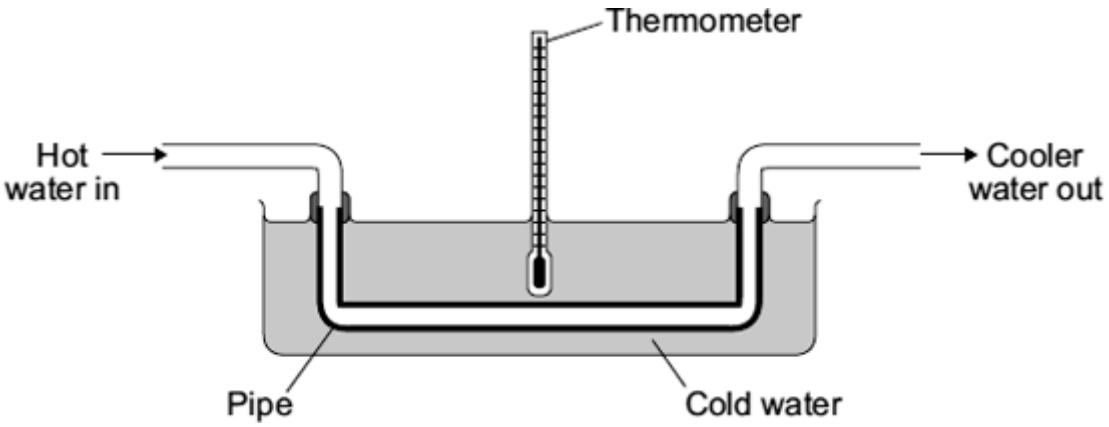
Name of the Student:_____
Max. Marks : 18 Marks **Time : 18 Minutes**

Q1.

Heat exchangers are devices that are used to transfer heat from one place to another.

The diagram shows a simple heat exchanger used by a student in an investigation.
Heat is transferred from the hot water inside the pipe to the cold water outside the pipe.



(a) By which process is heat transferred from the hot water inside the pipe to the cold water outside the pipe?

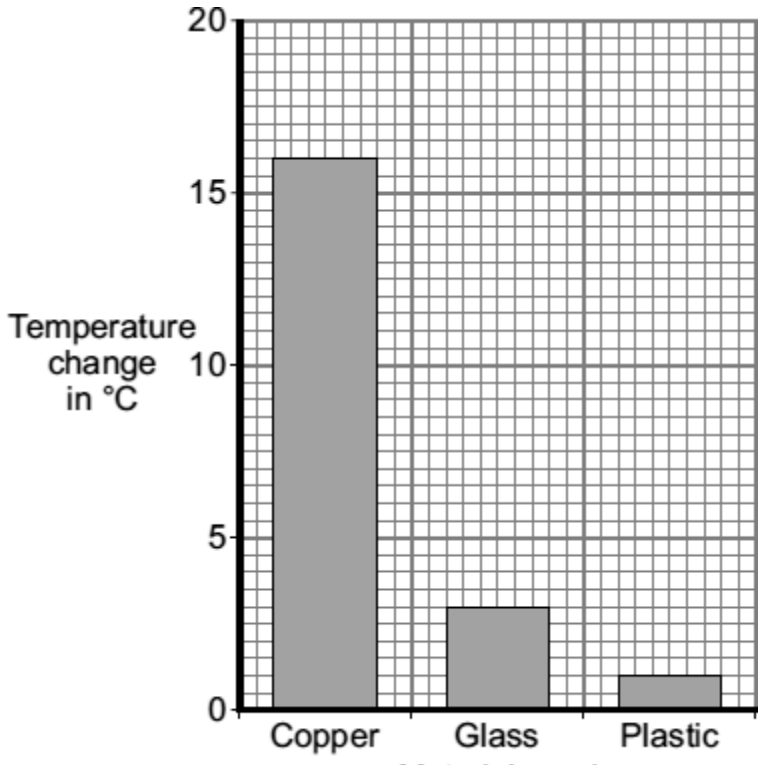
_____

(1)

(b) The student wanted to find out if the efficiency of a heat exchanger depends on the material used to make the pipe. The student tested three different materials. For each material, the rate of flow of hot water through the pipe was kept the same.

The results obtained by the student are recorded in the table and displayed in the bar chart.

Material	**Temperature of the cold water at the start in °C**	**Temperature of the cold water after 10 minutes in °C**
Copper	20	36
Glass	20	23
Plastic	20	21



(i) The rate of flow of hot water through the pipe was one of the control variables in the investigation.

Give **one** other control variable in the investigation.

_____

(1)

(ii) Why did the student draw a bar chart rather than a line graph?

_____

_____

(1)

(iii) Which **one** of the three materials made the best heat exchanger?

_____

Give a reason for your answer.

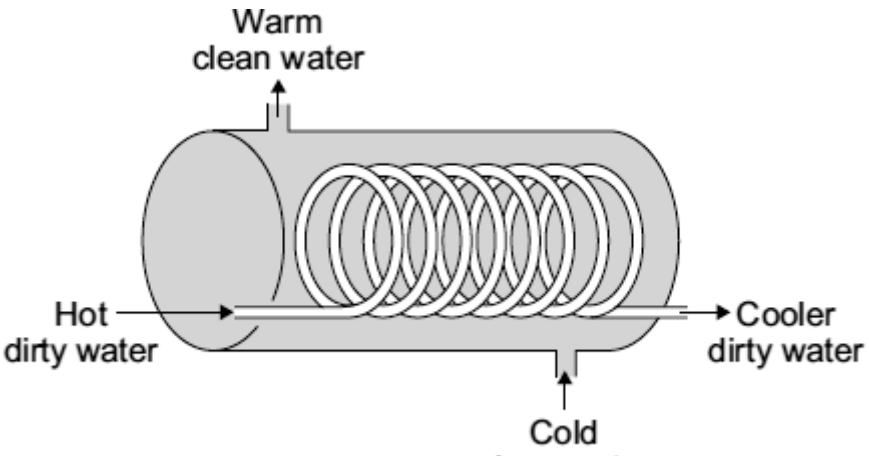
_____

_____

_____

(2)

(c) The student finds a picture of a heat exchanger used in an industrial laundry.
The heat exchanger uses hot, dirty water to warm cold, clean water.



Why does this heat exchanger transfer heat faster than the heat exchanger used by the student in the investigation?

_____

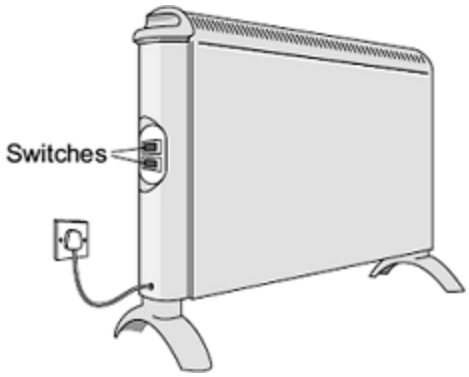
_____

(1)

(Total 6 marks)

Q2.

(a) The diagram shows two switches on a room heater. The heater has three power settings. The power produced by two of the settings is given in the table.



Setting	Power in watts
Low	700
Medium	1400
High	

(i) When both switches are on, the heater works at the high power setting.

What is the power of the heater, in kilowatts, when it is switched to the **high** power setting?

_____

Power = _____ kilowatts

(1)

(ii) The heater is used on the **high** power setting. It is switched on for 1½ hours.

Calculate the energy transferred from the mains to the heater in 1½ hours.

Show clearly how you work out your answer and give the unit.

_____

_____

_____

Energy transferred = _____

(3)

(iii) This type of heater is a very efficient device.

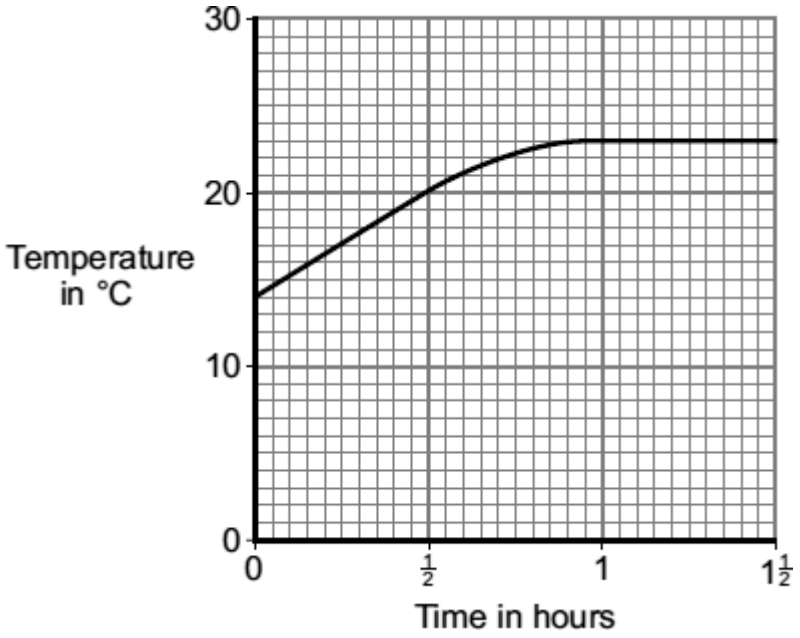
What is meant by a device being very efficient?

_____

_____

(1)

(b) The graph shows how the temperature of a room changes during the 1½ hours that the heater is used.



After 1 hour, the temperature of the room has become constant, even though the heater is still switched on.

Explain why.

_____

_____

_____

_____

(2)

(Total 7 marks)

Q3.

(a) In winter, energy is transferred from the warm air inside a house to the air outside.

(i) What effect will the energy transferred from the house have on the air outside?

_____

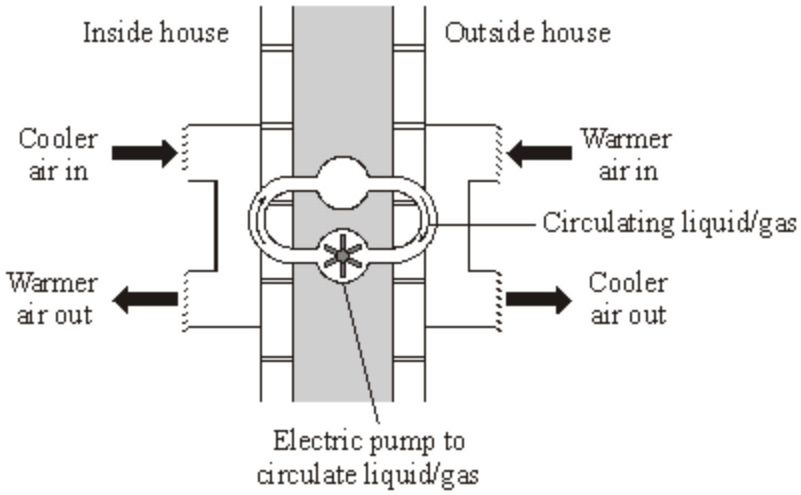
(1)

(ii) What would happen to the energy transfer if the temperature inside the house were reduced? Assume the temperature outside the house does not change.

_____

(1)

(b) To increase energy efficiency, a householder installs a heat exchanger to an outside wall of the house. The heat exchanger uses heat from the air outside to warm the inside of the house. The diagram shows the idea of the heat exchanger.



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(i) Why does the heat exchanger cost money to run?

_____

(1)

(ii) The heat exchanger is cost effective in reducing energy consumption. Explain why.

_____

_____

_____

_____

(2)

(Total 5 marks)