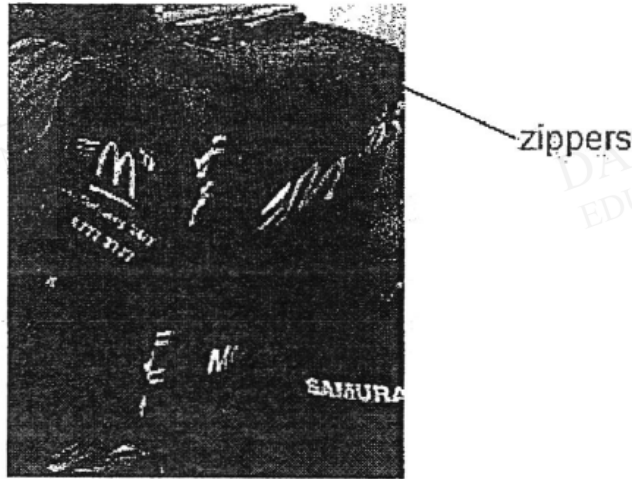


Fig. 10.1

The delivery bag has thick polyester (foam) insulation to ensure maximum thermal retention. In addition, heavy duty zippers provide a secure closure.

- (i) Describe and explain how the polyester (foam) insulation prevents heat loss.

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.....
.....[2]

- (ii) Explain how the zippers prevent heat loss.

.....
.....[1]

- (iii) What colour should the inner surface of the bag be? Explain your answer.

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.....
.....[1]

- (iv) When the food is placed in a vacuum bag, heat can still be transferred to its surroundings. State the main method of heat transfer in this scenario.

.....[1]

- (b) Fig. 10.2 shows the inside of an oven.

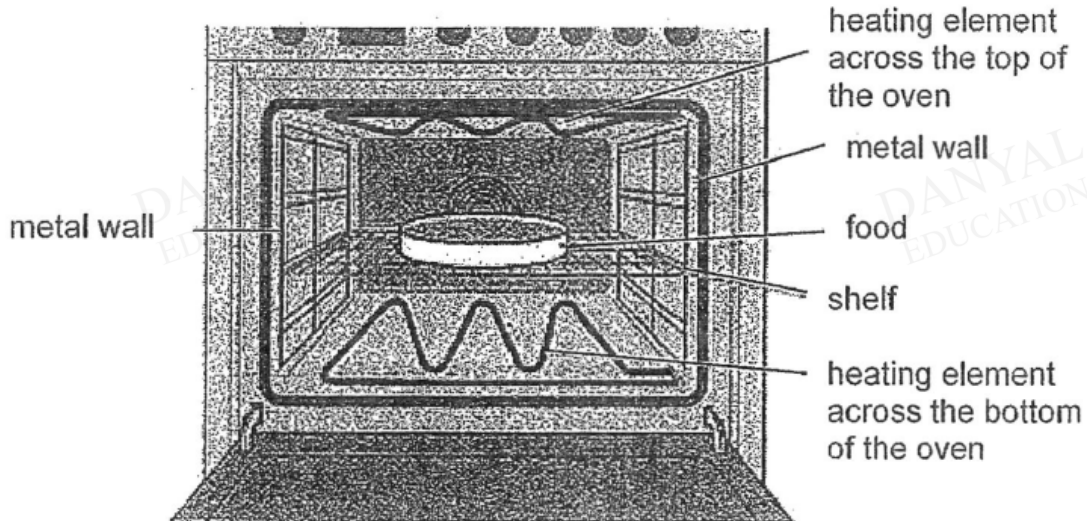


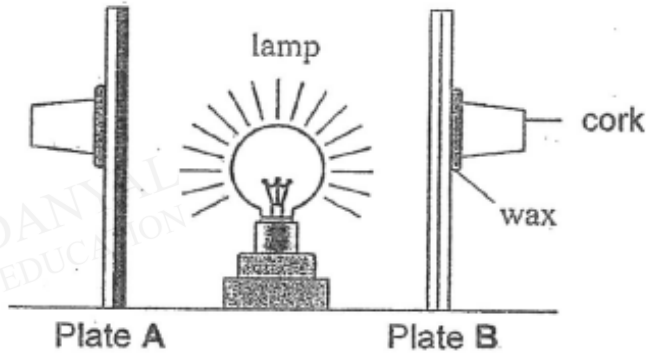
Fig 10.2

Explain how thermal energy is transferred from the heating element to the food being cooked

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.....[3]

Q2

The figure shows two identical metal plates of the same size placed at equidistance away from filament lamp. Plate A is painted dull black on the side facing the lamp while plate B is painted silver. Two identical corks are struck to the plates with some candle wax.



(i) Why do the plates heat up?

.....
..... [2]

(ii) Which cork will drop first? Explain.

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..... [3]

Q3

Fig. 12.1 shows an electric kettle connected to the 230 V mains supply.

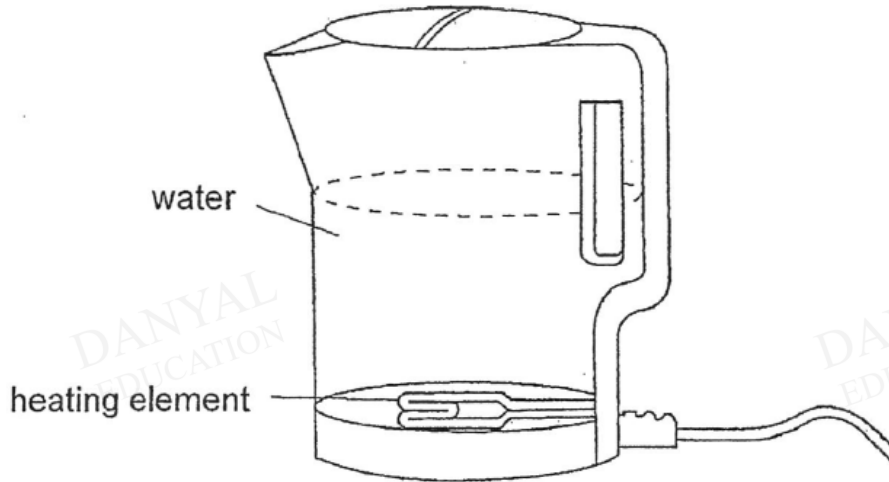


Fig 12.1

- a) The water is heated up via convection in the kettle.
Explain how the convection current is formed within the water.

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..... [2]

- b) The kettle body is made of white coloured plastic.
Explain how this design helps to reduce heat loss to the surroundings.

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..... [2]

Q4

In Terminal 3 of Singapore Changi Airport, outlets for cold air were observed to be positioned at a height 6 metres above ground as shown in Fig. 5 to bring about convection current in the terminal.

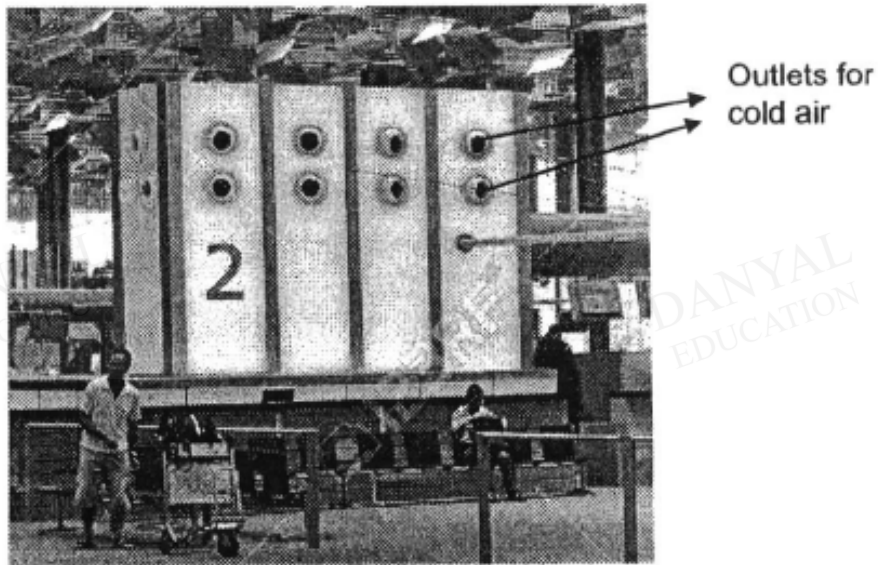


Fig. 5

(a) What is convection current? [1]

.....
.....

(b) State 2 reasons why the outlet for cold air was positioned 2 metres above the human height. [2]

.....
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(c) Suggest, with reason, one feature that could be found in the roof that could help to cool down the terminal faster on a sunny day. [2]

.....
.....

Q5

Fig. 3.1 shows a cylinder filled with water. The bottom of the cylinder rests on a block of ice at $0\text{ }^{\circ}\text{C}$.

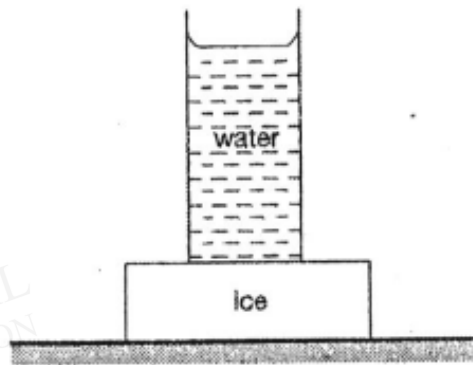


Fig. 3.1

Assume that the cylinder has been in place for a long time, and the room temperature is steady at about $30\text{ }^{\circ}\text{C}$.

- (a) Name the main process of heat transfer between the water and the ice and state the direction with which heat transfer is occurring.

.....
..... [2]

- (b) Explain why the temperature of the water near the top of the cylinder remains at about $30\text{ }^{\circ}\text{C}$.

.....
.....
..... [2]

Answers

Thermal Transfer Test 2.0

Q1

(ai)	polyester contains air which are poor conductors of thermal energy	[B1] [B1]
(aii)	prevents air from escaping, hence reducing heat loss due to convection	[B1]
(aiii)	shiny white poor absorber of radiant heat	[B1] [B1]
(aiv)	Radiation	[B1]
(b)	air near the bottom element heats up and rises, cooler air near the food sinks forming convection current Radiation from both the top and bottom element	[B1] [B1] [B1] [B1]

Q2

(i)	Heat travels from the lamp to the plate by radiation The plate absorbed the radiation and cause the atoms to vibrate more vigorously and the temperature increased as a result.	1 1
(ii)	Cork on plate A. Black surface is a better absorber of thermal energy. Hence temperature of plate A will increase more rapidly causing the wax to melt faster.	1 1 1

Q3

a	Water at the bottom is heated up by the heating element. The less dense hot water [0.5] rises up [0.5] while the denser cool water [0.5] at the top moves down [0.5]. The process continues and form a convection current.	
b	White colour is a poor emitter of heat so it reduces heat loss via radiation. Plastic is a poor conductor of heat so it reduces heat loss via conduction.	A1 A1

Q4

In Terminal 3 of Singapore Changi Airport, outlets for cold air were observed to be positioned at a height 6 metres above ground as shown in Fig. 5 to bring about convection current in the terminal.

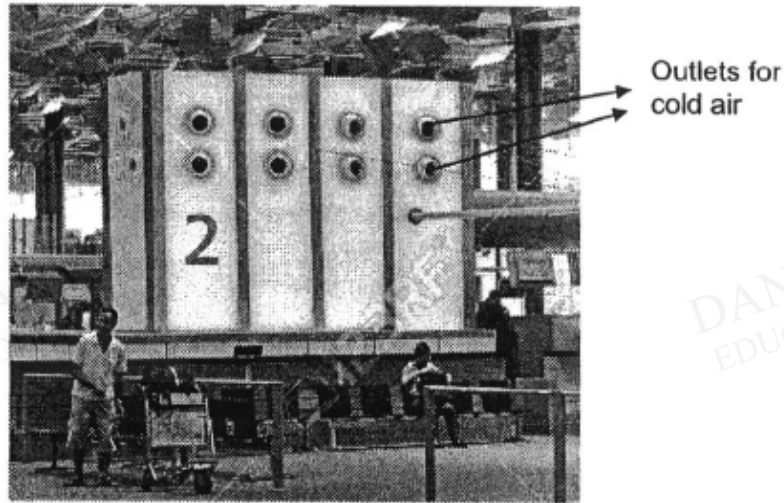


Fig. 5

- (a) What is convection current? [1]
It is the movement of fluid due to a change in density [1] of fluid.

.....
.....

- (b) State 2 reasons why the outlet for cold air was positioned 2 metres above the human height. [2]
To save cost as instead of cooling down the whole terminal it only cools down at

.....
The height where passengers are.

.....
To bring about a convection current as cold air sinks and hot air rises.
.....

- (c) Suggest, with reason, one feature that could be found in the roof that could help to cool down the terminal faster on a sunny day. [2]

By having a shiny [1] exterior roof to reflect the heat [1] OR

.....
By having a smooth [1] exterior roof to reflect the heat [1]
.....

Q5

- (a) Name the main process of heat transfer between the water and the ice and state the direction which heat transfer is occurring.

The main process is conduction and the direction is downwards

.....
..... [2]

- (b) Explain why the temperature of the water near the top of the cylinder remains at about 30 °C.

Cold water sinks, and warmer water rises to the top, hence warm water remains on top while cold water remains at the bottom no convection current is set up.

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..... [2]

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