**Name of the Student**:_____
**Max. Marks : 20 Marks** **Time : 20 Minutes**

## Q1.

A wood burning stove is used to heat a room.

Photograph supplied by iStockphoto/Thinkstock

The fire in the stove uses wood as a fuel. The fire heats the matt black metal case of the stove.

(a) The air next to the stove is warmed by infrared radiation.

How does the design of the stove help to improve the rate of energy transfer by infrared radiation?

_____

_____

_____

_____

**(2)**

(b) Burning 1 kg of wood transfers 15 MJ of energy to the stove. The stove then transfers 13.5 MJ of energy to the room.

Calculate the efficiency of the stove.

Show clearly how you work out your answer.

_____

_____

_____

Efficiency = _____

**(2)**

(c) Some of the energy from the burning wood is wasted as the hot gases leave the chimney and warm the air outside the house.

Name **one** other way energy is wasted by the stove.

_____

**(1)**

(d) Some people heat their homes using electric heaters. Other people heat their homes using a wood burning stove.

Give **two** environmental advantages of using a wood burning stove to heat a home rather than heaters that use electricity generated from fossil fuels.

1. _____

_____

2. _____

_____

**(2)**

(e) The metal case of the stove gets hot when the fire is lit.

Here is some information about the stove.

| | |
|---|---|
| Mass of metal case | 100 kg |
| Starting temperature of metal case | 20 °C |
| Final temperature of metal case | 70 °C |
| Specific heat capacity of metal case | 510 J/kg °C |

Calculate the energy required to raise the temperature of the metal case to 70 °C.

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

_____

_____

_____

_____

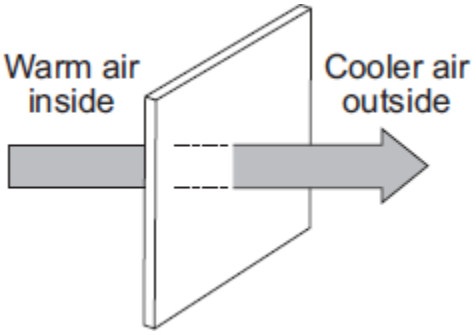
Energy required = _____

**(3)**

**(Total 10 marks)**

## Q2.

The diagram shows the direction of heat transfer through a single-glazed window.




(a) (i) Name the process by which heat is transferred **through** the glass.

_____

**(1)**

(ii) Explain how heat is transferred **through** the glass.

_____

_____

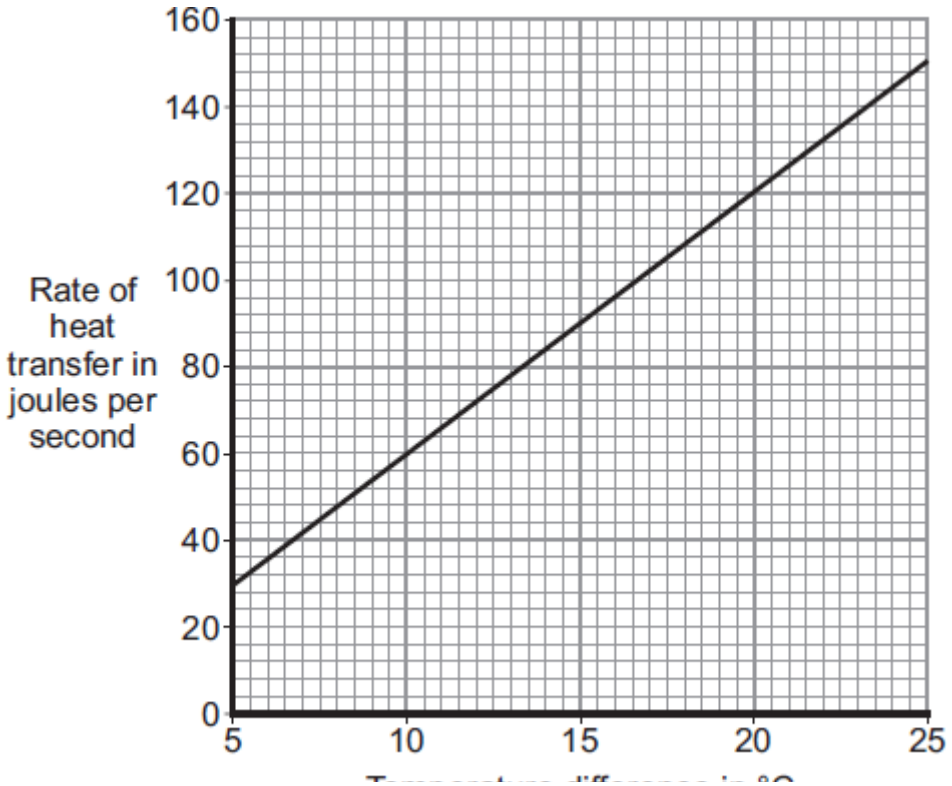
_____

_____

**(2)**

(b) The rate of heat transfer through a window depends on the difference between the inside and outside temperatures.

The graph shows the rate of heat transfer through a 1 $m^2$ single-glazed window for a range of temperature differences.




(i) What is the range of temperature differences shown in the graph?

From _____ to _____

**(1)**

(ii) A student looks at the graph and concludes:

'Doubling the temperature difference doubles the rate of heat transfer.'

Use data from the graph to justify the student's conclusion.

_____

_____

_____

_____

**(2)**

(iii) A house has single-glazed windows. The total area of the windows in the house is 15 $m^2$.

On one particular day, the difference between the inside and outside temperatures is 20 °C.

Use the graph to calculate the total rate of heat transfer through all of the windows on this particular day.

Show clearly how you work out your answer.

_____

_____

_____

Rate of heat transfer = _____ J/s

**(2)**

(c) A homeowner plans to replace the single-glazed windows in his home with double-glazed windows. He knows that double-glazed windows will reduce his annual energy bills.

The table gives information about the double glazing to be installed by the homeowner.

| **Cost to buy and install** | **Estimated yearly savings on energy bills** | **Estimated lifetime of the double-glazed windows** |
|---|---|---|
| £5280 | £160 | 30 years |

Explain, in terms of energy savings, why replacing the single-glazed windows with these double-glazed windows is not cost effective.

To gain full marks you must complete a calculation.

_____

_____

_____

_____

**(2)**

**(Total 10 marks)**