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**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 18 JUNE 2010: 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

INSTRUCTIONS TO CANDIDATES

- **Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.**
- **Use black ink. Pencil may be used for graphs and diagrams only.**
- **Read each question carefully and make sure that you know what you have to do before starting your answer.**
- **Answer ALL the questions.**
- **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).**

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 (a) The acidification of rivers, lakes and soil takes place when acid rain falls on them.

(i) Sulfur dioxide is one cause of acid rain.

Which of these processes is the main source of sulfur dioxide in the air?

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

gases breathed out by animals

the burning of fuels containing sulfur compounds

the spreading of fertiliser on fields

[1]

(ii) Sulfur dioxide reacts with two chemicals in the air to form acid rain.

Which chemicals in the air does it react with?

Put a ring around each of the TWO correct answers.

ARGON

CARBON DIOXIDE

NITROGEN

OXYGEN

WATER

[2]

- (iii) The lists show some names of gases and their formulae.

Only one of these gases causes acid rain.

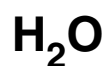
Put a ring around the NAME and a ring around the FORMULA of the gas that causes acid rain.

NITROGEN

NITROGEN DIOXIDE

OXYGEN

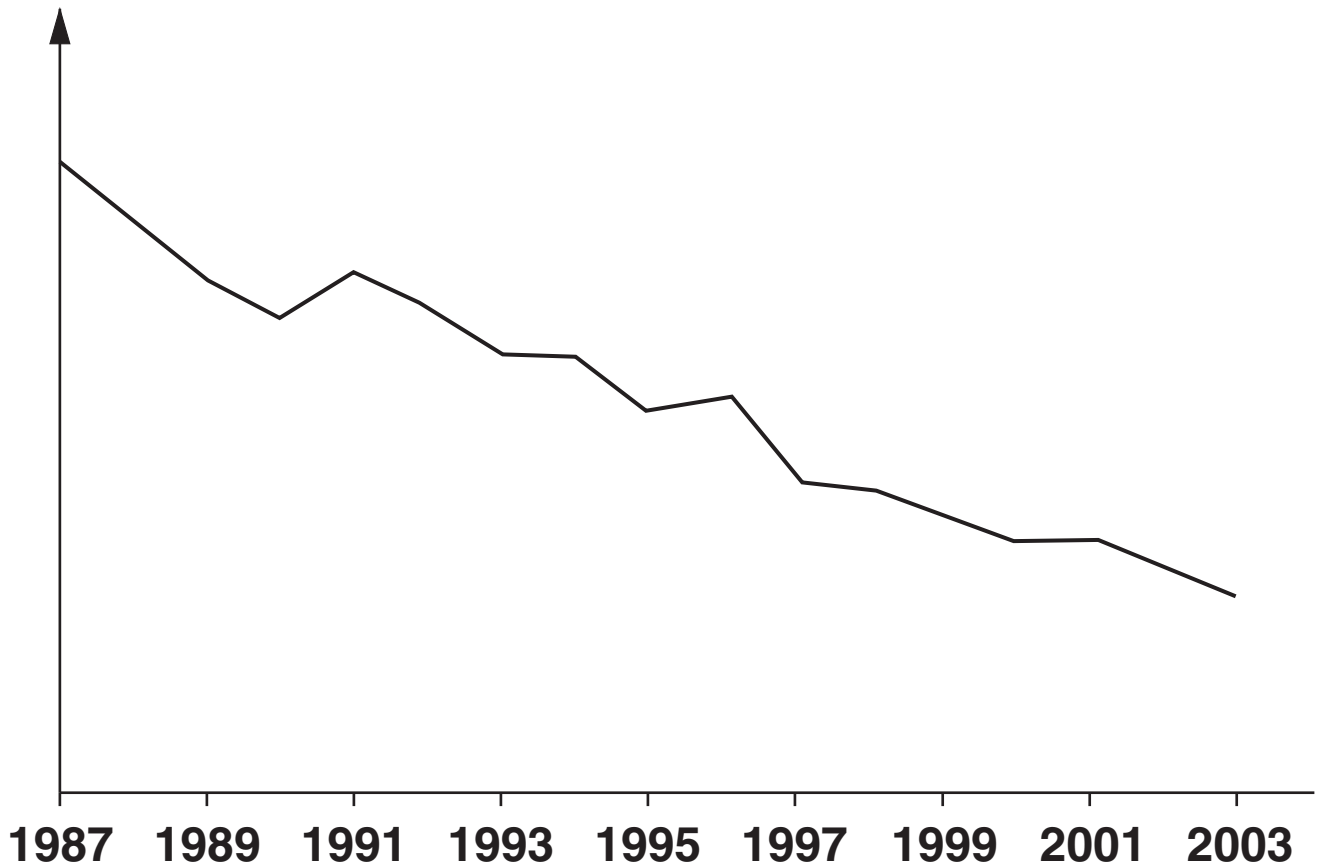
WATER VAPOUR



[2]

(b) The graph shows how the acidification of rivers and lakes caused by sulfur compounds changed between 1987 and 2003 in the United Kingdom.

**acidification caused
by sulfur compounds**



The graph shows that acidification caused by sulfur compounds fell from 1987 to 2003.

Which of these statements are reasons for this fall?

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

There was a decrease in the number of cars sold.

More cars and power stations changed to using low sulfur fuels.

There was an increase in the number of electrical appliances in people's homes.

More cars were fitted with catalytic converters.

More power stations were fitted with devices to remove sulfur compounds from flue gases.

More people changed from driving cars to using public transport.

[2]

(c) There is a set limit to the amount of each pollutant gas a power station is allowed to release.

Who decides this limit?

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

people living near the power station

people working in the power station

the Government

the companies supplying fuel to the power station

[1]

[Total: 8]

2 Petrol is a mixture of hydrocarbons.

When hydrocarbons burn completely in air the products are carbon dioxide and water.

In a car engine they burn incompletely, also producing carbon monoxide.

Modern cars are fitted with catalytic converters, which decrease the amount of carbon monoxide that is released into the air.

(a) Scientists test two types of catalytic converter: an old model and a new model.

For each catalytic converter, fitted to the same engine, the scientists took several measurements of the percentage of carbon monoxide in the exhaust gas.

They used their results to get a best estimate of the percentage of carbon monoxide released from each catalytic converter.

PERCENTAGE OF CARBON MONOXIDE						
	SAMPLE 1	SAMPLE 2	SAMPLE 3	SAMPLE 4	SAMPLE 5	BEST ESTIMATE
old catalytic converter	0.243	0.246	0.243	0.245	0.243	0.244
new catalytic converter	0.168	0.170	0.168	0.167	0.167	

- (i) Taking several measurements gives a better estimate of the percentage of carbon monoxide released than taking just one measurement.

Explain why.

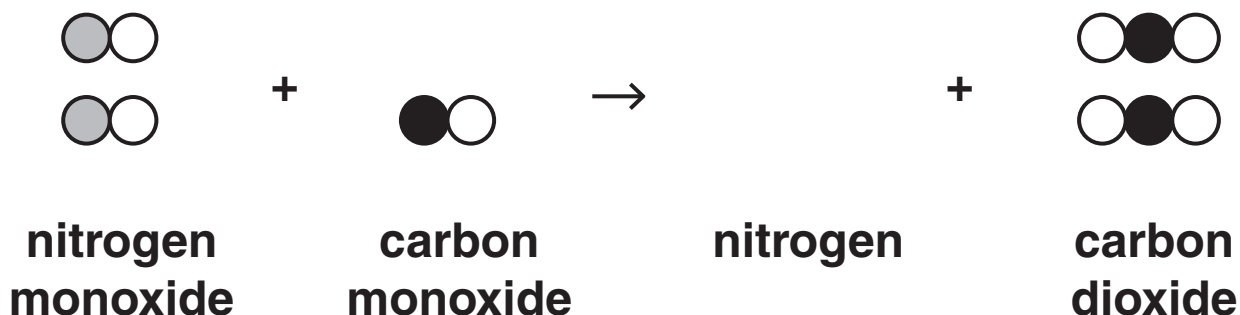
[2]

- (ii) Calculate the best estimate for the NEW catalytic converter.

best estimate = _____ % [2]

(b) A reaction taking place in each catalytic converter decreases the amount of carbon monoxide released.

The diagram shows the reactants and products for this reaction.



TWO molecules are missing from the diagram, ONE from the reactants and ONE from the products.

Put ticks (✓) in the boxes to show which molecule should be added to the REACTANTS and which molecule should be added to the PRODUCTS.

REACTANTS

PRODUCTS











[2]

[Total: 6]

- 3 A toy company wants to make plastic models using a polymer.

Scientists working for the company test two different polymers to find the temperature at which each polymer melts.

MELTING TEMPERATURE IN °C						
	SAMPLE 1	SAMPLE 2	SAMPLE 3	SAMPLE 4	SAMPLE 5	MEAN
polymer A	135	137	135	134	134	135
polymer B	265	265	264	262	264	264

- (a) (i) What is the best estimate for the true value of the melting temperature for polymer A?

best estimate = _____ °C [1]

- (ii) What is the range of the data for polymer A?

range = _____ °C to _____ °C [1]

- (iii) The scientists consider that the data for both polymers are reliable.**

What information in the table suggests that this is true?

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

The results for polymer B are much higher than those for polymer A.

For each set of results two of the samples have the same value as the mean.

The mean for each set of results is near to the middle of the range.

Each set of results has a narrow range.

[1]

(iv) The results for polymer A are not all identical.

Which of these statements gives a reason for the differences?

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

The scientists made many errors in their measurements.

Samples of the same polymer show small variations in structure.

Each polymer can have several different melting points.

[1]

(b) One of these polymers will be chosen to make the models.

It will be melted and forced into moulds to make the shapes.

(i) After looking at the melting temperature data, the scientists suggest that the company uses polymer A to make their models.

Suggest why and explain your answer.

[2]

- (ii) The company considers other properties before choosing the best polymer to make the models.

From each PROPERTY draw a line to the REASON why this property is important.

PROPERTY

strength

durability

stiffness

REASON

so that the models do not bend too easily

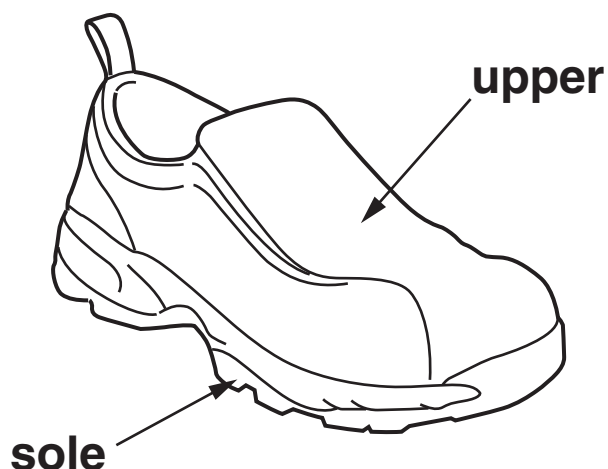
so that the models last a long time

so that the models are not easy to break

[2]

[Total: 8]

- 4 For many products, new materials have replaced the materials that were used in the past. These new materials often have better properties than the old ones.



Soles of shoes used to be made of leather.

Soles of shoes are now usually made from polyurethane.

The change of material for shoe soles is shown in the FIRST EXAMPLE in the table.

	FIRST EXAMPLE	SECOND EXAMPLE
product	shoe sole	
old material	leather	
new material	polyurethane	
advantage of new material	more durable	

- (a) Complete the table by filling in the details of a SECOND EXAMPLE that does not involve shoes.

[3]

(b) The Life Cycle Assessment (LCA) of a shoe with a polyurethane sole is different to that of a shoe with a leather sole.

Which of these reasons explain this difference?

Put ticks (✓) in the boxes next to the THREE best reasons.

Leather is renewable but polyurethane is not.

Leather has a more attractive appearance than polyurethane.

Leather is more expensive to buy than polyurethane.

Leather will rot when disposed of in landfill but polyurethane will not.

The manufacture of polyurethane uses more energy than the manufacture of leather.

Leather has been used for a longer period of time than polyurethane.

[2]

- (c) The use of leather to make shoes is more sustainable than the use of plastics such as polyurethane.

Which statement explains this?

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

Plastics are made using chemicals from crude oil.

Leather is made from animal skins.

Leather can be obtained without spoiling the environment for the future.

Leather is hard wearing so the product will last a long time.

[1]

[Total: 6]

- 5 **Diabetes is a disorder that affects the way the body processes sugar.**

In a person with diabetes, less sugar is removed from the blood for storage in the liver.

The resulting high blood sugar level causes symptoms such as excessive thirst, weight loss and poor vision. When untreated, it can lead to coma and death.

There are two types of diabetes: type 1 and type 2.

- (a) Decide whether each STATEMENT best applies to TYPE 1 DIABETES or TYPE 2 DIABETES.**

Put a tick (✓) in the correct box in each row.

STATEMENT	TYPE 1 DIABETES	TYPE 2 DIABETES
cannot be controlled by diet and exercise		
is less likely to occur in young people		
is caused when the body no longer responds to its own insulin		

[2]

- (b) (i) When a person eats a chocolate bar their blood sugar level rises quickly.**

Which statements explain how this happens?

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

The chocolate bar contains a lot of sugar.

The chocolate bar contains a lot of fat.

Fat is quickly digested into sugar.

Sugar is quickly absorbed into the blood stream.

[2]

- (ii) People who are obese are more likely to develop type 2 diabetes. Despite the higher risk, many people eat a poor diet and become obese.**

Suggest why a person may eat a poor diet despite the higher risk of developing type 2 diabetes.

[2]

[Total: 6]

6 Plants obtain nitrogen by absorbing nitrogen compounds from the soil. When crops are harvested this nitrogen is not returned to the soil.

(a) Complete this sentence to describe how plants use this nitrogen.

Use words from the list.

AMINO ACIDS

CARBOHYDRATES

PROTEINS

STARCH

SUGARS

Plants use nitrogen to make small molecules

called _____ which are

then used to make natural polymers called

_____ .

[2]

- (b) Synthetic fertilisers are not used in organic farming. Instead nitrogen compounds are added to the soil in other ways.**

One way is to add manure.

Describe and explain one OTHER organic farming method that adds nitrogen compounds to the soil.

_____ [2]

- (c) Farmers protect their crops from attack by pests and competition from weeds.**

- (i) Describe the methods used to do this in ORGANIC farming.**

_____ [3]

- (ii) The methods used in ORGANIC farming have less impact on the environment than those used in INTENSIVE farming.

Explain why.

[1]

[Total: 8]

END OF QUESTION PAPER



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