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OCR
RECOGNISING ACHIEVEMENT

Friday 15 June 2012 – Afternoon

GCSE TWENTY FIRST CENTURY SCIENCE CHEMISTRY A

A321/02   Unit 1: Modules C1 C2 C3 (Higher Tier)

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)

Duration: 40 minutes

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

* Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
* Use black ink. HB pencil may be used for graphs and diagrams only.
* Answer **all** the questions.
* 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).
* Do **not** write in the bar codes.

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**.
* This document consists of **16** pages. Any blank pages are indicated.

OCR is an exempt Charity

Turn over

Answer **all** the questions.

1 This question is about gases in the air.

  (a) The table shows information about gases in the air.

  Complete the table by filling in the empty boxes.

  Use the key below the table to help you.

Name	Percentage in air	Formula	Diagram
	1%		
carbon dioxide	very low		
	78%		
oxygen		O_2	

Key

  carbon   nitrogen   oxygen   argon

[4]

  (b) Carbon dioxide is released into the air when hydrocarbons burn. Water is also made.

  Pentane is a hydrocarbon.

  Complete the table below to balance the equation and show the atoms and molecules involved in the complete combustion of one molecule of pentane, C_5H_{12}.

	C_5H_{12} pentane	+	.... O_2 oxygen	→	5CO$_2$ carbon dioxide	+	.... H_2O water
Number of molecules	1		8		5		....
Number of carbon atoms	5		....		5		....
Number of hydrogen atoms	12		....		0		....
Number of oxygen atoms	0		....		10		....

[2]

(c) Burning fossil fuels adds other pollutant gases to the air, as well as carbon dioxide.

One of these pollutant gases is sulfur dioxide.

Name two other pollutant gases that are made when fossil fuels burn.

1 ....

2 ....   **[2]**

[Total: 8]

Turn over

2 Scientists want to know if there is a link between the concentration of sulfur dioxide in the air and the pH of rain water.

They measure the sulfur dioxide concentration in the air several times just before it rains on a number of days. On the same days they also collect some rain water and measure its pH.

They use these measurements to work out the mean values for sulfur dioxide concentration in the air and the pH of rain water.

They plot their results on a scatter graph.

concentration
of sulfur dioxide
in the air
in parts per billion

pH of rain water
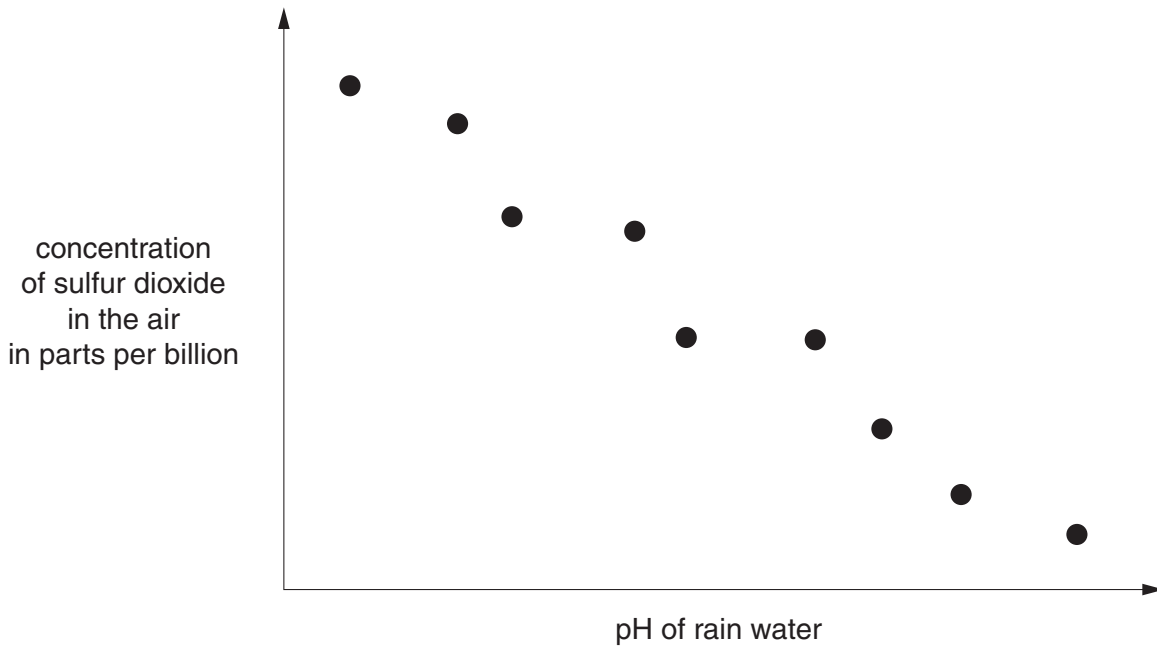
(a) Describe the relationship shown by the data.

....

.... **[1]**

(b) On each day the scientists take several measurements of sulfur dioxide concentration and pH.

The measurements taken on one day are shown in the table.

They were all taken in the same place at the same time.

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Best estimate
Concentration of sulfur dioxide in parts per billion	35	32	31	33	33	34	33
pH	5.3	5.4	5.0	5.1	3.4	5.2	

(i) Work out a best estimate for the pH.

best estimate for the pH = ... **[3]**

(ii) Measurements taken at the same place but one hour later were different.

Suggest reasons why.

....

....

....

.... **[2]**
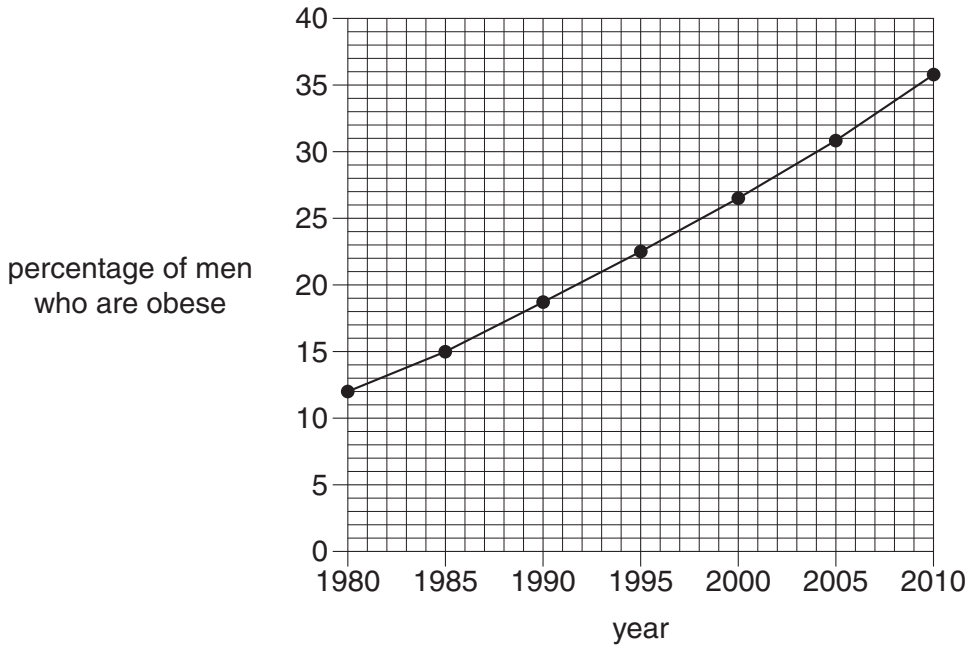
[Total: 6]

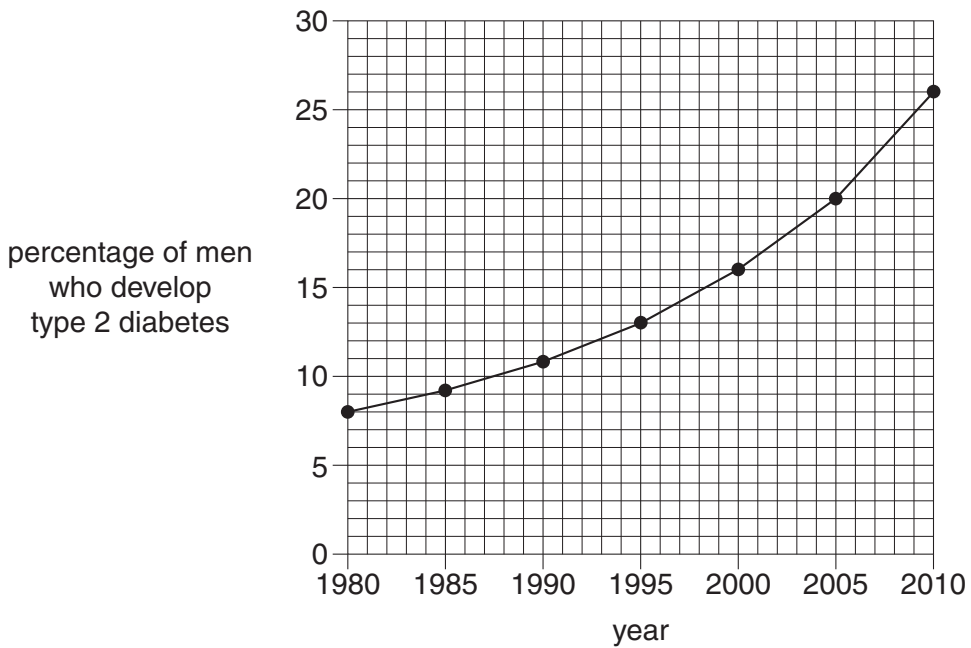**3** There are two types of diabetes, called type 1 and type 2.

Scientists investigate obesity and type 2 diabetes.

They look at data from a city for the period 1980 to 2010.

They look at the percentage of men who are obese.

They also look at the percentage of men who develop type 2 diabetes.

(a) What can the scientists conclude from these data?

Put ticks (✓) in the boxes next to the **two** correct statements.

Type 2 diabetes is caused by obesity. ☐

There is a correlation between the percentage of men who are obese and the percentage of men who develop type 2 diabetes. ☐

There is no connection between obesity and type 2 diabetes. ☐

As the percentage of men who are obese increases the percentage of men with type 2 diabetes increases. ☐

[1]

(b) A newspaper has this headline.

Obesity is a risk factor for type 2 diabetes

What does this statement mean?

....

....

.... **[2]**

(c) Obesity commonly results from poor diet and lack of exercise.

People can choose whether or not to follow the sort of lifestyle that may lead to obesity.

When making this choice a person may take into account information about type 2 diabetes.

What sort of information **about type 2 diabetes** should be considered when making this choice?

Put ticks (✓) in the boxes next to the **two** best statements.

The foods that are most likely to lead to obesity. ☐

The chance of an obese person developing type 2 diabetes. ☐

The other factors that may lead to the development of type 2 diabetes. ☐

The likely effects of type 2 diabetes on a person's health and lifespan. ☐

Other health issues that may arise from a person being obese. ☐

How the percentage of people with type 2 diabetes compares with those with type 1 diabetes. ☐

[2]

(d) Despite knowing that obesity is a risk factor in the development of type 2 diabetes, many people become obese.

Which of these statements give an explanation for this?

Put ticks (✓) in the boxes next to the **two** best explanations.

Some people may not be able to afford a healthy diet. ☐

The fact that obesity is a risk factor for diabetes has not been publicised enough. ☐

Type 2 diabetes is not a serious illness. ☐

Some people know the risk but choose to ignore it. ☐

The connection between lifestyle and obesity is not certain. ☐

[2]

[Total: 7]

4 Both polythene and glass are materials which can be used for making bottles to contain milk.

Scientists carry out Life Cycle Assessments to decide which type of material is better.

Table 1 shows part of the Life Cycle Assessment for the bottles.

It gives the mass of pollutant gases released into the air as each bottle is made.

Table 1

Pollutant gas		Mass of pollutant produced as bottles are made in g	
		Polythene	**Glass**
carbon dioxide	CO_2	1792	490
nitrogen oxides	NO_x	1.091	1.586
sulfur dioxide	SO_2	0.987	2.652
carbon monoxide	CO	0.670	0.057

(a) Use this data to compare the environmental impact of manufacturing bottles from these two materials.

....

....

....

.... **[2]**

(b) Glass bottles are collected, washed and refilled.

Polythene bottles are used only once.

Table 2 shows the energy used in making, filling and delivering bottles.

Table 2

	Polythene	**Glass**
Energy used to make a one litre bottle in MJ	4.7	7.2
Energy used to fill and deliver a one litre bottle in MJ	2.2	2.5

(i) The dairy delivers one bottle of milk every day for five days.

By reusing a glass bottle they can save about 15 MJ compared to using polythene bottles.

Show, with a calculation, that this is correct.

[3]

(ii) What do your calculations suggest about the sustainability of using these two types of bottle?

....

....

....

.... **[2]**

(iii) Which parts of a Life Cycle Assessment can be looked at using the data in Table 2?

Put ticks (✓) in the boxes next to the **two** correct statements.

The environmental impact of making the material. ☐

The energy input for making the material. ☐

The cost of disposal of the product. ☐

The energy input for making the product. ☐

The environmental impact of using the product. ☐

The energy input for using the product. ☐

[2]

[Total: 9]

Turn over

5 A company wants to replace the old plastic they use for making chairs with a new plastic.

Scientists test both the old plastic and the new plastic to see how well they can withstand the compression force put on a chair leg.

They place samples of plastic in a machine that pushes down with increasing force. Each sample measures 30 cm × 4 cm × 4 cm.

(a) The scientists used the same length and thickness of plastic for each sample.

Which statements explain why they did this?

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

All chair legs are made with this length and thickness. ☐

To see if the factor being investigated has an effect on the outcome, all other factors must be kept constant. ☐

They wanted to vary each factor in turn to see which has the most effect on the outcome. ☐

The machine could only accept plastic samples of this size. ☐

If another factor is varied this could change the results so that the effect of two types of plastic cannot be compared. ☐

Using samples of another size would have changed all of the results. ☐

[2]

(b) The table shows the force needed to make each sample bend.

	force needed to make sample bend in kN						
	sample 1	sample 2	sample 3	sample 4	sample 5	sample 6	best estimate
old plastic	543	526	533	521	552	541	536
new plastic	565	572	584	590	582	575	578

The scientists decide that there is a **real difference** between the strength of the old plastic and new plastic.

Which statements support this conclusion?

Put ticks (✓) in the boxes next to the **three** correct statements.

The range of the results for the old plastic does not overlap with the range for the new plastic. ☐

The ranges of the results for the old plastic and new plastic are similar. ☐

The best estimate for the new plastic is 42 kN higher than that for the old plastic. ☐

The range of the results for the old plastic does not include the value 578. ☐

The best estimate for the old plastic is not within the range of the new plastic. ☐

Neither set of results contains an outlier. ☐

[3]

[Total: 5]

6 The chemical metaldehyde kills slugs and helps to protect crops from damage.

In the United Kingdom farmers spread about 250 tonnes of metaldehyde pellets on their land every year.

Water companies measure the metaldehyde concentration in drinking water.

The European limit for metaldehyde is 0.1 micrograms/litre.

Levels found are sometimes close to the European limit and, on a few occasions, are slightly above the European limit.

(a) Which of these statements suggest that there is very little risk to health from metaldehyde in drinking water?

Put ticks (✓) in the boxes next to the **two** correct statements.

Metaldehyde helps to protect crops. ☐

The European limit is set well below the level that could cause harm to people. ☐

It is not possible for anything to be completely safe. ☐

People do not drink very much water. ☐

Water samples are rarely above the limit. ☐

[2]

(b) Use ideas of risk and benefit to suggest why metaldehyde is used by farmers.

....

....

....

....

....

.... **[3]**

(c) A pressure group wants the UK Government to ban the use of metaldehyde on farms.

They think that the Government should apply the **precautionary principle**.

Dora

It is best to make the amount of metaldehyde we take in as low as possible.

Albert

It is not possible for anything to be completely safe.

Barbara

The European permitted level of metaldehyde in drinking water is too low to cause any harm.

Colin

We cannot be certain whether the European permitted level of metaldehyde in drinking water will do us harm.

Edward

A concentration of 0.1 g / L will cause harm if the water is drunk regularly.

Faisal

Since the risk cannot be known for certain it would be better to avoid having any metaldehyde in drinking water.

Whose two opinions, when put together, describe how the precautionary principle could be applied to the use of metaldehyde on farms?

.... and .... **[2]**

[Total: 7]

END OF QUESTION PAPER

PLEASE DO NOT WRITE ON THIS PAGE