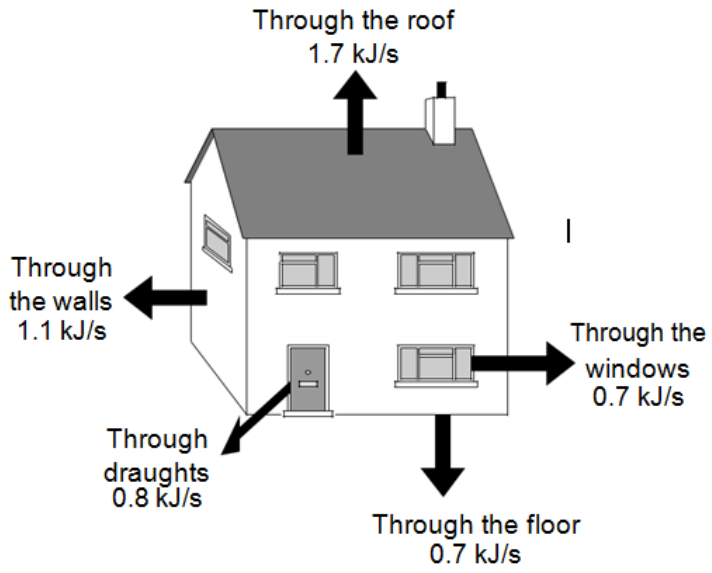
Effeciency and Reducing Unwanted Energy transfers 2

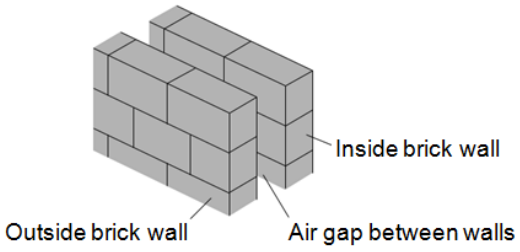
Q:1 Diagram 1 shows the energy transferred per second from a badly insulated house on a cold day in winter.



a) Diagram 2 shows how the walls of the house are constructed.

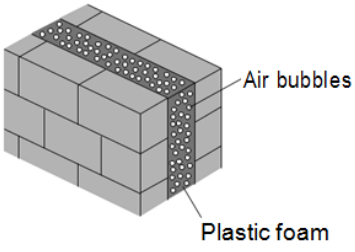
Diagram 3 shows how the insulation of the house could be improved by filling the air gap between the two brick walls with plastic foam.

Diagram 2



U-value of the wall = 0.7

Diagram 3



U-value of the wall = 0.3

The plastic foam reduces energy transfer by convection.Explain why.

_____

_____

_____

_____

(2 marks)

(b) A homeowner has part of the outside wall of her house removed and replaced with double-glazed glass doors.

U-value of the wall = 0.3

U-value of glass doors = 1.8

Explain the effect of replacing part of the outside wall with glass doors on the rate of energy transfer from the house.

_____

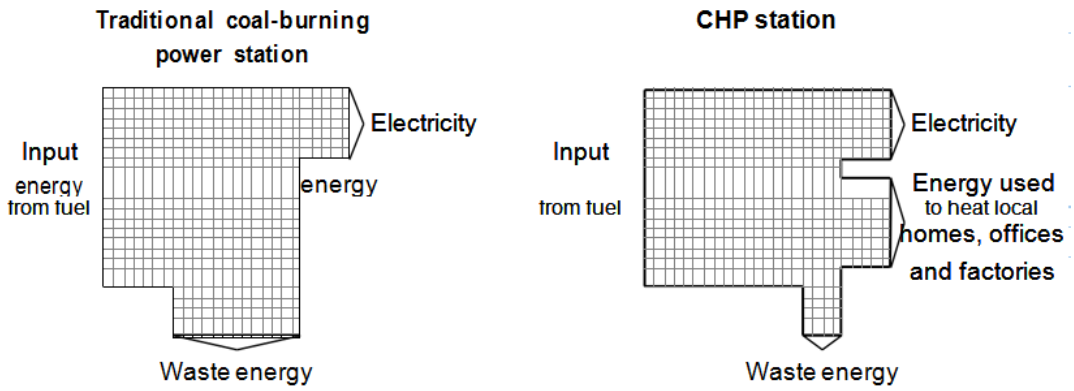
_____

_____

_____

(2 marks)

Q:2 The Sankey diagrams show the energy transfers in a traditional coal-burning power station and a combined heat and power (CHP) station.



(a) What effect does the waste energy from a power station have on the surroundings?

_____

_____

(1 mark)

(b) Calculate the efficiency of the CHP station.

Use the correct equation from the Physics Equations Sheet.

_____

_____

_____

Efficiency = _____

(2 marks)

(c) Why is a CHP station more efficient than a traditional coal-burning power station?

_____

_____

_____

(2 marks)

(d) A CHP station is usually used to meet the demand for electricity within the local area.

The electricity is not transmitted and distributed through the National Grid.

(d) (i) What is the National Grid?

Tick (☒) one box.

A system of cables and pylons. ☐

A system of cables and transformers. ☐

A system of cables, transformers and power stations. ☐

(1 mark)

(d) (ii) Using the electricity locally and not transmitting it through the National Grid increases the overall efficiency of a CHP station by 7%.

Give one reason why.

_____

_____

(1 mark)

Q:3 The Sankey diagram shows energy transfers in a petrol engine.

$$\text{efficiency} = \frac{\text{useful energy transferred by the device}}{\text{total energy supplied to the device}}$$

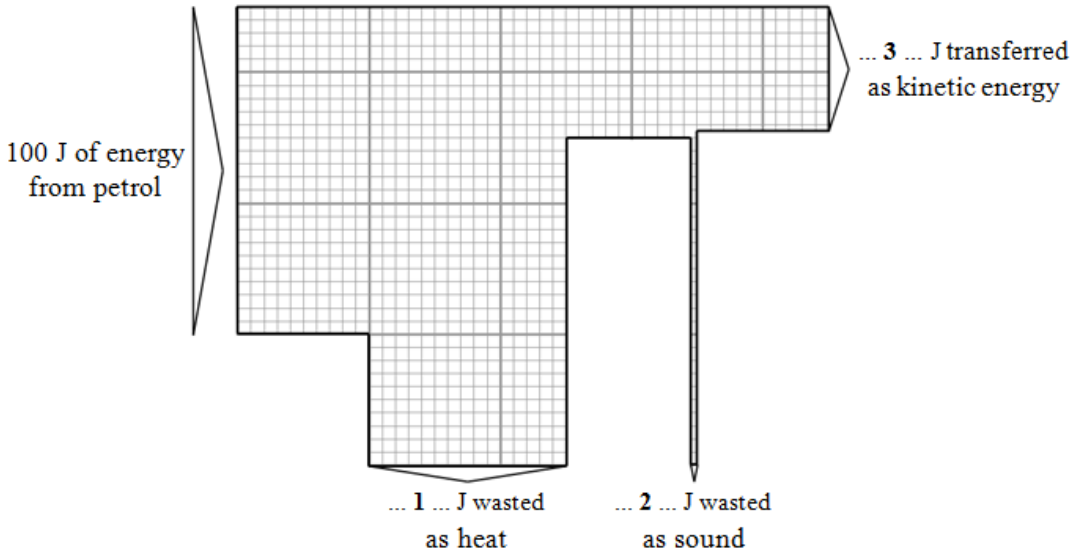
Match numbers, A, B, C and D, with the spaces 1– 4 on the diagram.

A 0.38

B 2

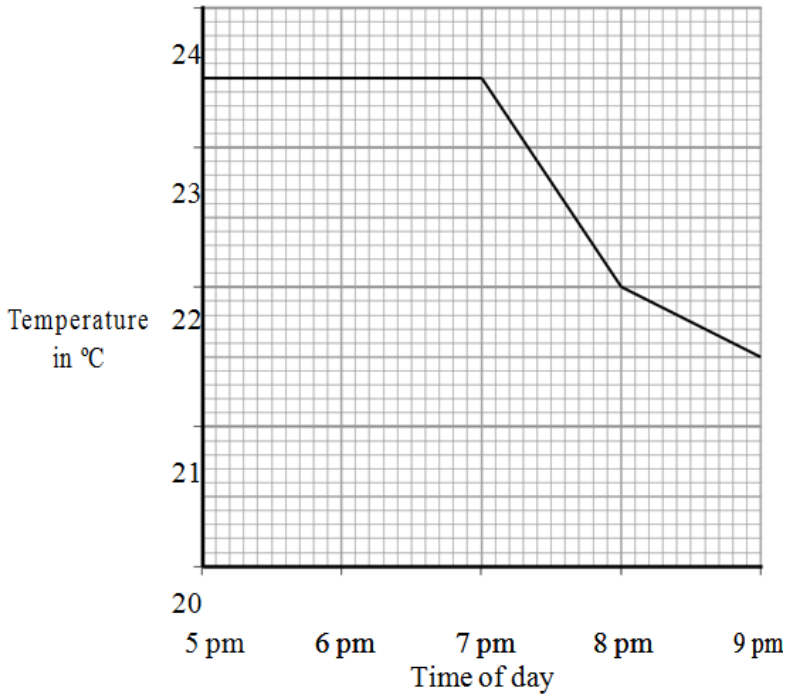
C 38

D 60



The efficiency of the engine is ... **4** ... .

Q:4 **(a)** The graph shows the temperature inside a flat between 5 pm and 9 pm. The central heating was on at 5 pm.



(i) What time did the central heating switch off?

_____

(1 mark)

(ii) Closing the curtains reduces heat loss from the flat. What time do you think the curtains were closed?

_____

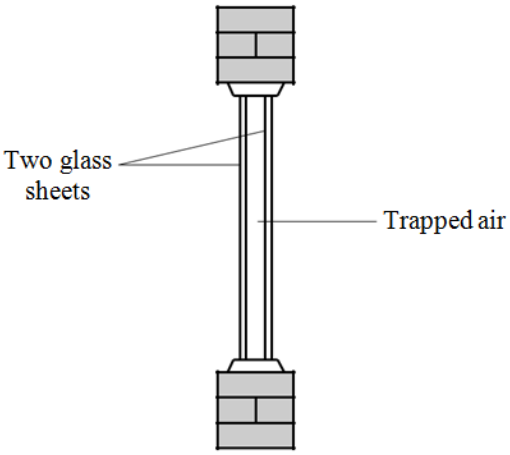
Give a reason for your answer.

_____

_____

(2 marks)

(b) Less heat is lost through double-glazed windows than through single-glazed windows.



A double-glazed window

Complete the following sentences by choosing the correct words from the box.Each word may be used once or not at all.

Conduction	conductor	convection	evaporation	insulator	radiation

Air is a good _____ When trapped between two sheets of glass it

reduces heat loss by _____ and _____

(3 marks)

(ii) Explain why people often install loft insulation before installing double glazing or cavity wall insulation.

_____

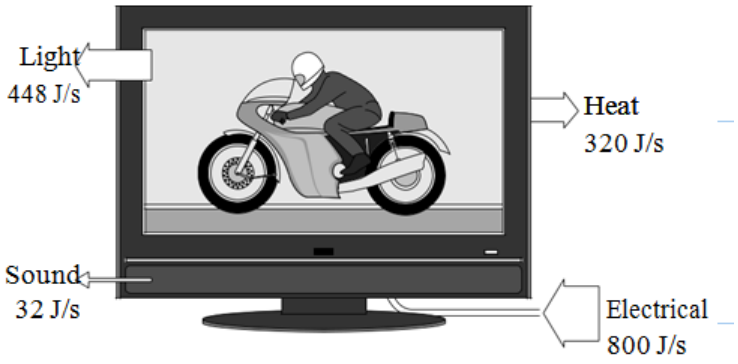
_____

_____

_____

(2 marks)

Q:5(a) The diagram shows the energy transformations produced by a TV.



(a) (i) Use the information in the diagram and the equation in the box to calculate the efficiency of the TV.

$$\text{efficiency} = \frac{\text{useful energy transferred by the device}}{\text{total energy supplied to the device}}$$

Show clearly how you work out your answer.

_____

_____

Efficiency = _____

(2 marks)

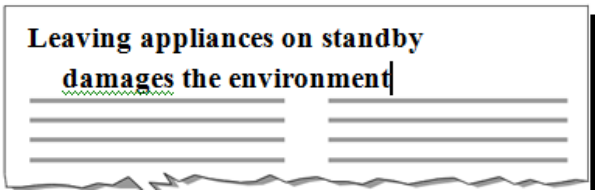
(a) (ii) What eventually happens to the useful energy transferred by the TV?

_____

_____

(1 mark)

(b) A headline from a recent newspaper article is shown below.



Explain why leaving appliances on standby damages the environment.

_____

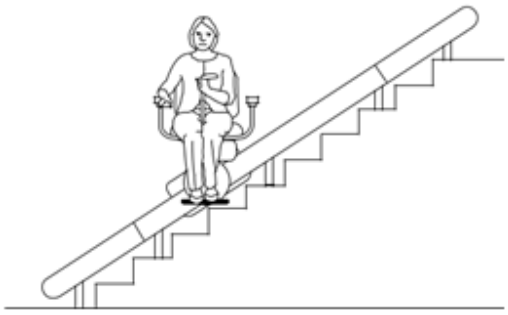
_____

_____

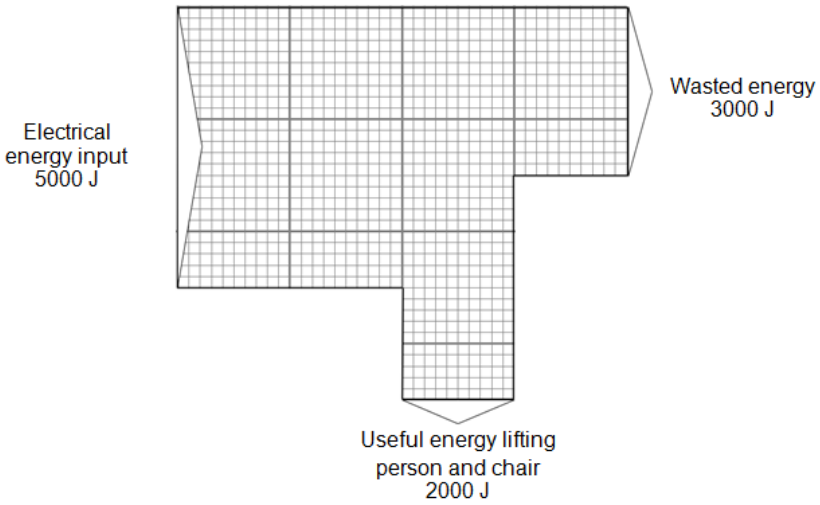
_____

(2 marks)

Q:6 A person uses a stairlift to go upstairs. The stairlift is powered by an electric motor.



The Sankey diagram shows the energy transfers for the electric motor.



(a) Complete the following sentence.

The electric motor wastes energy as _____ energy.

(1 mark)

(b) Use the equation in the box to calculate the efficiency of the electric motor.

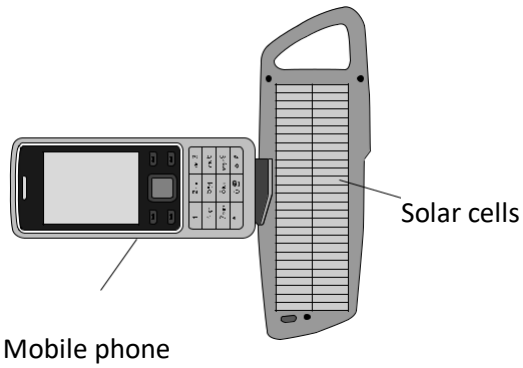
$$\text{efficiency} = \frac{\text{useful energy transferred by the device}}{\text{total energy supplied to the device}}$$

Show clearly how you work out your answer.

Efficiency = _____

(2 marks)

Q:7(a) The diagram shows a solar powered device being used to recharge a mobile phone.



On average, the solar cells produce 0.6 joules of electrical energy each second.

The solar cells have an efficiency of 0.15.

(a) (i) Use the following equation to calculate the average energy input each second to the device.

$$\text{efficiency} = \frac{\text{useful energy transferred by the device}}{\text{total energy supplied to the device}}$$

Show clearly how you work out your answer.

Average energy input each second =_____ J/s (2 marks)

(a) (ii) Draw a labelled Sankey diagram for the solar cells.The diagram does not need to be drawn to scale.

(1 mark)

(a) (iii) Energy from the Sun is stored by a rechargeable battery inside the device. Suggest one factor that would affect the time it takes to fully charge the battery. Give a reason for your answer.

_____

_____

_____

_____

(2 marks)

(b) Scientists have developed a new type of solar cell with an efficiency of over 40 %.

The efficiency of the solar cell was confirmed independently by other scientists.Suggest why it was important to confirm the efficiency independently.

_____

_____

(1 mark)

(c) The electricity used in homes in the UK is normally generated in a fossil fuel power station.

Outline some of the advantages of using solar cells to generate this electricity.

_____

_____

_____

TOTAL MARKS=37 (2 marks)