

Write your name here	
Surname	Other names
Centre Number	Candidate Number
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Edexcel GCE	
Chemistry	
Advanced Subsidiary	
Unit 3B: Chemistry Laboratory Skills I Alternative	
Thursday 13 May 2010 – Morning Time: 1 hour 15 minutes	Paper Reference 6CH07/01
Candidates may use a calculator.	Total Marks
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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 50.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*
- You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically, including your use of grammar, punctuation and spelling.
- A Periodic Table is printed on the back cover of this paper.

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.

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Answer ALL the questions. Write your answers in the spaces provided.

1 Compound **A** is a white solid that contains one Group 1 cation and one anion.

(a) (i) Describe how you would carry out a flame test on compound **A**.

(3)

.....

.....

.....

.....

.....

.....

(ii) In a flame test, compound **A** gives a red flame. Deduce the formula of the cation present.

(1)

.....

(b) On prolonged strong heating, compound **A** forms a white solid, **B**, and a gas. The gas turns limewater milky.

(i) Identify, by name or formula, the compound that is dissolved in water to make limewater.

(1)

.....

(ii) Suggest the formula for the anion in compound **A**. Justify your answer.

(2)

.....

.....

.....



(c) When water is added to the white solid, **B**, it dissolves completely and exothermically to form solution **C**.

(i) Identify, by name or formula, the anion present in **B**.

(1)

(ii) Identify, by name or formula, the anion present in **C**.

(1)

(iii) Suggest a test for the anion present in **C**. Give the result of your test.

(2)

Test

Result

(d) Suggest the **formula** of compound **A**.

(1)

(Total for Question 1 = 12 marks)



2 This question is about two isomeric halogenoalkanes, **P** and **Q**.

(a) A hot aqueous solution of silver nitrate is added to each halogenoalkane. Both halogenoalkanes react to form a yellow precipitate.

(i) Identify, by name or formula, this yellow precipitate.

(1)

(ii) The isomers have relative molecular mass 169.9. Deduce the molecular formula of the isomers.

(1)

(iii) Halogenoalkane **P** forms the yellow precipitate faster than halogenoalkane **Q**. Draw a displayed formula for halogenoalkane **P**.

(1)

(iv) Give the name or structural formula of the alcohol, **R**, formed by the reaction of halogenoalkane, **P**, with hot aqueous silver nitrate.

(1)



(b) When **R** is boiled with a mixture of potassium dichromate(VI) and dilute sulfuric acid, the organic product **S** forms.

(i) Give the colour change you would expect to see. (2)

From **to**

(ii) Give the **name** of **S**. (1)

(iii) Give the type of reaction involved in the conversion of **R** to **S**. (1)

(Total for Question 2 = 8 marks)



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3 The purity of a sample of potassium iodate(V) was determined by titration.

The steps of the experimental procedure are as follows.

1. 0.100 g of the sample was dissolved in water in a beaker and the solution made up to 100 cm³ in an appropriate flask.
2. A 10.0 cm³ portion of this solution of potassium iodate(V) was transferred to a conical flask.
3. An excess of both potassium iodide solution and sulfuric acid were then added to the conical flask. This produced a solution, **T**, containing iodine.
4. Solution **T** was titrated with 0.0200 mol dm⁻³ sodium thiosulfate solution using a suitable indicator.
5. Steps 2, 3 and 4 were repeated twice.

(a) (i) Name the piece of apparatus used to remove the 10.0 cm³ portions of potassium iodate(V) solution (step 2).

(1)

(ii) Name the indicator you would use for the titration and give the colour change you would expect to see (step 4).

(2)

Indicator

Colour change from to

(b) The following results were obtained for the titrations.

Titration number	1	2	3
Final burette reading / cm ³	19.50	33.20	46.95
Initial burette reading / cm ³	5.00	19.50	33.20
Titre / cm ³			

(i) Complete the table by calculating the titres.

(1)



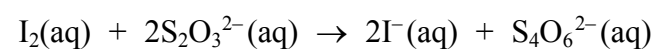
(ii) Explain why the correct value for the mean titre is 13.73 cm³.

(1)

(iii) Calculate the number of moles of sodium thiosulfate in the mean titre.

(1)

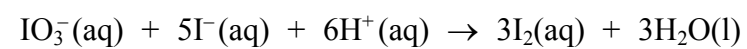
(c) The ionic equation for the reaction between iodine and sodium thiosulfate in the titration is shown below.



Calculate the number of moles of iodine in solution **T** using this equation and your answer to (b)(iii).

(1)

(d) The ionic equation for the reaction of iodate(V) ions with iodide ions is shown below.



Using this equation and your answer to (c), calculate the number of moles of iodate(V) ions which reacted to produce solution **T**.

(1)



(e) (i) Name the appropriate flask used in step 1.

(1)

(ii) Describe how you would make up exactly 100 cm³ of potassium iodate(V) solution in this flask, ready for step 2.

(3)

(iii) Calculate the number of moles of potassium iodate(V) in 100 cm³ of the solution, using your answer to (d).

(1)

(iv) Calculate the mass of potassium iodate(V) in the sample.

[Assume the molar mass of potassium iodate(V) is 214 g mol⁻¹]

(1)

(v) Calculate the percentage purity of the sample.

(1)

(f) Suggest the most significant hazard in step 3.

(1)

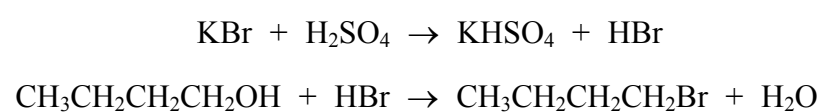
(Total for Question 3 = 16 marks)



- 4 An experiment to prepare 0.100 mol of 1-bromobutane uses the reaction of butan-1-ol with hydrogen bromide.

Hydrogen bromide is formed in the reaction mixture from potassium bromide and moderately concentrated sulfuric acid.

The process has an 80 % yield after purification of the 1-bromobutane.



The steps of the experimental procedure are as follows.

1. Add measured amounts of potassium bromide and butan-1-ol to 10 cm³ of water into a 50 cm³ two-necked flask.
2. Fit the two-necked flask with a reflux condenser and a tap funnel.
3. Immerse the flask in a beaker of cold water and add 10 cm³ of concentrated sulfuric acid from the tap funnel, a few drops at a time.
4. Remove the flask from the cold water and close the tap on the tap funnel. Heat the mixture under reflux for 30 minutes.
5. Allow the mixture to cool. Then set up the apparatus for distillation. Boil the mixture and collect the distillate in a measuring cylinder.
6. Transfer the distillate to a separating funnel. The distillate consists of two layers, an aqueous layer and impure 1-bromobutane. Separate the two layers.
7. Wash the impure 1-bromobutane with concentrated hydrochloric acid and separate the two layers.
8. Wash the 1-bromobutane layer with sodium hydrogencarbonate solution, releasing any gas formed.
9. Collect the 1-bromobutane layer in a conical flask and add anhydrous sodium sulfate.
10. Decant the 1-bromobutane into a 50 cm³ flask.

Data

Property	Butan-1-ol	1-bromobutane	Water
Density / g cm ⁻³	0.81	1.3	1.0
Molar mass / g mol ⁻¹	74	137	18
Boiling temperature / °C	117.3	101.7	100.0



(a) (i) Show, by calculation, that 0.125 mol of butan-1-ol is needed to make 0.100 mol of 1-bromobutane.

(2)

(ii) Calculate the volume of 0.125 mol of butan-1-ol, in cm^3 .

(2)

(iii) Calculate the minimum mass of potassium bromide required in step 1.

[The molar mass of potassium bromide is 119 g mol^{-1}]

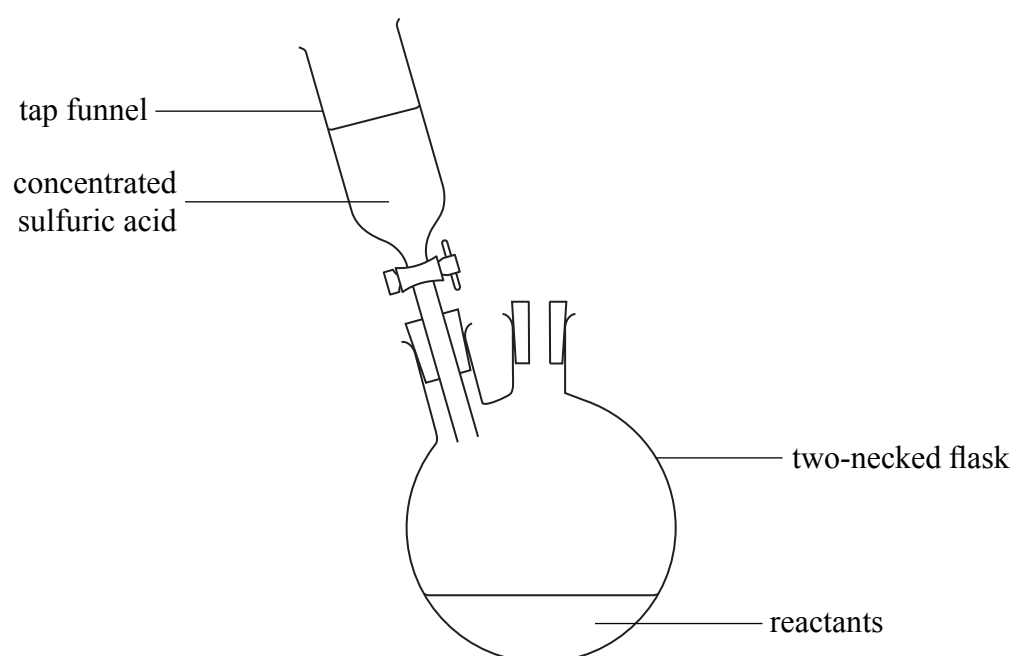
(1)



(b) Complete and label the diagram below of the apparatus assembled in steps 1, 2 and 3.

[You may assume that the apparatus is suitably clamped.]

(4)



(c) (i) State, with a reason, whether the upper or lower layer contains 1-bromobutane in step 6.

(1)

(ii) The product is washed with concentrated hydrochloric acid in step 7 to remove unreacted butan-1-ol. In step 8, why is the product then washed with sodium hydrogencarbonate solution and what causes a build up of gas?

(2)

(d) (i) What further step is necessary to purify the 1-bromobutane obtained in step 10?

(1)

(ii) How does the step in (d)(i) give information about the purity of the product?

(1)

(Total for Question 4 = 14 marks)

TOTAL FOR PAPER = 50 MARKS



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The Periodic Table of Elements

1	2	3	4	5	6	7	0 (8)
6.9 Li lithium 3	9.0 Be beryllium 4	(13) 10.8 B boron 5	(14) 12.0 C carbon 6	(15) 14.0 N nitrogen 7	(16) 16.0 O oxygen 8	(17) 19.0 F fluorine 9	(18) 20.2 Ne neon 10
23.0 Na sodium 11	24.3 Mg magnesium 12	(13) 27.0 Al aluminium 13	(14) 28.1 Si silicon 14	(15) 31.0 P phosphorus 15	(16) 32.1 S sulfur 16	(17) 35.5 Cl chlorine 17	(18) 39.9 Ar argon 18
39.1 K potassium 19	40.1 Ca calcium 20	(13) 69.7 Ga gallium 31	(14) 72.6 Ge germanium 32	(15) 74.9 As arsenic 33	(16) 79.0 Se selenium 34	(17) 79.9 Br bromine 35	(18) 83.8 Kr krypton 36
85.5 Rb rubidium 37	87.6 Sr strontium 38	(13) 114.8 In indium 49	(14) 118.7 Sn tin 50	(15) 121.8 Sb antimony 51	(16) 127.6 Te tellurium 52	(17) 126.9 I iodine 53	(18) 131.3 Xe xenon 54
132.9 Cs caesium 55	137.3 Ba barium 56	(13) 204.4 Tl thallium 81	(14) 207.2 Pb lead 82	(15) 209.0 Bi bismuth 83	(16) [209] Po polonium 84	(17) [210] At astatine 85	(18) [222] Rn radon 86
[223] Fr francium 87	[226] Ra radium 88	(13) 45.0 Sc scandium 21	(14) 47.9 Ti titanium 22	(15) 50.9 V vanadium 23	(16) 52.0 Cr chromium 24	(17) 54.9 Mn manganese 25	(18) 55.8 Fe iron 26
		(13) 88.9 Y yttrium 39	(14) 91.2 Zr zirconium 40	(15) 92.9 Nb niobium 41	(16) 95.9 Mo molybdenum 42	(17) 98 Tc technetium 43	(18) 101.1 Ru ruthenium 44
		(13) 138.9 La* lanthanum 57	(14) 178.5 Hf hafnium 72	(15) 180.9 Ta tantalum 73	(16) 183.8 W tungsten 74	(17) 186.2 Re rhenium 75	(18) 190.2 Os osmium 76
		(13) [227] Ac* actinium 89	(14) [261] Rf rutherfordium 104	(15) [262] Db dubnium 105	(16) [266] Sg seaborgium 106	(17) [264] Bh bohrium 107	(18) [277] Hs hassium 108
		(13) 140 Ce cerium 58	(14) 141 Pr praseodymium 59	(15) 144 Nd neodymium 60	(16) 150 Sm samarium 62	(17) 152 Eu europium 63	(18) 159 Tb terbium 65
		(13) 232 Th thorium 90	(14) [231] Pa protactinium 91	(15) 238 U uranium 92	(16) [242] Pu plutonium 94	(17) [243] Am americium 95	(18) [245] Bk berkelium 97
		(13) 140 Ce cerium 58	(14) 141 Pr praseodymium 59	(15) 144 Nd neodymium 60	(16) 150 Sm samarium 62	(17) 152 Eu europium 63	(18) 159 Tb terbium 65
		(13) 163 Dy dysprosium 66	(14) 165 Ho holmium 67	(15) 167 Er erbium 68	(16) 173 Yb ytterbium 70	(17) 175 Lu lutetium 71	
		(13) 232 Th thorium 90	(14) [231] Pa protactinium 91	(15) 238 U uranium 92	(16) [242] Pu plutonium 94	(17) [243] Am americium 95	(18) [245] Bk berkelium 97
		(13) 163 Dy dysprosium 66	(14) 165 Ho holmium 67	(15) 167 Er erbium 68	(16) 173 Yb ytterbium 70	(17) 175 Lu lutetium 71	
		(13) 254 Fm fermium 100	(14) [254] Es einsteinium 99	(15) [256] Md mendelevium 101	(16) [254] No nobelium 102	(17) [257] Lr lawrencium 103	

Elements with atomic numbers 112-116 have been reported but not fully authenticated

* Lanthanide series

* Actinide series

