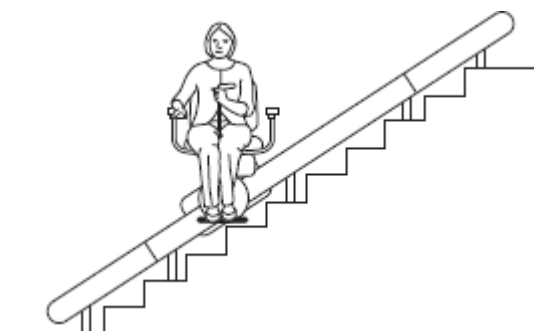
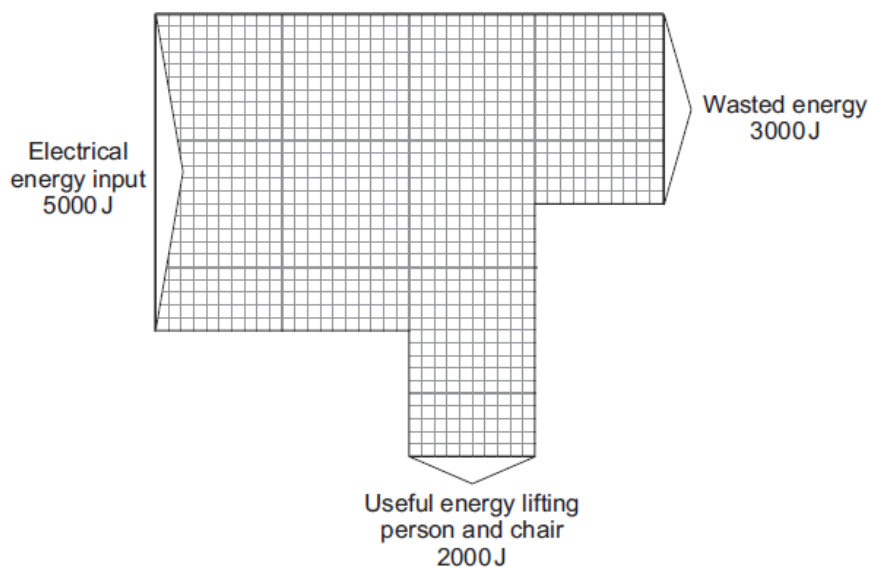


### P3.1 Energy Resources Homework task 1

**Q1.** 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)

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

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

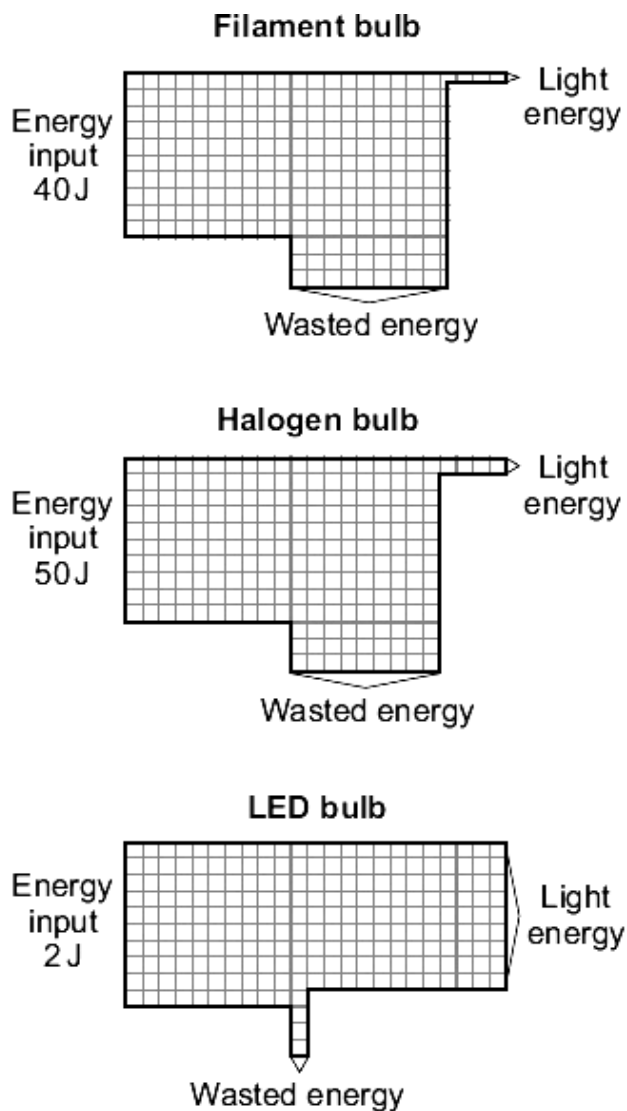
Show clearly how you work out your answer.

\_\_\_\_\_

\_\_\_\_\_ Efficiency = \_\_\_\_\_

(2) (Total 3 marks)

**Q2.** The Sankey diagrams show the energy transferred to the surroundings each second by three different bulbs.



(a) The filament bulb is the least efficient of the three bulbs.

Explain what *least efficient* means.

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(2)

- (b) Calculate the percentage efficiency of the halogen bulb.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

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Efficiency = \_\_\_\_\_%

(2)

- (c) What effect does the wasted energy from a bulb have on the surroundings?

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(1)

- (d) Use the Sankey diagrams to give a reason why the overall cost of using an LED bulb is the lowest of the three bulbs.

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(1)

- (e) The table gives further information about each type of bulb.

Bulb	Cost to buy in £	Average lifespan in hours
Filament	0.50	1000
Halogen	2.00	2500
LED	15.00	25000

Use **only** the information in the table to answer the following questions.

- (i) Which type of bulb is the most cost-effective?

Give a reason for your answer.

Bulb \_\_\_\_\_

Reason \_\_\_\_\_

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(2)

- (ii) Sales of LED bulbs are increasing.

Suggest **one** reason why.

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(1)

(Total 9 marks)

## Higher Tier Questions

### Q3

The table gives data about two types of low energy bulb.

Type of bulb	Power input in watts	Efficiency	Lifetime in hours	Cost of one bulb
Compact Fluorescent Lamp (CFL)	8	20%	10 000	£3.10
Light Emitting Diode (LED)	5		50 000	£29.85

(a) Both types of bulb produce the same useful power output.

(i) Calculate the useful power output of the CFL.

Show clearly how you work out your answer.

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Useful power output = \_\_\_\_\_ W

(2)

(ii) Calculate the efficiency of the LED bulb.

Show clearly how you work out your answer.

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Efficiency = \_\_\_\_\_

(1)

(b) LED bulbs are expensive. This is because of the large number of individual electronic LED chips needed to produce sufficient light from each bulb.

(i) Use the data in the table to evaluate the cost-effectiveness of an LED bulb compared to a CFL.

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(2)

(ii) Scientists are developing brighter and more efficient LED chips than those

currently used in LED bulbs.

Suggest **one** benefit of developing brighter and more efficient LED chips.

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(1)

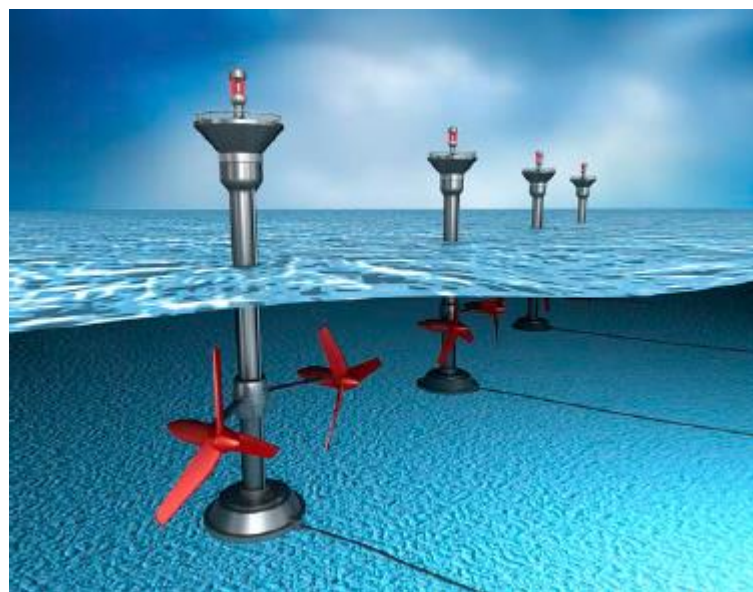
(Total 6 marks)

**Q4.**

Electricity in the UK is generated in many ways.

The figure below shows an undersea turbine.

The undersea turbine uses tidal energy to generate electricity.



© alex-mit/iStock/Thinkstock

(a) What is the original source of energy for tidal power schemes?

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(1)

(b) Explain **two** advantages of using undersea tidal turbines to generate electricity rather than burning fossil fuels.

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(4)

- (c) Some power stations burn wood instead of fossil fuels to generate electricity.

A coal-burning power station burns 6 million tonnes of coal per year.

Coal has an average energy value of 29.25 MJ per kg.

Wood chip from willow trees has an energy value of 13 MJ per kg.

A hectare of agricultural land can produce 9 tonnes of dry willow wood per year.

If this power station burned dry willow wood instead of coal, how much agricultural land would be needed to grow the willow?

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Amount of land needed = \_\_\_\_\_ hectares

(3)

- (d) The table below shows the carbon dioxide emissions of four fuels used to generate electricity.

Fuel	Direct CO <sub>2</sub> emissions in kg per MWh	Lifecycle CO <sub>2</sub> emissions in kg per MWh
Coal	460	540
Natural gas	185	215
Oil	264	313
Wood	2 100	58

**Direct CO<sub>2</sub> emissions** are the amounts of carbon dioxide released when the fuel is burned.

**Lifecycle CO<sub>2</sub> emissions** is the total amount of carbon dioxide released during all stages from fuel extraction to when the fuel has been used.

Use the data from the table above to explain why wood is considered to be a low carbon dioxide emitting fuel.

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(2)

(Total 10 marks)