OCR
RECOGNISING ACHIEVEMENT

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A323/01

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

CHEMISTRY A

Unit 3 Ideas in Context plus C7 (Foundation Tier)

FRIDAY 23 MAY 2008

Afternoon

Time: 60 minutes

Candidates answer on the question paper.
Additional materials (enclosed):
Insert

Calculators may be used.
Additional materials: Pencil
Ruler (cm/mm)

CUP/T48789

Candidate Forename		Candidate Surname	
Centre Number		Candidate Number	

INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or 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.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **55**.
- The Periodic Table is printed on the back page.
- Where you see this icon you will be awarded a mark for the quality of written communication in your answer.

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
1	**13**	
2	**12**	
3	**10**	
4	**10**	
5	**10**	
TOTAL	**55**	

This document consists of **14** printed pages, **2** blank pages and an insert.

[Turn over

Answer **all** the questions.

1 This question is based on the article 'The Periodic Table'.

(a) Johann Dobereiner arranged elements into groups of three called Triads.

(i) Name the three elements in one Triad mentioned in the article.

1 .....

2 .....

3 ..... [2]

(ii) Dobereiner put the three elements in this Triad because they have similar properties.

Describe two of these similar properties.

1 .....

2 ..... [2]

(b) Newlands' 'Law of Octaves' was not accepted by other chemists.

Suggest why.

.....

.....

.....

..... [3]

(c) Look at the table **'Properties of some elements'**.

Mendeleev found a pattern of similar properties in every eighth element.

Use the properties of **three** elements to describe how the table shows this pattern.

.....

.....

.....

..... [2]

(d) Mendeleev said that some elements had not yet been discovered.

He predicted the properties of these elements.

Explain how these predictions helped his ideas to be accepted by other chemists.

.....

.....

..... [2]

(e) Many chemists suggested different patterns for the elements.

They all used the **same** data.

Suggest why these chemists could not agree.

.....

.....

.....

..... [2]

[Total: 13]

2 Manufacturers around the world are trying to find alternative fuels to petrol and diesel. This will stop drivers using up the world's fossil fuels. One alternative fuel is bio-ethanol, made by the fermentation of wheat or beet sugar.

Bio-ethanol can be mixed with petrol. When burned, this produces less carbon dioxide and other pollutants. Bio-ethanol also provides more energy and is a renewable energy source.

(a) Fermentation of carbohydrates by yeast produces a solution that is distilled to produce bio-ethanol.

(i) What are the optimum conditions for this fermentation?

One mark is for correct use of scientific terms.

.....

.....

..... [2+1]

(ii) Why is the solution distilled?

.....

..... [1]

(b) Ethanol can also be made from ethane. Ethane is obtained from natural gas.

(i) Outline the industrial method used to make ethanol from ethane.

.....

.....

.....

.....

..... [3]

(ii) Making ethanol by fermentation is more sustainable than making ethanol from ethane.

Explain why.

.....

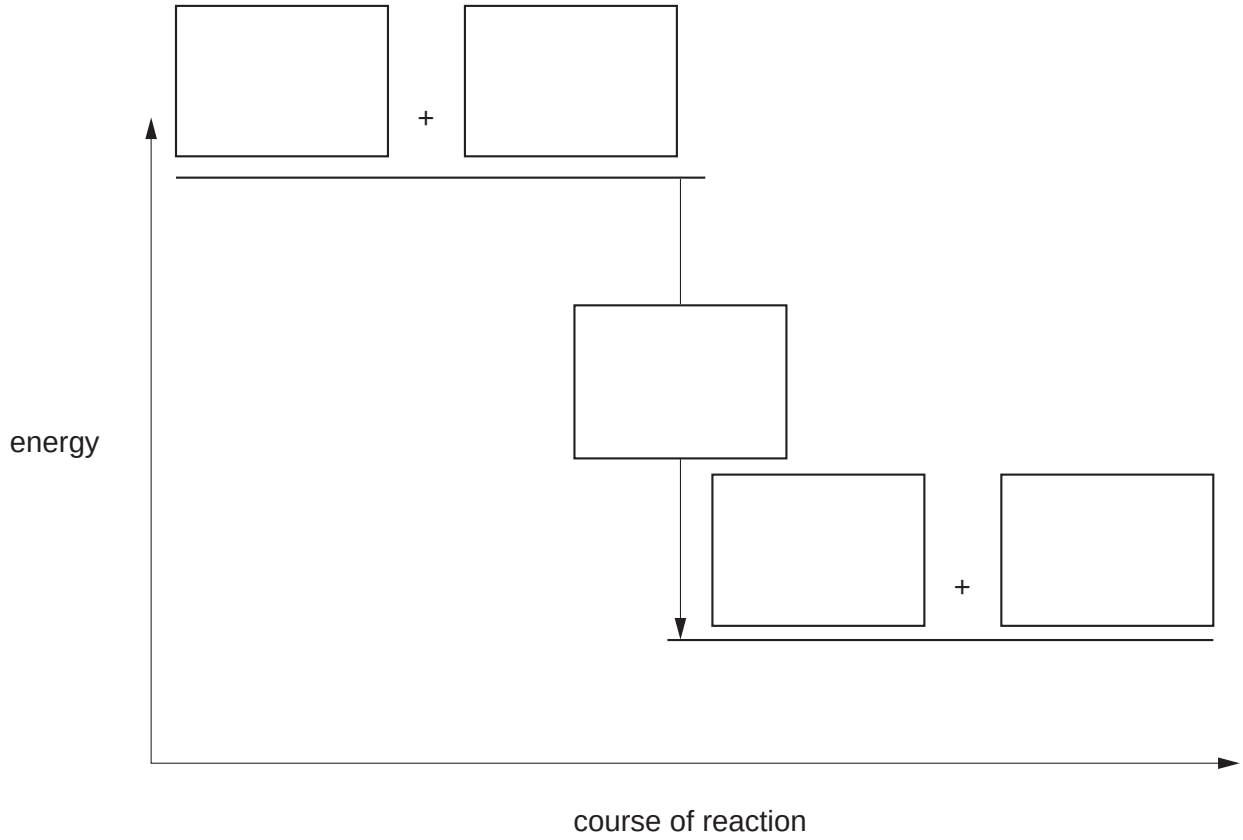
.....

..... [2]

(c) The burning of ethanol is an exothermic reaction.

Finish the energy level diagram for this reaction by writing the correct terms from the list in the boxes.

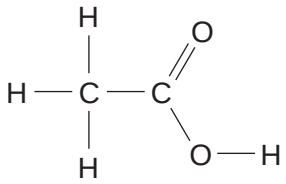
carbon dioxide **energy released** **energy absorbed** **ethanol** **oxygen** **water**



[3]

[Total: 12]

3 **(a)** Ethanoic acid is a weak acid. The diagram shows the structural formula of ethanoic acid.



What is the **molecular formula** of ethanoic acid?

..... [1]

(b) Ethanoic acid reacts with ethanol to produce ethyl ethanoate and water.

(i) Finish this word equation for the reaction.

…… + …… → ethyl ethanoate + …… [1]

(ii) To make ethyl ethanoate, ethanoic acid is mixed with ethanol and a strong acid. The mixture is then heated.

What job does the strong acid do?

..... [1]

(iii) Write down **two** uses of esters.

1 .....

2 ..... [2]

(c) In a solution of ethanoic acid there is a dynamic equilibrium.

$$CH_3COOH \rightleftharpoons CH_3COO^- + H^+$$

(i) What does the $\rightleftharpoons$ sign show about this reaction?

..... [1]

(ii) Complete these sentences to explain why this is a **dynamic equilibrium**.

Use words from this list.

atoms forward increasing ions

constant molecules reverse water

When ethanoic acid is dissolved in water, water molecules react

with acid …… to make ions.

Some of these ions react together to make ethanoic acid

and …… molecules.

At first, the rate of the forward reaction is higher than

the rate of the …… reaction.

After a while, the rates of the two reactions become equal.

The forward and reverse reactions are still taking place,

but the concentrations of ethanoic acid and the two ions are …… .

[4]

[Total: 10]

4 Gemma works for a company making vinegar.

She measures the amount of ethanoic acid in 25 cm^3 samples of the company's product.

She carries out a titration using a standard solution of sodium hydroxide and an indicator.

(a) Gemma makes her standard solution of sodium hydroxide to use for her titration.

The statements describe how she makes up this solution. They are in the wrong order.

A Rinse all of the solution from the beaker using more distilled water.

B Place a stopper in the graduated flask and shake it.

C Dissolve the sodium hydroxide in a small volume of distilled water in a beaker.

D Accurately weigh 1.0 g of sodium hydroxide.

E Transfer the solution to a 250 cm^3 graduated flask.

F Add more distilled water up to the volume mark on the graduated flask.

(i) Write the letters of these statements in the boxes to show the correct order.

The first and last have been done for you.

D					B

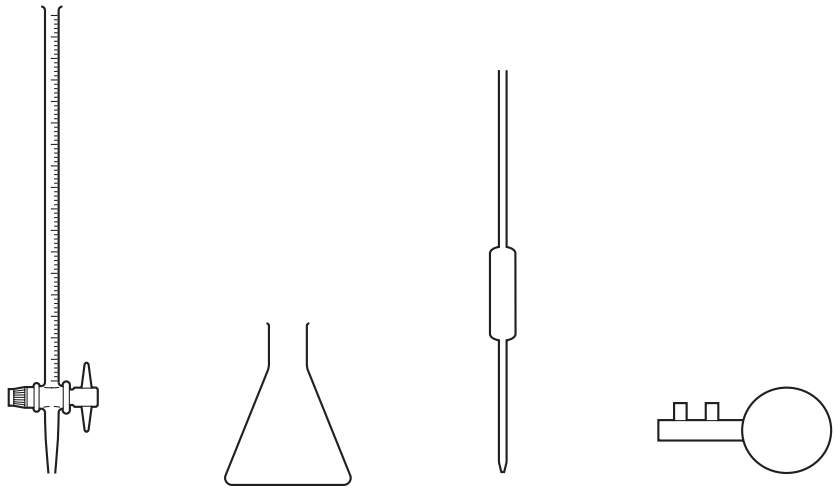
[3]

(ii) Why does she shake the flask in step **B**?

.....

..... [1]

(b) Gemma uses this apparatus.



burette conical flask pipette pipette filler

(i) Gemma fills the burette with sodium hydroxide solution.

What does she put into the conical flask?

..... [1]

(ii) Why does she use a pipette instead of a measuring cylinder?

..... [1]

(iii) Where does she put the indicator?

..... [1]

(iv) Why does she use a pipette filler?

..... [1]

(c) Gemma carries out six titrations in the morning and six more in the afternoon.

All of the samples she tests are from the same vinegar.

Her results are shown in the table.

	volume of sodium hydroxide solution / cm^3					
morning	12.9	12.2	12.5	12.8	12.9	12.1
afternoon	12.4	12.6	12.5	12.5	12.4	12.6

Gemma decides to use the results she obtained in the afternoon to calculate the concentration of ethanoic acid in the vinegar.

Explain why she chose the afternoon set of results.

.....

.....

..... [2]

[Total: 10]

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Question 5 begins on page 12.

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5 Phosphoric acid is manufactured in large quantities.

The most common process uses a feedstock of phosphate rock. The rock is first crushed and then reacted with concentrated sulfuric acid.

$$\text{calcium phosphate} + \text{sulfuric acid} \longrightarrow \text{phosphoric acid} + \text{calcium sulfate}$$

The insoluble calcium sulfate is separated from the phosphoric acid by filtration.

Calcium sulfate is a useful by-product. It is dried and crushed into powder ready to be sold.

The dilute phosphoric acid formed is concentrated by evaporation.

The final concentrated acid is analysed to find its concentration and measure any impurities.

(a) Phosphoric acid is called a '**bulk**' chemical.

Explain why.

.....

..... [1]

(b) The manufacture of most industrial chemicals involves a number of stages.

Briefly describe how each of the stages in the manufacture of phosphoric acid is carried out.

preparation of feedstock

.....

synthesis

.....

separation of products

.....

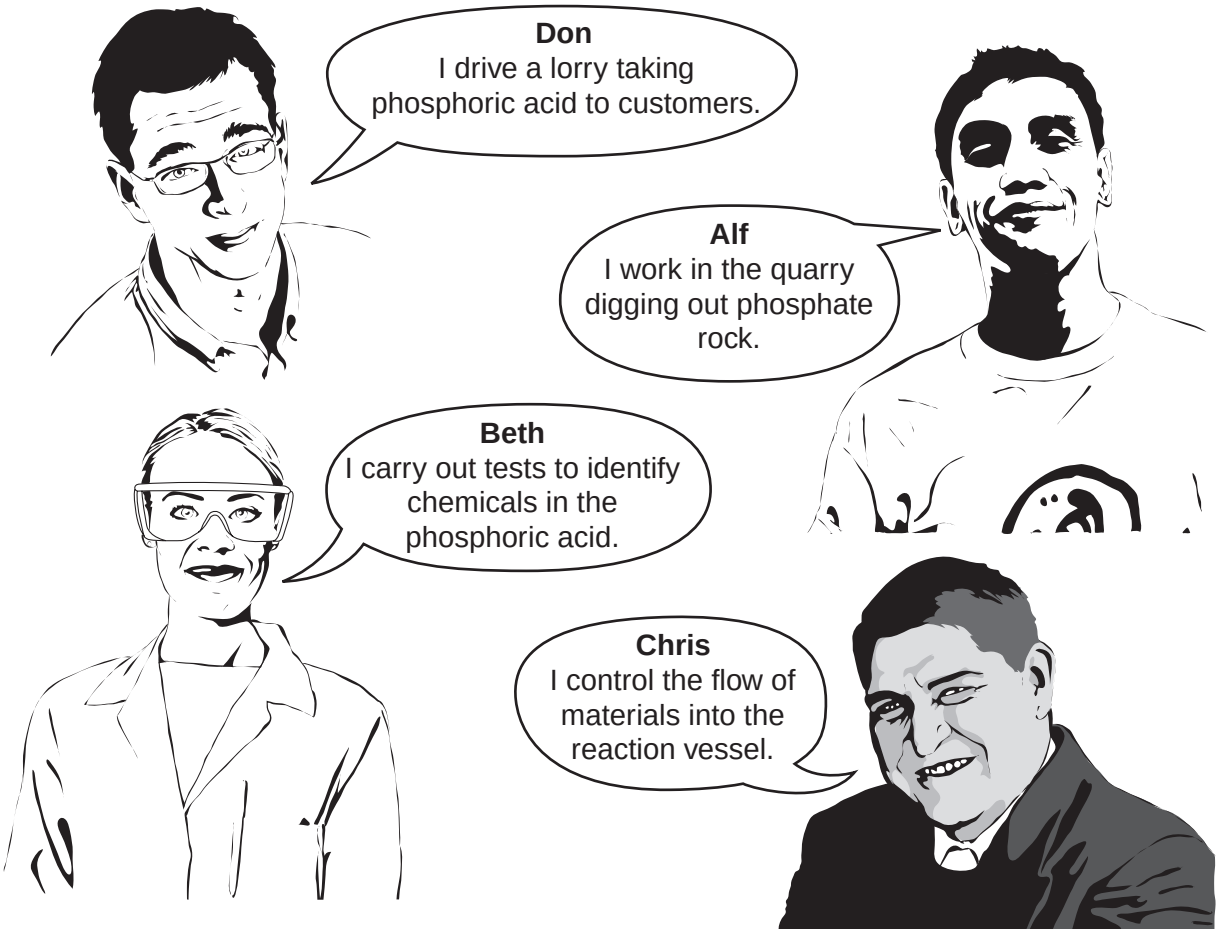
handling of by-products

.....

monitoring of purity

..... [5]

(c) Some of the people involved in the manufacture of phosphoric acid describe their jobs.



(i) Who tests the purity of the phosphoric acid?

..... [1]

(ii) Explain your answer.

.....

..... [1]

(d) The sustainability of a chemical manufacturing process depends on a number of factors.

List **two** things which affect the sustainability of a chemical manufacturing process.

1 .....

2 ..... [2]

[Total: 10]

END OF QUESTION PAPER

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The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.*

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.