



**LEVEL 1/2 AWARD**

**9851/01**

**SCIENCE FOR WORK (IVQ)**

**Reducing Our Carbon Footprint**

**P.M. MONDAY, 8 JUNE 2015**

**1 hour plus your additional time allowance**

**Surname** \_\_\_\_\_

**Other Names** \_\_\_\_\_

**Centre Number** \_\_\_\_\_

**Candidate Number** 0 \_\_\_\_\_

<b>For Examiner's use only</b>		
<b>Question</b>	<b>Maximum Mark</b>	<b>Mark Awarded</b>
<b>1.</b>	<b>6</b>	
<b>2.</b>	<b>9</b>	
<b>3.</b>	<b>7</b>	
<b>4.</b>	<b>17</b>	
<b>5.</b>	<b>7</b>	
<b>6.</b>	<b>8</b>	
<b>Total</b>	<b>54</b>	

## **ADDITIONAL MATERIALS**

**In addition to this paper you will require:**

**a calculator, pencil and a ruler;**

**a copy of the data sheet with a list of equations supplied by WJEC.**

## **INSTRUCTIONS TO CANDIDATES**

**Use black ink, black ball-point pen or your usual method.**

**Write your name, centre number and candidate number in the spaces on the front cover.**

**Answer ALL questions.**

**Write your answers in the spaces provided in this booklet.**

## **INFORMATION FOR CANDIDATES**

**The number of marks is given in brackets at the end of each question or part-question.**

**You are reminded to show all your workings. Credit is given for correct workings even when the final answer given is incorrect.**

Answer ALL the questions in the spaces provided.

1. Carbon dioxide is a greenhouse gas. It is believed that mankind's production of carbon dioxide through combustion of fossil fuels is changing our environment.

(i) In the box below circle **THREE** ways in which increasing levels of carbon dioxide in the atmosphere is believed to be changing our environment. [3]

melting of polar ice caps	fossil fuels running out
more tsunamis	more earthquakes
more extremes of weather	expanding deserts

(ii) Methane and water vapour are also greenhouse gases. Draw lines on the diagram opposite to link the **MAIN** process by which each gas enters the atmosphere. Carbon dioxide has been done as an example. [2]

(iii) Complete this word equation for combustion of coal. [1]

carbon + \_\_\_\_\_ → carbon dioxide

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**methane**

**water vapour**

**carbon dioxide**

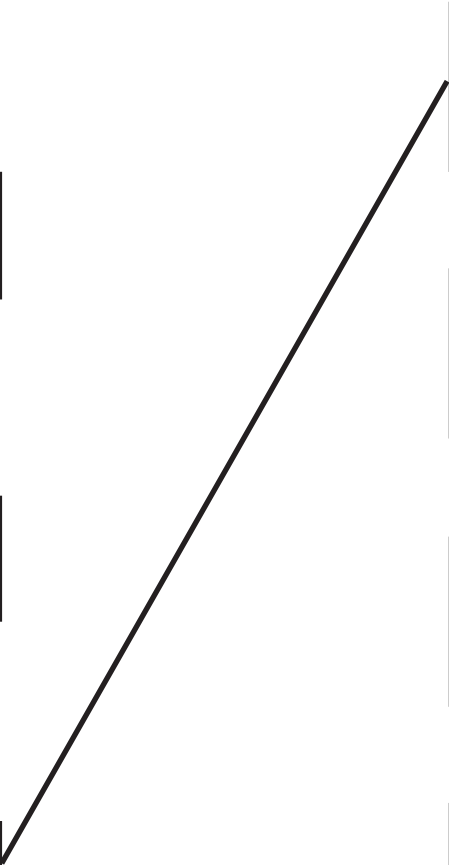
**combustion**

**evaporation**

**decomposition**

**condensation**

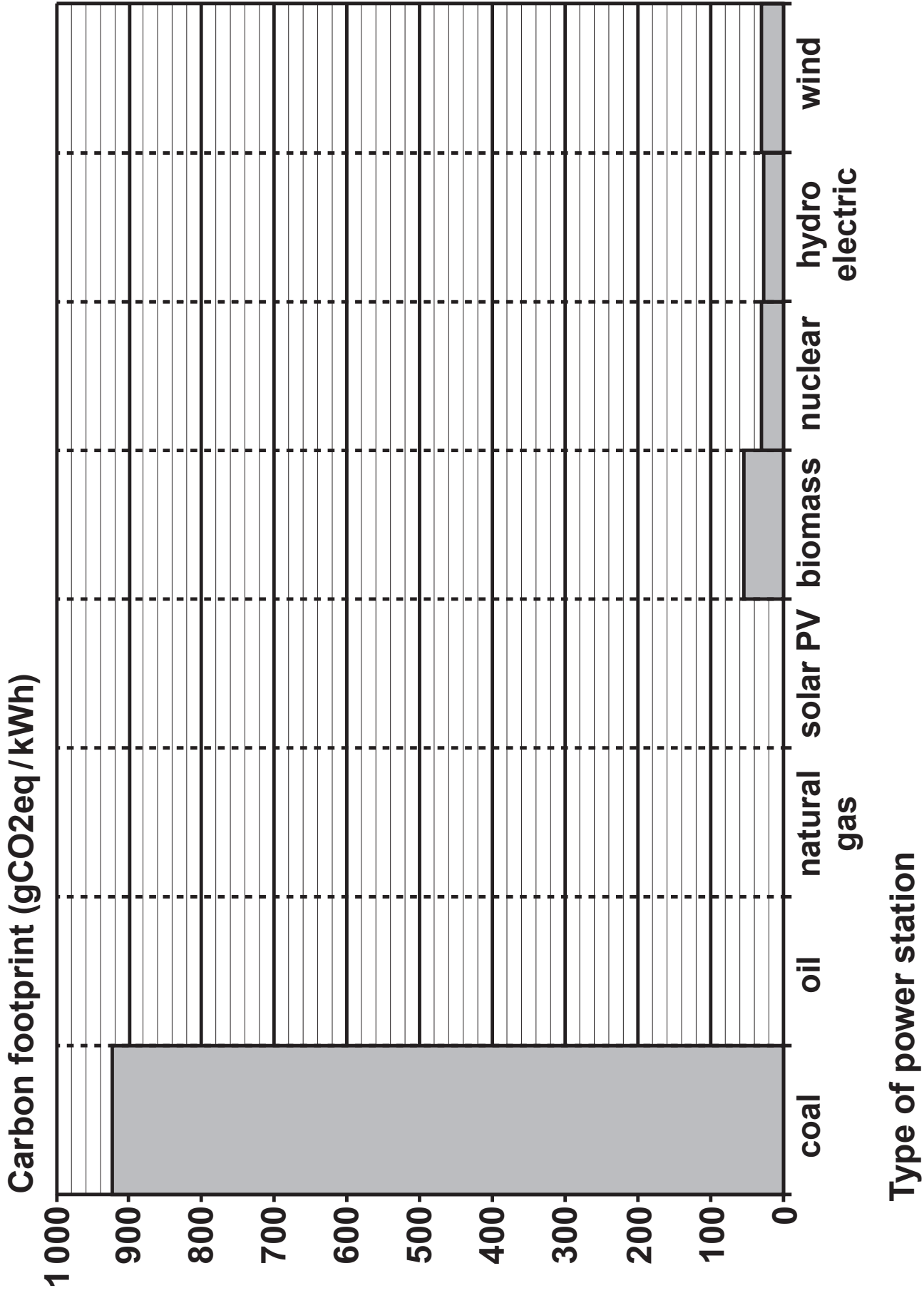
**photosynthesis**



2. The table below shows the mean carbon footprint for 1 kWh of electricity generated by different types of power stations.

Type of power station	Carbon footprint gCO <sub>2</sub> eq/kWh
coal	921
oil	750
natural gas	500
solar PV	100
biomass	52
nuclear	30
hydroelectric	27
wind	30

- (a) (i) Use the table to complete the bar chart opposite. [2]



**2(ii) Use the data from the table on page 5 to calculate the carbon dioxide equivalent mass produced when 50 kWh of electricity is produced using hydroelectric power. [1]**

\_\_\_\_\_ g

**(b) (i) What is meant by the term CARBON FOOTPRINT? [2]**

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**2(b)(ii) Nuclear power stations produce no carbon dioxide while generating electricity. Give TWO reasons why they still have a carbon footprint. [2]**

**1.** \_\_\_\_\_

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**2.** \_\_\_\_\_

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**2(b)(iii) Suggest ONE way of reducing the CARBON FOOTPRINT of nuclear power stations. [1]**

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**(iv) Give ONE reason why a biomass power station is described as CARBON NEUTRAL. [1]**

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- 3. All buildings in the UK must have an Energy Performance Certificate (EPC). An energy performance survey could help you identify ways to save money on your energy bills.**



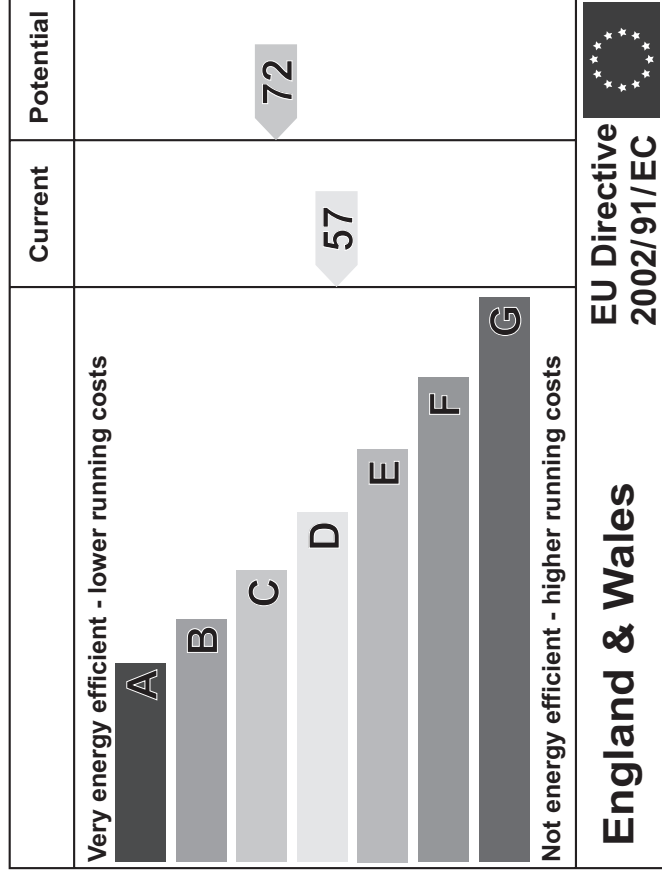
**Ed and Yvette buy a house.**

**The house was built in the 1930's.**

**In 2014, the previous owners fitted a new boiler, double glazing and 10 cm thick loft insulation.**

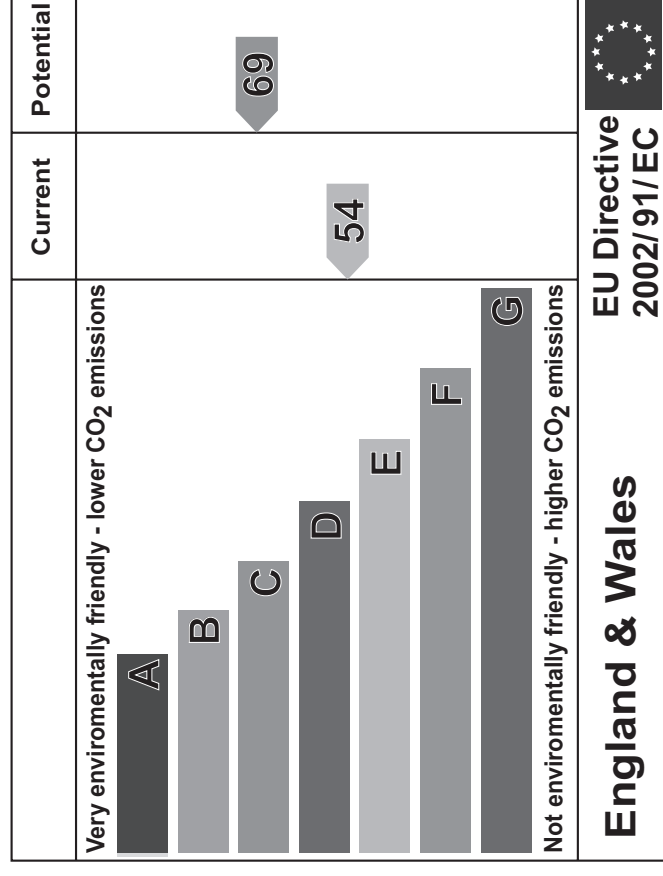
**The house was given the EPC as shown opposite.**

## Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills will be.

## Environmental Impact (CO<sub>2</sub>) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO<sub>2</sub>) emissions. The higher the rating the less impact it has on the environment.

**3(a) Ed and Yvette want to make the house as energy efficient as they can.**

**(i) Calculate by how much they can increase their energy efficiency rating. [1]**

\_\_\_\_\_

**(ii) State TWO advantages of making the house more energy efficient. [2]**

**1.** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**2.** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**3(a)(iii) Explain ONE way that they could improve the overall energy efficiency of the house. [2]**

**Method** \_\_\_\_\_

\_\_\_\_\_

**Reason** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**(b) Ed and Yvette are considering fitting solar photovoltaic panels. Discuss how the solar panels could affect the EPC. [2]**

\_\_\_\_\_

\_\_\_\_\_

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\_\_\_\_\_

\_\_\_\_\_

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**4(b) State ONE advantage of fossil fuels over:**

**(i) wind power. [1]**

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**(ii) nuclear power. [1]**

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**4(c) Study the diagram opposite. Governments also support Carbon Capture and Storage (CCS) technologies. Carbon capture and storage traps carbon dioxide permanently underground. One such scheme is in the Latrobe Valley in Australia. Local politicians are in favour of the scheme, but local residents are protesting against it.**

**(i) Why is the permanent storing of carbon dioxide important to the environment? [1]**

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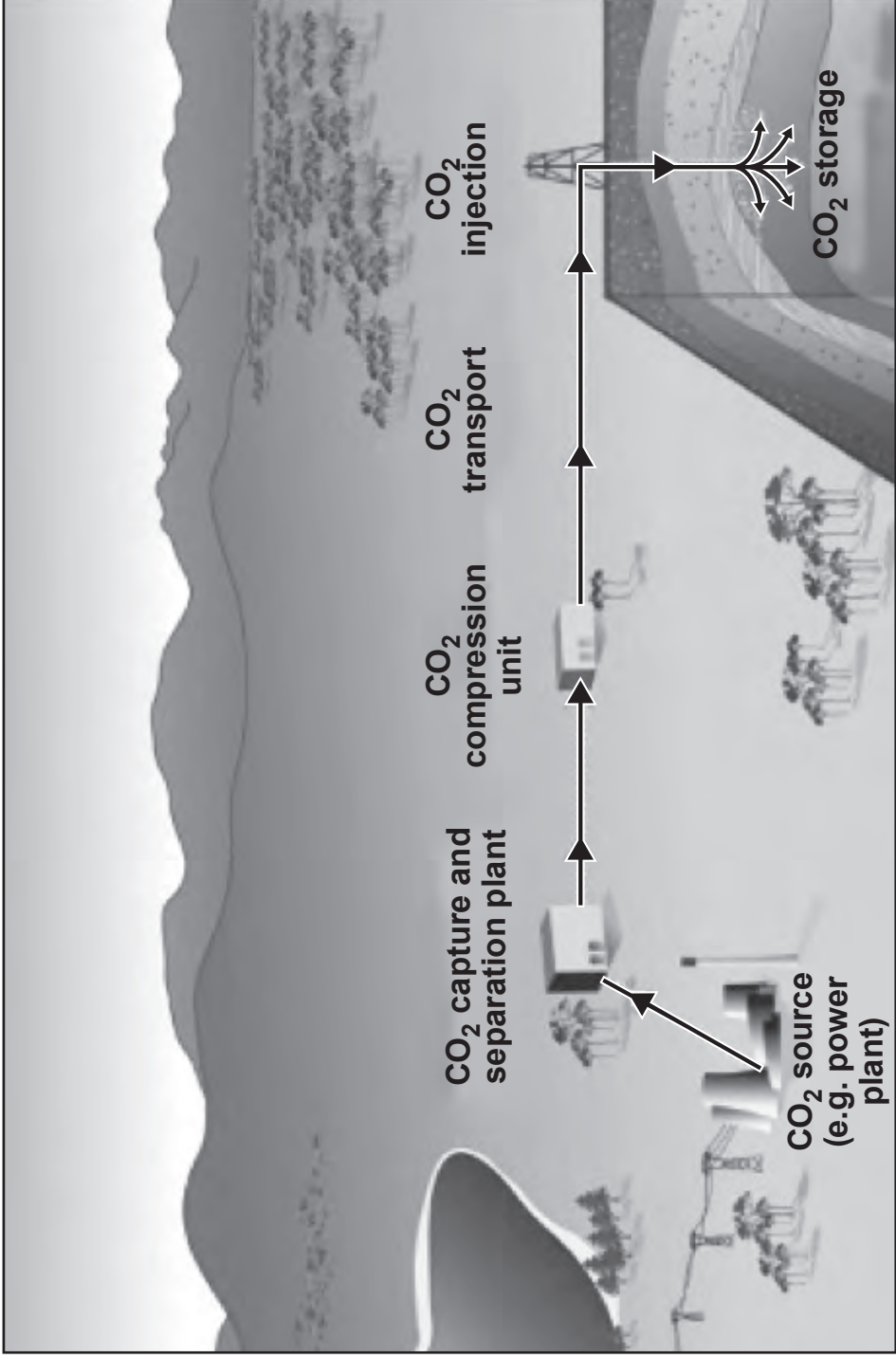
**(ii) Local politicians like the scheme. State ONE reason for this. [1]**

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**4(c)(iii) Give TWO reasons why local residents may object to the scheme. [2]**

1. \_\_\_\_\_

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2. \_\_\_\_\_

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**4(d) The Latrobe power plant generates 500 MW of electricity and has an efficiency of 25%.**

**(i) What is meant by the phrase, “has an efficiency of 25%”? [1]**

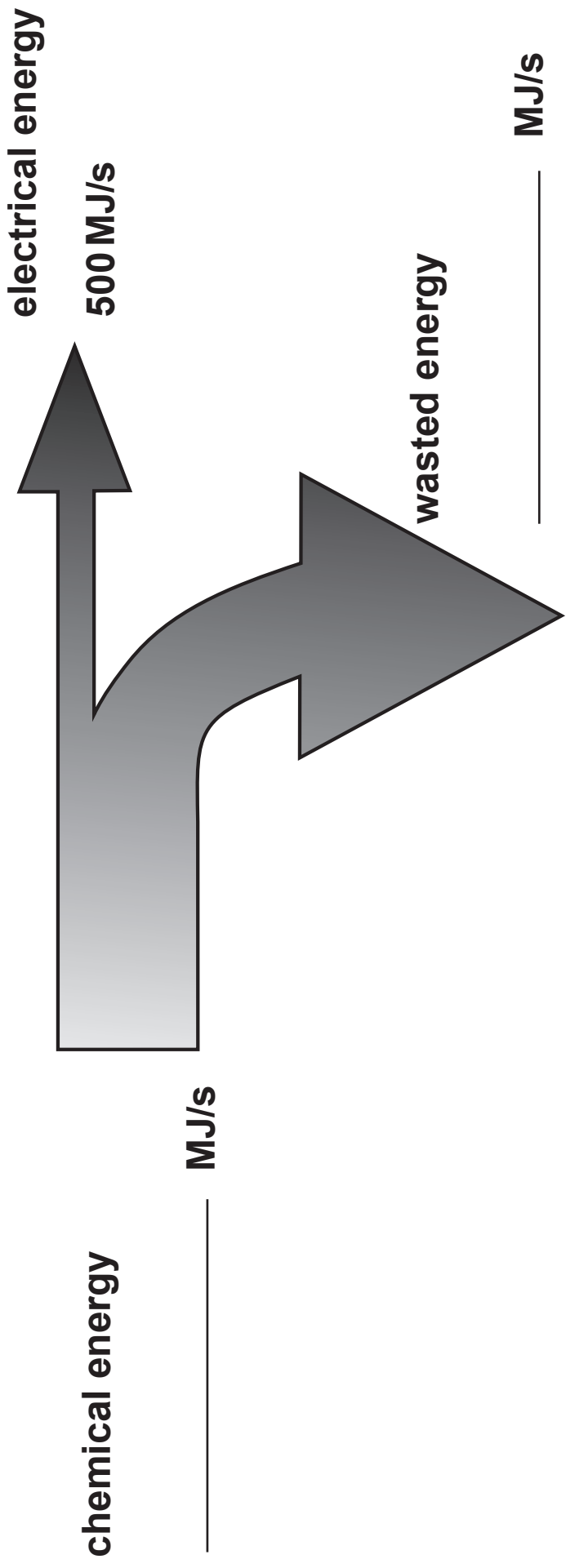
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**(ii) Complete the Sankey diagram opposite for the Latrobe power plant. [2]**

**(iii) CCS reduces the electrical energy output by a further 7%. Calculate the new output of the power plant. [2]**

**Output = \_\_\_\_\_ MJ/s**



**4(d)(iv) Calculate the new efficiency of the power plant. You will need to use an equation from the Data Sheet and the answer to part (d)(iii). [2]**

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

**(e) In order to build the CCS plant, trees will need to be cut down. This can increase the greenhouse effect. Name ONE possible ECONOMIC effect of an increased greenhouse effect. [1]**

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5. The following was published in a newspaper.

A study suggests that a vast reservoir of the potent greenhouse gas methane, may be locked beneath the Antarctic ice sheet.

Half of the West Antarctic Ice Sheet and a quarter of the East Antarctic Ice Sheet lie on pre-glacial sedimentary basins containing around  $2.1 \times 10^{17}$  kg of methane.

Scientists say “If enough of the ice melts away, methane could be released into the atmosphere, adding to global warming”.

5(a) Explain how methane in the atmosphere causes the greenhouse effect. [3]

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**5(b) Methane has a global warming potential of 25.**

**(i) Explain the term GLOBAL WARMING POTENTIAL (GWP). [1]**

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**(ii) Calculate the carbon dioxide equivalent for the methane locked beneath the Antarctic ice sheet using an equation from the Data Sheet. [2]**

\_\_\_\_\_ kgCO<sub>2</sub>eq

(c) State ONE reason why it is important to have some greenhouse gases in the atmosphere. [1]

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6. **Shelden and Aimee are a young couple whose flat is fitted with six old style filament lamps.**

**Shelden has seen an advert for LED light bulbs and is convinced they should replace all of the lamps. Aimee is not sure. She thinks they should wait and only replace the filament lamps if they break.**

**Information taken from the advert is shown opposite:**

- (a) (i) **Shelden says that these bulbs will help reduce their carbon footprint. Calculate the mass of carbon dioxide produced by six filament lamps in one year. [1]**

\_\_\_\_\_ kg

	<b>One Filament lamp</b>	<b>Equivalent LED lamp</b>
<b>Power input (watts)</b>	<b>100</b>	<b>10</b>
<b>Expected lifetime (years)</b>	<b>2</b>	<b>15</b>
<b>Cost to buy</b>	<b>£0.75</b>	<b>£15.00</b>
<b>Carbon footprint for one lamp (kgCO<sub>2</sub>/year)</b>	<b>63</b>	<b>11</b>
<b>Average hours used (per year)</b>	<b>1500</b>	<b>1500</b>

- 6(a)(ii) Calculate how much more carbon dioxide is produced using the six filament lamps compared to six LED lamps in ONE year. [2]**

\_\_\_\_\_ kg

- (b) Sheldon also says that they will save money on their electricity bill.**

**Calculate, using appropriate equations from the Data Sheet:**

- (i) how much energy (in kWh) the six filament lamps will use in ONE year. [2]**

\_\_\_\_\_ kWh

6(b)(ii) how many units of electricity the six LED lamps will use in ONE year. [2]

\_\_\_\_\_ units

(iii) the cost of using the six LED lamps for ONE year if one unit of electricity costs 15p. [1]

\_\_\_\_\_ p

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