

Write your name here	
Surname	Other names
Centre Number	Candidate Number
Edexcel GCSE Chemistry Unit C3: Chemistry in Action	
Higher Tier	
Thursday 23 May 2013 – Morning Time: 1 hour	Paper Reference 5CH3H/01
You must have: Calculator, ruler	Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
– *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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PEARSON

The Periodic Table of the Elements

1	2	3					4	5	6	7	0
		1Hhydrogen1									
Key											
		relative atomic mass atomic symbol atomic (proton) number									
7	9										
Li lithium 3	Be beryllium 4										
23	24										
Na sodium 11	Mg magnesium 12										
39	40	45	48	51	52	55	56	59	63.5	65	
K potassium 19	Ca calcium 20	Sc scandium 21	Ti titanium 22	V vanadium 23	Cr chromium 24	Mn manganese 25	Fe iron 26	Co cobalt 27	Ni nickel 28	Zn zinc 30	
85	88	89	91	93	96	[98]	101	103	106	112	
Rb rubidium 37	Sr strontium 38	Y yttrium 39	Zr zirconium 40	Nb niobium 41	Mo molybdenum 42	Tc technetium 43	Ru ruthenium 44	Rh rhodium 45	Pd palladium 46	Cd cadmium 48	
133	137	139	178	181	184	186	190	192	195	201	
Cs cesium 55	Ba barium 56	La* lanthanum 57	Hf hafnium 72	Ta tantalum 73	W tungsten 74	Re rhenium 75	Os osmium 76	Ir iridium 77	Pt platinum 78	Hg mercury 80	
[223]	[226]	[227]	[261]	[262]	[266]	[264]	[277]	[268]	[271]	[272]	
Fr francium 87	Ra radium 88	Ac* actinium 89	Rf rutherfordium 104	Db dubnium 105	Sg seaborgium 106	Bh bohrium 107	Hs hassium 108	Mt meitnerium 109	Ds darmstadtium 110	Rg roentgenium 111	
Elements with atomic numbers 112-116 have been reported but not fully authenticated											

* 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.



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Questions begin on next page.



P 4 1 9 4 1 A 0 3 2 0

Answer ALL questions

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Electrolysis

1 (a) The ions in sodium chloride solution are

sodium ions, Na^+
chloride ions, Cl^-
hydrogen ions, H^+
hydroxide ions, OH^-

Sodium chloride solution is electrolysed using a direct electric current.

(i) Which of these ions will be attracted to the cathode during the electrolysis of sodium chloride solution?

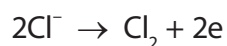
Put a cross (☒) in the box next to your answer.

(1)

- ☐ **A** H^+ ions only
- ☐ **B** H^+ and Na^+ ions
- ☐ **C** Cl^- ions only
- ☐ **D** Cl^- and OH^- ions

(ii) Chlorine is one of the products of the electrolysis.

The half-equation for the production of chlorine is



Explain how the half-equation shows that chloride ions are oxidised.

(2)

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(iii) Suggest why the solution remaining at the end of the electrolysis is alkaline.

(1)

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.....



(iv) The electrolysis of sodium chloride solution does not produce metallic sodium.

State what change you would make to the electrolyte to obtain metallic sodium.

(1)

(b) (i) When copper sulfate solution is electrolysed using inert electrodes, oxygen is formed at the positively charged anode.

Explain how the oxygen is formed from ions in the solution.

(2)

(ii) The other product is copper.

1.27 g of copper were produced in an experiment.

Calculate the number of moles of copper, Cu, produced in this experiment.

(Relative atomic mass: Cu = 63.5)

(1)

amount of copper produced = ... mol

(Total for Question 1 = 8 marks)



P 4 1 9 4 1 A 0 5 2 0

Organic chemistry

2 (a) (i) Which of the following is the formula for a molecule of butane?

Put a cross (☒) in the box next to your answer.

(1)

- ☐ **A** C_3H_6
- ☐ **B** C_3H_8
- ☐ **C** C_4H_8
- ☐ **D** C_4H_{10}

(ii) Draw the structure of a molecule of propene, showing all covalent bonds.

(2)

(b) Complete the sentence by putting a cross (☒) in the box next to your answer.

Ethanol, C_2H_5OH , can be converted into ethanoic acid, CH_3COOH .

In this reaction, ethanol is

(1)

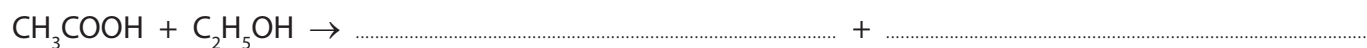
- ☐ **A** dehydrated
- ☐ **B** neutralised
- ☐ **C** oxidised
- ☐ **D** reduced



(2)

(2)

Complete the balanced equation for this reaction.



(Total for Question 2 = 8 marks)



Ethanol

- 3 (a) Ethanol can be produced by reacting ethene with steam.

Write the balanced equation for this reaction.

(2)

- (b) Ethanol can also be produced by fermentation.

Describe how ethanol can be produced from sugar by fermentation.

(2)

- (c) A country has large amounts of available fertile land.

It has no reserves of crude oil.

It is not a wealthy country.

Explain why this country produces the ethanol it needs by fermentation rather than from ethene.

(3)



- (d) Ethanol is a member of the homologous series of alcohols.
The first three members of the series are

methanol CH_3OH

ethanol $\text{C}_2\text{H}_5\text{OH}$

propanol $\text{C}_3\text{H}_7\text{OH}$

Use the formulae of these molecules to explain why these alcohols are members of the same homologous series.

(2)

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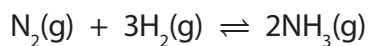
(Total for Question 3 = 9 marks)



P 4 1 9 4 1 A 0 9 2 0

Ammonia

- 4 When nitrogen and hydrogen react to form ammonia, the reaction can reach a dynamic equilibrium.



- (a) Explain what is meant by a **dynamic equilibrium**.

(2)

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- (b) In industry, the reaction between nitrogen and hydrogen is affected by the conditions used.

- (i) The pressure used is 250 atmospheres.

Explain how the use of a higher pressure would affect the equilibrium yield of ammonia.

(2)

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- (ii) The reaction between nitrogen and hydrogen to form ammonia is exothermic. The temperature used is 450 °C.

Explain how the use of a lower temperature would affect the equilibrium yield of ammonia.

(2)

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(iii) Even at 450°C, the reaction is very slow.

State what is used in industry to overcome this problem.

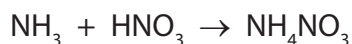
(1)

(c) (i) Calculate the minimum volume of hydrogen required to completely convert 1000 dm³ of nitrogen into ammonia.

(1)

volume of hydrogen = ... dm³

(ii) Ammonia is reacted with excess nitric acid, HNO₃, to make ammonium nitrate, NH₄NO₃.



Calculate the mass of ammonium nitrate produced by the complete reaction of 34 g of ammonia.

(Relative atomic masses H = 1.0, N = 14, O = 16)

(3)

mass of ammonium nitrate produced = ... g

(Total for Question 4 = 11 marks)



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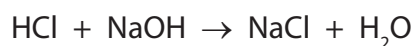


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Using titration

- 5 Titration can be used to determine the exact amount of hydrochloric acid that reacts with a given amount of sodium hydroxide solution.



- (a) What type of reaction takes place when hydrochloric acid reacts with sodium hydroxide solution?

(1)

Put a cross (☒) in the box next to your answer.

- ☐ **A** neutralisation
- ☐ **B** oxidation
- ☐ **C** precipitation
- ☐ **D** reduction

- (b) Suggest why universal indicator must not be used in titration experiments.

(1)





(6)

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(d) Sodium hydroxide solution is titrated with dilute hydrochloric acid.

The results of the experiment are

volume of sodium hydroxide solution = 25.0 cm³

volume of 0.100 mol dm⁻³ hydrochloric acid used

rough titration = 23.1 cm³

1st titration = 22.6 cm³

2nd titration = 22.8 cm³

- (i) State the volume of hydrochloric acid that must be used to calculate the concentration of sodium hydroxide solution.

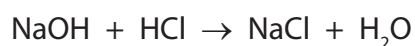
(1)

volume of hydrochloric acid = ... cm³

- (ii) In a different experiment, 25.0 cm³ of sodium hydroxide solution reacted with 23.2 cm³ of 0.100 mol dm⁻³ hydrochloric acid, HCl.

Calculate the concentration of this sodium hydroxide solution, NaOH, in mol dm⁻³.

(3)



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concentration of sodium hydroxide solution = ... mol dm⁻³

(Total for Question 5 = 12 marks)



P 4 1 9 4 1 A 0 1 5 2 0

Identifying salts

6 (a) Substance **X** is an ammonium salt.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

A test was carried out to find which anion is present in substance **X**.

Dilute hydrochloric acid was added to a sample of substance **X**.

There was effervescence and the gas given off turned limewater milky.

The anion present in substance **X** is

(1)

☐ **A** carbonate ion, CO_3^{2-}

☐ **B** chloride ion, Cl^-

☐ **C** nitrate ion, NO_3^-

☐ **D** sulfate ion, SO_4^{2-}

(ii) Describe how sodium hydroxide solution can be used to show that ammonium ions are present in substance **X**.

(2)

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(b) Aluminium ions, Al^{3+} , react with hydroxide ions in solution to give a white precipitate of aluminium hydroxide.

Write the ionic equation for this reaction.

(3)

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