Candidate forename		Candidate surname	

Centre number						Candidate number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION

A321/01

TWENTY FIRST CENTURY SCIENCE
CHEMISTRY A

Unit 1: Modules C1 C2 C3 (Foundation Tier)

FRIDAY 17 JUNE 2011: Afternoon
DURATION: 40 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

Candidates answer on the question paper.
A calculator may be used for this paper.

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

Pencil
Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF

DC (NH/CGW) 11MEP06186 46706

INSTRUCTIONS TO CANDIDATES

- **Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.**
- **Use black ink. Pencil may be used for graphs and diagrams only.**
- **Read each question carefully. Make sure you know what you have to do before starting your answer.**
- **Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).**
- **Answer ALL the questions.**

INFORMATION FOR CANDIDATES

- **The number of marks is given in brackets [ ] at the end of each question or part question.**
- **The total number of marks for this paper is 42.**

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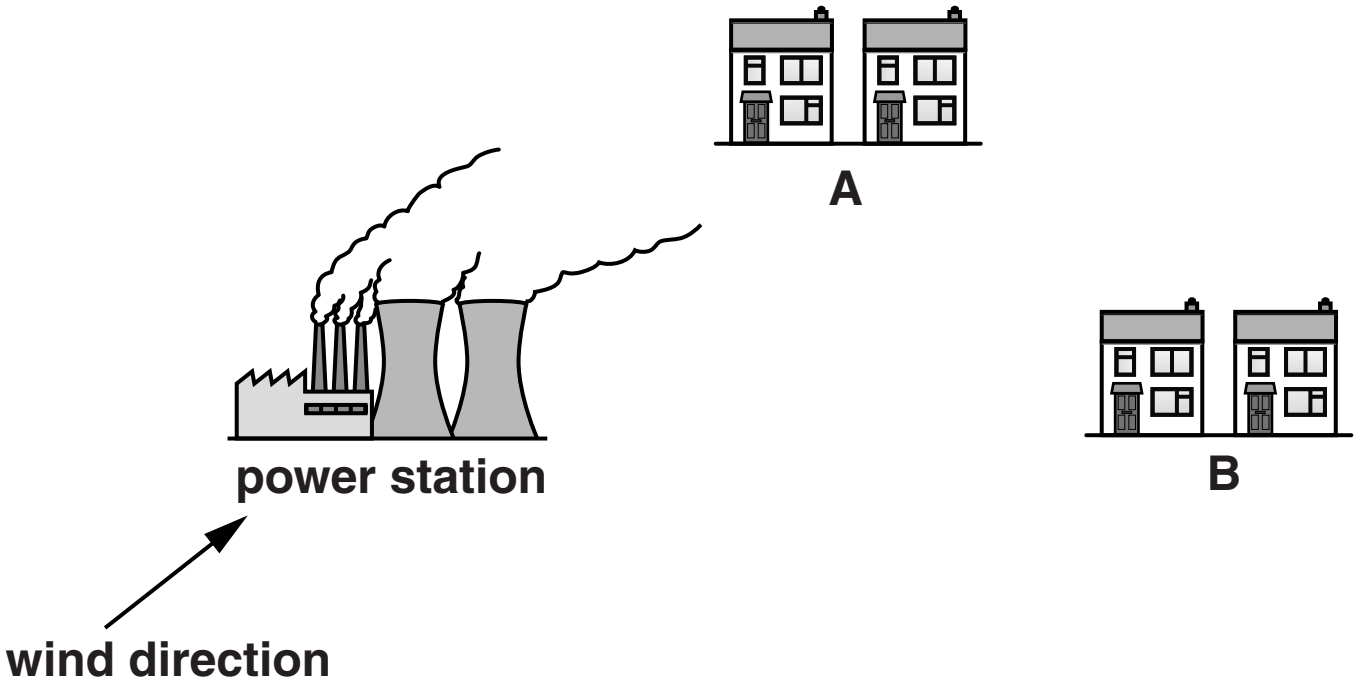
Answer ALL the questions.

1 Scientists measure the sulfur dioxide concentration in the air at two places near to a power station that burns coal.



The map shows that houses at A are in the direction that the wind is blowing from the power station, but houses at B are not.

The scientists take five air samples at A and five air samples at B.

Their results are shown in the table.

	SULFUR DIOXIDE CONCENTRATION IN μg/m^3					
	SAMPLE 1	SAMPLE 2	SAMPLE 3	SAMPLE 4	SAMPLE 5	BEST ESTIMATE
A	451	447	453	450	449	450
B	115	102	112	106	118	

(a) (i) The scientists work out the mean (average) of the sulfur dioxide concentration measurements at A.

They use this as the BEST ESTIMATE of the sulfur dioxide concentration at A.

Work out the best estimate for the sulfur dioxide concentration at B.

Show your working.

best estimate = _____ μg/m^3 [2]

(ii) The range of the measurements taken at A is 447 to 453 μg/m^3.

What is the range for the measurements taken at B?

range = _____ to _____ μg/m^3 [1]

(iii) The scientists suggest that the measurements taken at A are more reliable than those taken at B.

Which of these statements explains why they make this suggestion?

Put a tick (✓) in the box next to the correct answer.

The measurements taken at A are larger than those taken at B. ☐

A is nearer to the power station than B. ☐

The range of measurements taken at A is smaller than the range at B. ☐

There are no outliers in the measurements taken at A. ☐

[1]

(iv) The scientists took five measurements at A and five measurements at B.

Taking five measurements is likely to give a better estimate than taking only one measurement.

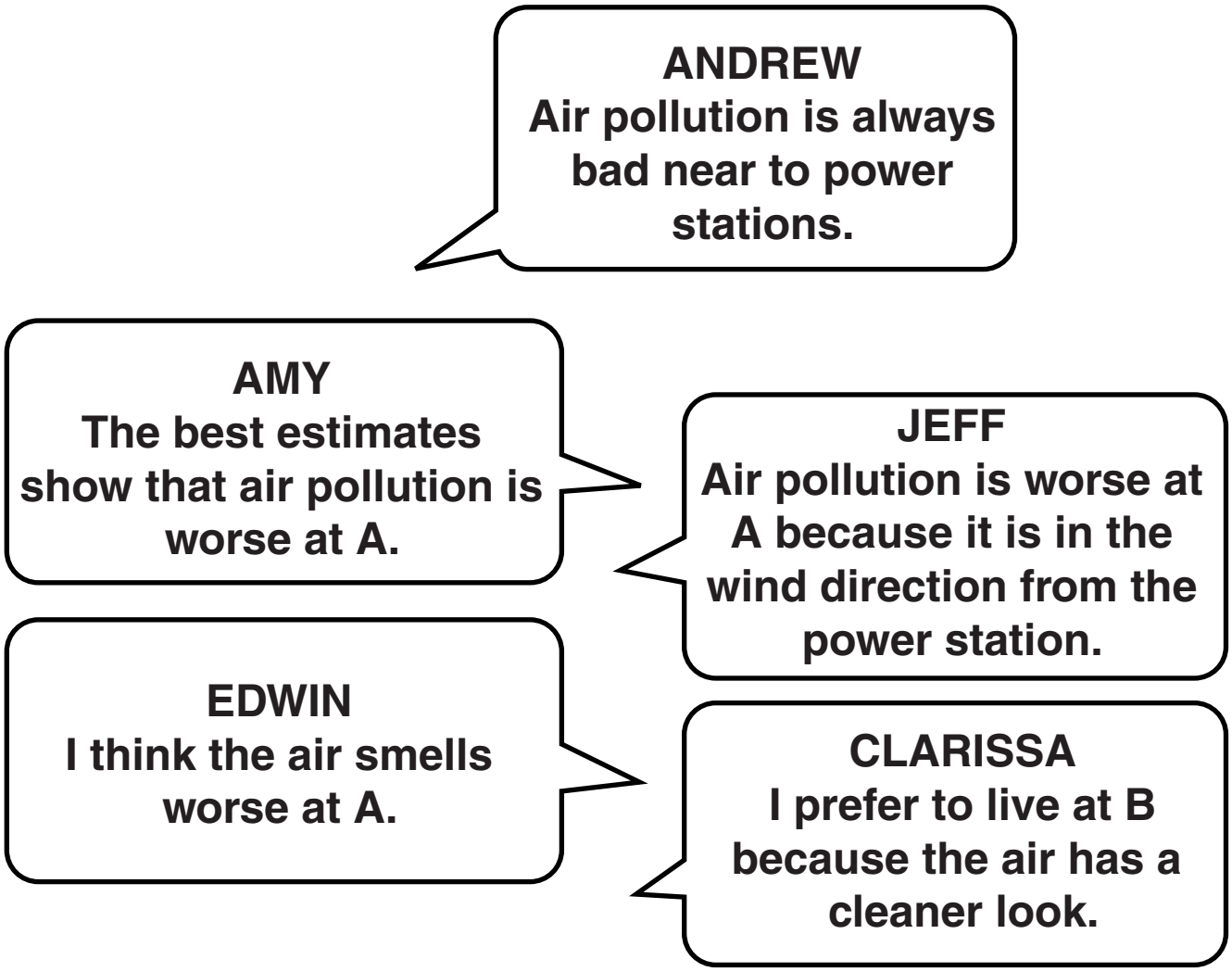
Explain why.

_____

_____

_____ **[2]**

(b) A group of people talk about the sulfur dioxide pollution at A and B.



Put ticks (✓) in the correct boxes to show

- **who is using the DATA from the map and table on pages 4 and 5 to justify an explanation**

- **who is giving their opinion.**

	DATA	OPINION
Andrew		
Amy		
Jeff		
Edwin		
Clarissa		

[3]

[Total: 9]

2 An investigation shows that there is a correlation between the number of cars that enter a town and the level of nitrogen dioxide in the air.

(a) The town council decides to charge a fee for every car with a driver but no passengers.

There is no fee for cars with passengers.

This decision reduces the air pollution in the town.

Explain why.

_____

_____

_____

_____ **[3]**

(b) Nitrogen dioxide does not stay in the air.

Which two statements, when taken together, describe how nitrogen dioxide is removed from the air?

Put ticks (✓) in the boxes next to the TWO best answers.

Nitrogen dioxide is absorbed by plants.	☐
Nitrogen dioxide reacts with oxygen and water to form nitric acid.	☐
Nitrogen dioxide forms a black solid.	☐
Plants use nitrogen dioxide in photosynthesis.	☐
Nitric acid falls to the ground in acid rain.	☐
Nitrogen dioxide leaves a dirty black coating on buildings.	☐

[2]

[Total: 5]

3 A product is made from a material. It is used and then disposed of.

(a) Complete the table to show the stages in the Life Cycle of the product.

STAGE	DESCRIPTION
1	make the material from natural resources
2	_____
3	_____
4	dispose of the product

[2]

(b) Shirts can be made using cotton fibres. These fibres are made from a natural polymer.

Shirts can also be made using polyester fibres. These fibres are made from a synthetic polymer.

The table shows a Life Cycle Assessment (LCA) for each shirt over a lifetime of two years.

	PER kg OF COTTON SHIRT	PER kg OF POLYESTER SHIRT
energy used in MJ	140.1	171.5
crude oil in kg	0	1.53
fertilisers in g	457	0
carbon dioxide given out in kg	5.3	3.8
water usage in dm^3	26700	1900

Which of these statements support the idea that cotton shirts are more sustainable than polyester shirts?

Put ticks (✓) in the boxes next to the TWO best answers.

Crude oil is not used in the manufacture of cotton. ☐

Water is in short supply where cotton is grown. ☐

There is already carbon dioxide in the air. ☐

Less energy is used during the lifetime of cotton shirts. ☐

Cotton needs fertiliser to grow. ☐

[2]

(c) The strength of fibres can be increased by cross-linking their polymer molecules.

Explain how cross-linking increases the strength of polymers.

Use ideas about the forces between polymer chains in your answer.

_____

_____

_____

_____

_____ **[3]**

[Total: 7]

4 The table shows data about ropes made from a number of materials. Each of the ropes has the same diameter.

MATERIAL	BREAKING LOAD IN kg	SOURCE	WATER ABSORPTION	EASE OF ROTTING
coir	245	coconut husk	high	high
hemp	1295	hemp plant stem	high	high
nylon	4650	synthetic	low	low
polyester	2750	synthetic	low	low
poly(propene)	2940	synthetic	low	low
sisal	1225	sisal plant leaves	high	high

(a) Which material makes the strongest rope with high water absorption?

_____ **[1]**

(b) In a country with no chemical industry most of the rope used is made from hemp and little from poly(propene).

Which statements give the best reasons for this difference?

Use the table to help you.

Put ticks (✓) in the boxes next to the TWO best answers.

Hemp rots more easily than poly(propene).	☐
Poly(propene) rope is expensive because it has to be imported.	☐
Rope made from natural material lasts longer.	☐
Hemp is stronger than poly(propene).	☐
Natural materials are available locally.	☐
Poly(propene) absorbs less water than hemp.	☐

[2]

(c) A rock climber uses rope made from nylon rather than sisal.

Explain why it is better to use nylon rope.

Use information from the table in your answer.

_____

_____

_____

_____ **[2]**

(d) (i) A company making a synthetic rope decides to use a more flexible form of the polymer.

How could the company increase the flexibility of the polymer?

Put a tick (✓) in the box next to the correct answer.

increase the cross linking ☐

increase the polymer chain length ☐

polymerise more molecules into polymer ☐

add plasticizer to the polymer ☐

[1]

(ii) Scientists working for this company test the strength of samples of the new polymer and the original polymer.

	BREAKING LOAD IN kg						
	SAMPLE 1	SAMPLE 2	SAMPLE 3	SAMPLE 4	SAMPLE 5	SAMPLE 6	BEST ESTIMATE
new polymer	1662	1672	1666	1669	1663	1664	1666
original polymer	2680	2672	2682	1685	2677	2679	2678

Which sample's result is an outlier for the original polymer?

sample _____ [1]

[Total: 7]

5 Joe currently uses an intensive method of farming, but he plans to change to an organic method.

Farmers have to follow UK national standards if they want to say that their crops are organic.

(a) The list below describes a number of farming activities.

Which activities can Joe use when he changes to organic farming?

Put ticks (✓) in the boxes next to the correct answers.

add synthetic fertiliser to soil	☐
add manure to soil	☐
use synthetic pesticides	☐
pick off pests by hand	☐
add pest predators to crops	☐

[3]

(b) Intensive farming methods and organic farming methods have advantages and disadvantages to the farmer.

(i) What ADVANTAGE may Joe gain when he changes to organic farming?

Put a tick (✓) in the box next to the best answer.

Joe will have fewer problems with pests attacking his crops. ☐

Joe will be able to increase his crop yield. ☐

Joe will be able to charge more for the crops he sells. ☐

Joe will not need to add any type of fertiliser to his soil. ☐

[1]

(ii) What DISADVANTAGE may Joe find when he changes to organic farming?

Put a tick (✓) in the box next to the best answer.

Joe will get a lower yield for the crops he grows. ☐

Joe will have fewer pests attacking crops. ☐

The fertility of the soil on Joe's farm will decrease. ☐

Joe must grow different crops. ☐

[1]

(c) Joe says that his change to organic farming is a sustainable development.

Suggest and explain a reason for this.

_____

_____

_____

_____ **[2]**

[Total: 7]

6 (a) The table lists three types of chemical.

Show which elements are present in each chemical.

Put ticks (✓) in the correct boxes.

CHEMICAL	ELEMENTS PRESENT			
	CARBON	HYDROGEN	NITROGEN	OXYGEN
hydrocarbon				
sugar				
protein				

[3]

(b) Some processed foods contain a high level of sugar.

When these foods are eaten, what happens to the sugar in the body?

Put ticks (✓) in the boxes next to the TWO correct answers.

The sugar is not digested and is released in faeces.	☐
The sugar is broken down into amino acids.	☐
The sugar is quickly absorbed into the blood stream.	☐
There is a rapid rise in blood oxygen concentration.	☐
There is a rapid rise in blood sugar concentration.	☐
There is a rapid rise in blood amino acid concentration.	☐

[2]

(c) Sugar is added to some food products, such as jam, to act as a preservative.

What job does a PRESERVATIVE do?

Put ticks (✓) in the boxes next to the TWO correct answers.

It makes the food taste sweeter. ☐

It gives the food an attractive appearance. ☐

It keeps the food safe for longer. ☐

It prevents the growth of harmful microbes. ☐

It destroys harmful chemicals. ☐

It helps to mix food ingredients together. ☐

[2]

[Total: 7]

END OF QUESTION PAPER

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