

Surname	Centre Number	Candidate Number
Other Names		0



LEVEL 1/LEVEL 2 AWARD

9851/01

**SCIENCE FOR WORK (IVQ)
Reducing Our Carbon Footprint**

A.M. MONDAY, 16 June 2014

1 hour

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	3	
2.	15	
3.	11	
4.	9	
5.	11	
6.	5	
Total	54	

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

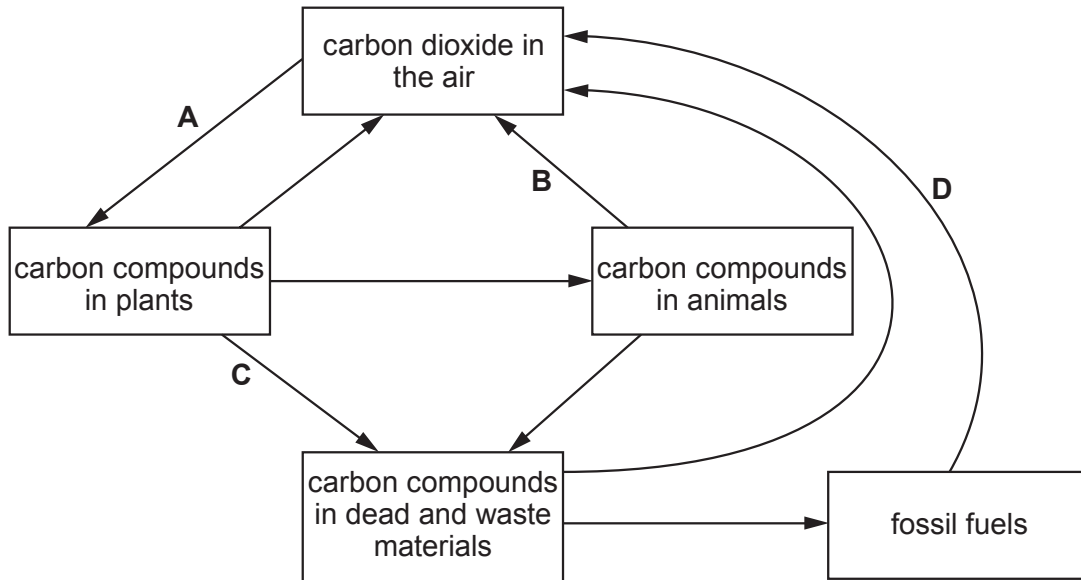
Use black ink or black ball-point pen.
Write your name, centre number and candidate number in the spaces at the top of this page.
Answer **all** questions.
Write your answers in the spaces provided in this booklet.

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 working. Credit is given for correct working even when the final answer given is incorrect.

Answer **all** the questions in the spaces provided.

1. The diagram below shows part of the carbon cycle. The arrows show how carbon is taken from and given back to the atmosphere.



Draw lines to link the letters **A**, **B** and **C** to the correct processes. **D** has been done for you. [3]

A	Combustion
B	Consumption
C	Decomposition
D	Photosynthesis
	Respiration

- 2. Drax, in North Yorkshire, is the largest coal-powered electricity generating plant in Western Europe. It is claimed by *Greenpeace* to be the biggest polluter in the UK. It accounts for 7% of the UK's greenhouse gases. *Greenpeace* believes it should be shut down.



- (a) (i) Name **two** greenhouse gases. [2]

..... and

- (ii) What is the role of organisations such as *Greenpeace*? [1]

.....

- (b) In 2006, Drax was partly converted to burn wood chips in order to reduce its carbon footprint.

- (i) What is meant by the term *carbon footprint*? [2]

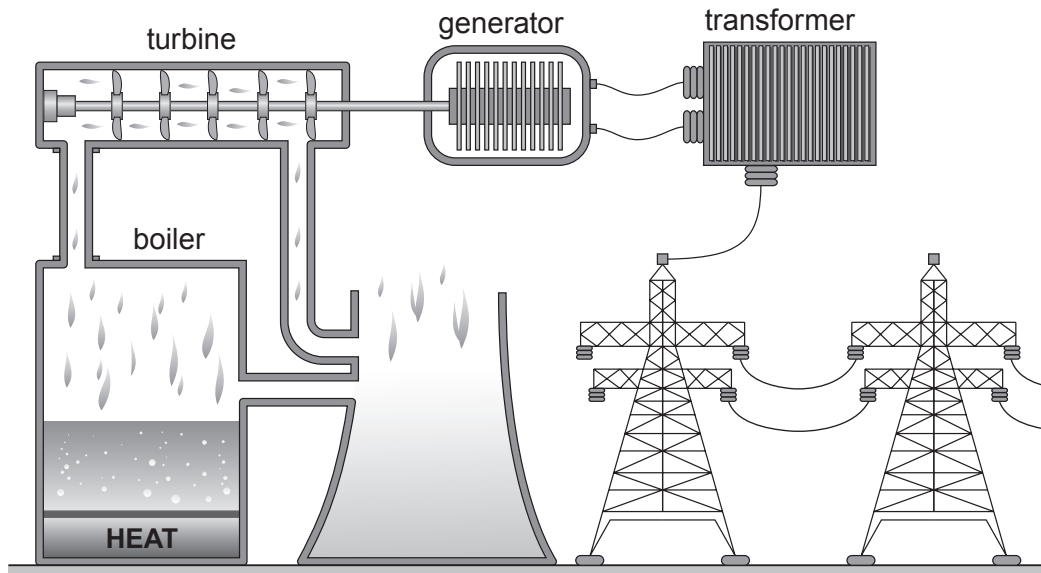
.....

- (ii) Explain why burning wood chips helps to reduce the carbon footprint for Drax. [2]

.....

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- (c) The diagram below shows the main parts of a coal-fuelled power station and how it connects to the National Grid.



- (i) Some of the parts of the power station are:

boiler turbine generator transformer

Use these words to complete the sentences below. [2]

Thermal energy is changed to kinetic energy in the

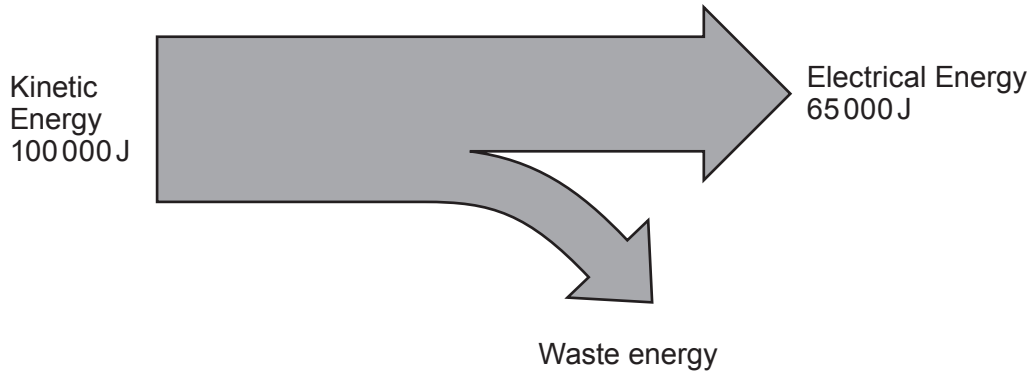
This kinetic energy is changed to electrical energy in the

- (ii) Coal is made mostly of carbon.

Complete the word equation for the complete combustion of carbon. [2]

carbon + →

(d) A Sankey Diagram for a typical generator is shown below:



(i) Select an equation from the separate data sheet and use it to calculate the percentage efficiency of this generator.

..... % [2]

(ii) Name **two** types of energy that are likely to be wasted by a generator.

..... and [2]

9851
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3. The Government gives a £5000 grant to buyers of electric vehicles. Two such electric vehicles are the Ampotec and the Voltec.

The Voltec car has an electric motor only. The Ampotec car has both an electric motor and a petrol engine. Both cars cost a similar amount to buy.

	Typical petrol engine car	Ampotec	Voltec
Range per charge (km)	not applicable	80	175
Range on one tank of fuel (km)	700	660	not applicable
Average fuel used (litres per 100 km)	6.0	1.2	0
Official CO ₂ produced (g/km) (Tested over 100 km)	100	27	0

- (a) Jack travels 100 km each day. He is concerned about his carbon footprint. Why would he choose a Voltec rather than an Ampotec car? [1]

.....

- (b) Calculate the mass of CO₂ produced if the Ampotec is driven 280 km. [2]

..... g

- (c) Give **two** reasons why the government gives a grant to purchase electric vehicles. [2]

.....

.....

.....

(d) The following was stated in a vehicle review:

“While running on just its petrol engine, the Amptec uses the same amount of fuel and produces a similar amount of CO₂ as the petrol engine car.”

Explain how this statement disagrees with the official data in the table opposite and yet is still valid. [2]

.....
.....
.....
.....

(e) Using a 50 kW charger the Voltec can be charged fully in eight hours.

(i) Select an equation from the separate data sheet to calculate how much energy in kWh is taken from the mains. [2]

..... kWh

(ii) Calculate how much carbon dioxide is produced to fully charge the Voltec. The electricity used produces 0.45 kg of carbon dioxide per kWh. [2]

..... kg

11

4. One of the largest man-made sources of methane is rice farming. Rice plants grow in flooded fields. As plant matter decays in the water, methane is produced.



The table below gives the global warming potential for carbon dioxide, methane and nitrous oxide gases.

Gas	Global-warming potential
carbon dioxide	1
methane	25
nitrous oxide	300

(a) What do you understand by:

- (i) Global Warming Potential (GWP);

[1]

.....

.....

- (ii) Carbon dioxide equivalent (kgCO₂eq).

[1]

.....

.....

(b) In China, 50 billion kilograms (50 000 000 000 kg) of methane is released from rice fields every year. The Chinese government plans to reduce this by draining the fields for 6 months. This halves the amount of methane produced but also releases 1 billion kg (1 000 000 000 kg) of nitrous oxide.

(i) Select an equation from the separate data sheet and use it to calculate the carbon dioxide equivalent for the 50 billion kilograms of methane. [2]

..... kgCO₂eq

(ii) If the Chinese government drains the fields for 6 months, what is the new total carbon dioxide equivalent? [3]

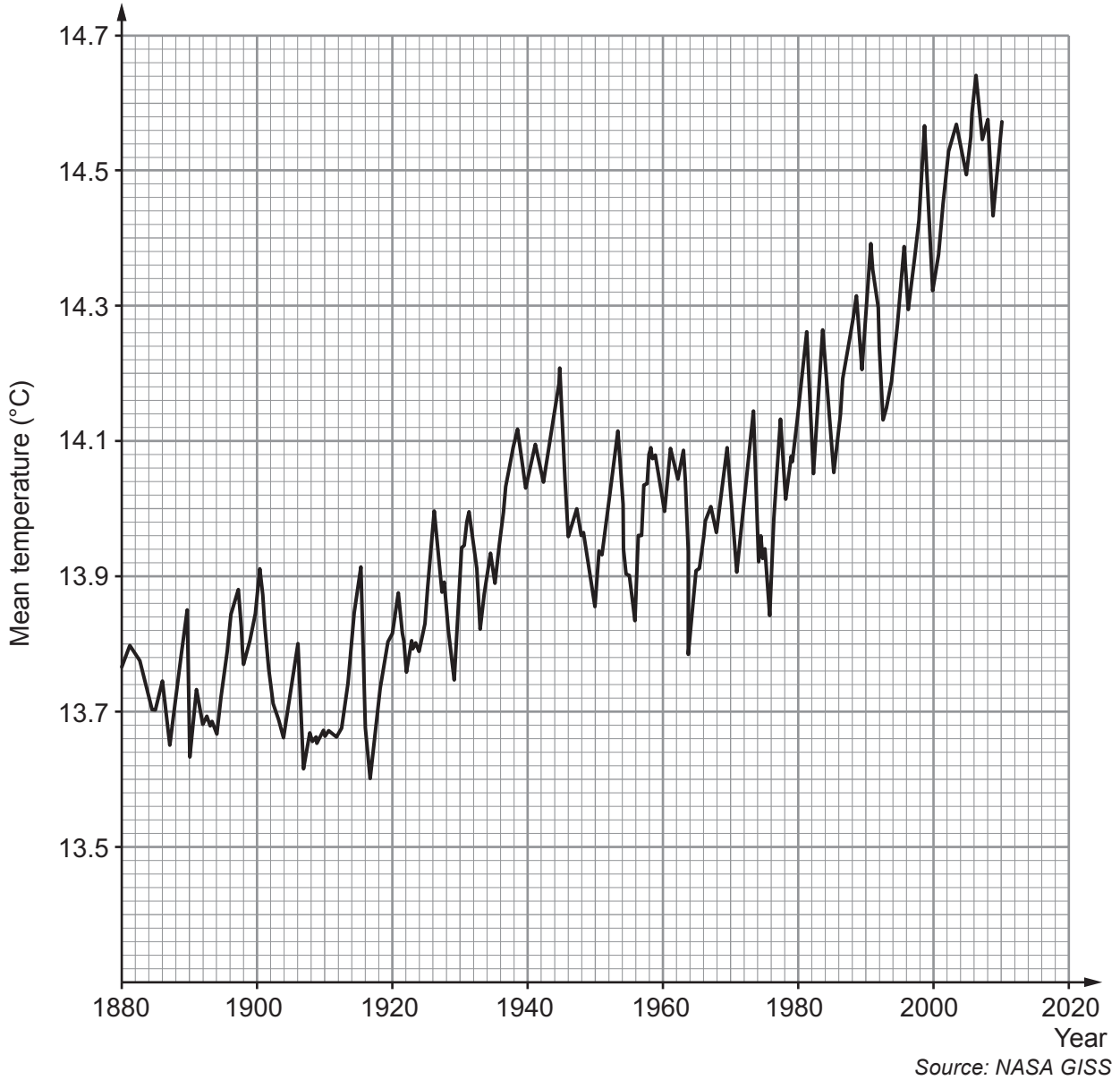
..... kgCO₂eq

(iii) Using your answers from (b)(i) and (b)(ii), explain the effects of draining the rice fields on China's carbon footprint. [2]

.....
.....

5. (a) Scientists monitor global temperature. The graph below shows the Earth's mean temperature since 1880.

Graph 1



- (i) Describe the **trend** shown by this graph. [2]

.....

.....

.....

- (ii) State **two** possible effects on the environment that could occur if this trend continues. [2]

1.

2.

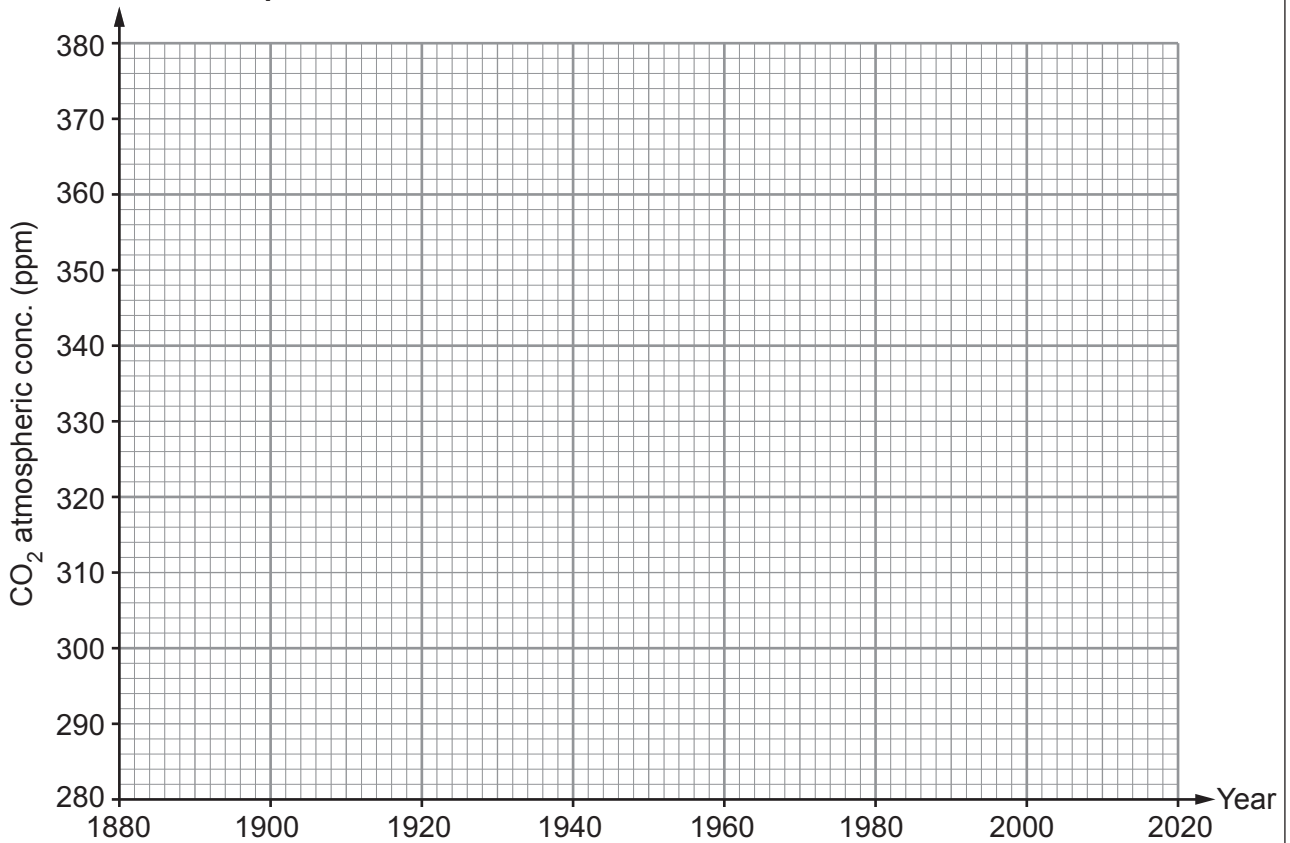
(b) Scientists have also measured the amount of CO₂ in the atmosphere.

Year	CO ₂ atmospheric conc. (ppm)
1880	290
1900	295
1920	305
1940	310
1960	320
1980	340
2000	370

(i) Use the data in the table to plot a graph on the axes below.

[3]

Graph 2



(ii) What conclusions can be made from the data in **Graph 1** and **Graph 2**?

[2]

.....

.....

(iii) Explain how CO₂ in the atmosphere causes the greenhouse effect.

[2]

.....

.....

.....

6. In 1997 a number of governments signed the Kyoto Protocol. Some people see it as being a failure.



Cartoon showing George W. Bush who was the U.S. President at the time of the signing of the Kyoto Protocol.

Why do some people see the Kyoto Protocol as a failure?

[5]

Include the following in your answer:

- what the Kyoto Protocol is;
- how governments have implemented the Protocol;
- the failings of the Kyoto Protocol.

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END OF PAPER



LEVEL 1/LEVEL 2 AWARD

9851/01-A

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DATA SHEET

Useful Equations

Work done or energy = force \times distance

$$W = Fd$$

Power (W) = current (A) \times voltage (V)

$$P = IV$$

Energy (J) = power (W) \times time (s)

$$E = Pt$$

Units used (kWh) = power (kW) \times time (h)

Cost = units used \times cost of each unit

Percentage efficiency = $\frac{\text{useful energy transfer}}{\text{total energy used}} \times 100$

kgCO₂eq = mass of gas(kg) \times global warming potential of the gas

$$\text{kgCO}_2\text{eq} = m(\text{kg}) \times \text{GWP}$$

Units

g carbon dioxide equivalent

gCO₂eq

kg carbon dioxide equivalent

kgCO₂eq

kg carbon dioxide equivalent per kilowatt hour

kgCO₂eq/kWh

SI multipliers

Prefix	Multiplier
p	10^{-12}
n	10^{-9}
μ	10^{-6}
m	10^{-3}

Prefix	Multiplier
k	10^3
M	10^6
G	10^9
T	10^{12}