

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	
Monday 11 January 2010 – Afternoon 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 cation and one anion.

(a) A flame test is carried out on compound A by mixing the solid with concentrated hydrochloric acid and using a piece of wire to place some of the solution formed in a Bunsen flame. The flame is coloured yellow.

(i) Name a material from which the wire is made.

Suggest ONE reason why this material is used.

(2)

Name.....

Reason.....

(ii) Identify, by name or formula, the cation present in compound A.

(1)

(b) When aqueous silver nitrate solution is added to a solution of compound A, a cream precipitate forms. The cream precipitate dissolves in concentrated aqueous ammonia solution.

(i) **Name** the cream precipitate formed when aqueous silver nitrate is added to the solution of compound A.

(1)

(ii) Give the **formula** of the anion in compound A.

(1)

(iii) Describe what you would see if the cream precipitate in (b)(i) was left in sunlight.

(1)



(c) Concentrated sulfuric acid is added to compound A in a test tube. Steamy fumes are seen at the mouth of the test tube.

After a few minutes, the contents of the test tube turn brown. A gas is given off which is tested with a piece of filter paper soaked in a solution of aqueous acidified potassium dichromate(VI). The paper turns green.

(i) Identify, by name or formula, the steamy fumes formed initially. (1)

(ii) Describe a further test you could carry out to confirm the identity of the steamy fumes. Give the result of your test. (2)

Test

Result

(iii) Identify, by name or formula, the substance responsible for the brown colour in the test tube. (1)

(iv) Name the gas which turned the filter paper green. Suggest the type of reaction by which this gas was formed from sulfuric acid. (2)

Gas

Type of reaction

(Total for Question 1 = 12 marks)



2 This question is about two isomeric alcohols, **X** and **Y**, each with molar mass 60 g mol^{-1} .

A solution of potassium dichromate(VI) in dilute sulfuric acid is added to each alcohol. Both alcohols cause the same colour change of the mixture on heating.

(a) A colourless liquid, **B**, is distilled from the mixture containing alcohol **X**.

The liquid **B** forms a red precipitate when it is boiled with Benedict's or Fehling's solution.

Give the displayed formula of liquid **B**, and the name of alcohol **X**.

(2)

Liquid **B**

Name of alcohol **X**

(b) A colourless liquid, **C**, is distilled from the mixture containing alcohol **Y**.

C does **not** react when it is boiled with Benedict's or Fehling's solution.

Give the **names** of liquid **C** and alcohol **Y**.

(2)

Liquid **C**

Alcohol **Y**

(Total for Question 2 = 4 marks)



3 This question is about calcium hydroxide, Ca(OH)_2 .

The solubility of calcium hydroxide in water can be found by titrating a saturated solution of calcium hydroxide with hydrochloric acid of known concentration.

(a) Describe how you would make a saturated solution of calcium hydroxide suitable for use in this titration. Do not describe the subsequent titration procedure.

(2)

.....

.....

.....

(b) 10.0 cm^3 portions of the saturated solution are placed in a conical flask and titrated with $0.0500 \text{ mol dm}^{-3}$ hydrochloric acid added from a burette.

(i) Name the apparatus used to measure the 10.0 cm^3 portions.

(1)

.....

(ii) Suggest a suitable indicator for this titration and state the colour change you would expect to see at the end-point.

(2)

Indicator

Colour change from to



(c) The following results were obtained:

Titration numbers	1	2	3
Final burette reading / cm^3	19.20	28.05	37.10
Initial burette reading / cm^3	10.00	19.20	28.15
Titre / cm^3	9.20	8.85	

(i) Fill in the third titre value in the table. (1)

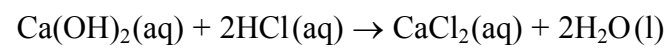
(ii) Suggest why the first titre should be disregarded. (1)

(iii) Calculate the mean titre. (1)

..... cm^3
(iv) Calculate the number of moles of hydrochloric acid in the mean titre. (1)



(v) The equation for the reaction is



Calculate the number of moles of calcium hydroxide in a 10.0 cm^3 portion of the saturated solution.

(1)

(vi) Calculate the concentration of calcium hydroxide in mol dm^{-3} .

(1)

(vii) Calculate the solubility of calcium hydroxide in g dm^{-3} .

(1)



(d) The standard enthalpy change for the reaction of calcium hydroxide with hydrochloric acid was found by reacting 0.0100 mol of solid calcium hydroxide with 50.0 cm³ of a 1.00 mol dm⁻³ solution of hydrochloric acid (an excess), in a polystyrene cup. The temperature rose from 21.2 °C to 26.7 °C.

(i) Calculate the energy, in joules, transferred in the reaction. Use the expression

$$\text{Energy transferred} = \text{mass} \times \text{specific heat capacity} \times \text{temperature change}$$

[Assume density of solution = 1.0 g cm⁻³,
specific heat capacity of solution = 4.18 J g⁻¹ °C⁻¹]

(1)

(ii) Calculate the standard enthalpy change, ΔH^\ominus , for the reaction. Include a sign and units in your answer.

(2)

(iii) Calculate the percentage error in the temperature change caused by an uncertainty of 0.1 °C in each thermometer reading.

(2)



(iv) The experiment was repeated using 50.0 cm^3 of a 1.00 mol dm^{-3} solution of nitric acid instead of the hydrochloric acid. Explain why the temperature change was the same in both experiments.

(1)

(v) The experiment was repeated again using 25 cm^3 of 2.00 mol dm^{-3} hydrochloric acid. Predict the temperature change in this experiment.

(1)

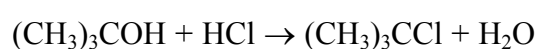
(vi) Which of the experiments in (iv) and (v) gave the least error in the temperature change? Justify your answer.

(1)

(Total for Question 3 = 20 marks)



- 4 An experiment to prepare a sample of 2-chloro-2-methylpropane uses the reaction of 2-methylpropan-2-ol with concentrated hydrochloric acid.



The steps of the experimental procedure are as follows

1. Place 0.20 mol of 2-methylpropan-2-ol and 70 cm³ of concentrated hydrochloric acid in a large conical flask.
2. Stopper and shake the flask at intervals, releasing any pressure after each shaking.
3. Separate the 2-chloro-2-methylpropane from the aqueous solution using a separating funnel.
4. To the 2-chloro-2-methylpropane in the separating funnel, add 20 cm³ of sodium hydrogencarbonate solution. Shake the separating funnel, carefully releasing carbon dioxide frequently.
5. Separate the 2-chloro-2-methylpropane and repeat the washing with sodium hydrogencarbonate solution until this washing step is no longer necessary.
6. Transfer the 2-chloro-2-methylpropane to a small conical flask and add a suitable drying agent.
7. Filter off the drying agent, collecting the 2-chloro-2-methylpropane into a distillation flask. Heat the flask, collecting the fraction that distils off between 50 °C and 52 °C.

Data

Property	2-methylpropan-2-ol	2-chloro-2-methylpropane
Density / g cm ⁻³	0.789	0.842
Molar mass / g mol ⁻¹	74.1	92.6
Boiling temperature / °C	82.4	50.8



(a) Calculate the volume of 2-methylpropan-2-ol used in the preparation.

(1)

(b) Draw a diagram of a separating funnel that could be used in step 3.
Label the 2-chloro-2-methylpropane layer.

(2)

(c) (i) Suggest why the product is washed with sodium hydrogencarbonate solution (step 4).

(1)

(ii) How would you know that no further washing with sodium hydrogencarbonate was necessary?

(1)



(d) Suggest a suitable drying agent to dry the 2-chloro-2-methylpropane (step 6).

(1)

(e) Draw a labelled diagram of the apparatus you would use to carry out the final distillation (step 7).

(4)



(f) A reaction produced 18.7 cm^3 of 2-chloro-2-methylpropane starting from 0.20 mol 2-methylpropan-2-ol. Calculate the percentage yield of the product of this reaction.

(2)

(g) A suitable chemical test for the chlorine in a chloroalkane, such as 2-chloro-2-methylpropane, is to add the chloroalkane to a mixture of aqueous silver nitrate solution and ethanol.

(i) Suggest why ethanol is added to the mixture.

(1)

(ii) Give the expected result of this test.

(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) (8) (9) (10) (11) (12)										13	14	15	16	17	18																																																
6.9	Li	lithium	3	9.0	Be	beryllium	4											10.8	B	boron	5	12.0	C	carbon	6	14.0	N	nitrogen	7	16.0	O	oxygen	8	19.0	F	fluorine	9	20.2	Ne	neon	10																										
23.0	Na	sodium	11	24.3	Mg	magnesium	12											27.0	Al	aluminium	13	28.1	Si	silicon	14	31.0	P	phosphorus	15	32.1	S	sulfur	16	35.5	Cl	chlorine	17	39.9	Ar	argon	18																										
39.1	K	potassium	19	40.1	Ca	calcium	20	45.0	Sc	scandium	21	47.9	Ti	titanium	22	50.9	V	vanadium	23	52.0	Cr	chromium	24	54.9	Mn	manganese	25	55.8	Fe	iron	26	58.7	Ni	nickel	28	58.9	Co	cobalt	27	63.5	Cu	copper	29	65.4	Zn	zinc	30																				
85.5	Rb	rubidium	37	87.6	Sr	strontium	38	88.9	Y	yttrium	39	91.2	Zr	zirconium	40	92.9	Nb	niobium	41	95.9	Mo	molybdenum	42	[98]	Tc	technetium	43	101.1	Ru	ruthenium	44	106.4	Pd	palladium	46	102.9	Rh	rhodium	45	107.9	Ag	silver	47	112.4	Cd	cadmium	48	114.8	In	indium	49	118.7	Sn	tin	50	121.8	Sb	antimony	51	126.9	Te	tellurium	52	131.3	Xe	xenon	54
132.9	Cs	caesium	55	137.3	Ba	barium	56	138.9	La*	lanthanum	57	178.5	Hf	hafnium	72	180.9	Ta	tantalum	73	183.8	W	tungsten	74	186.2	Re	rhenium	75	190.2	Os	osmium	76	195.1	Pt	platinum	78	192.2	Ir	iridium	77	197.0	Au	gold	79	200.6	Hg	mercury	80	204.4	Pb	lead	82	207.2	Bi	bismuth	83	209.0	Po	polonium	84	[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	[271]	Ds	damstadtium	110	[268]	Mt	meitnerium	109	[272]	Rg	roentgenium	111	Elements with atomic numbers 112-116 have been reported but not fully authenticated																							
* Lanthanide series		140	Ce	cerium	58	141	Pr	praseodymium	59	144	Nd	neodymium	60	[147]	Pm	promethium	61	150	Sm	samarium	62	152	Eu	europium	63	157	Gd	gadolinium	64	159	Tb	terbium	65	163	Dy	dysprosium	66	165	Ho	holmium	67	167	Er	erbium	68	169	Tm	thulium	69	173	Yb	ytterbium	70	175	Lu	lutetium	71										
* Actinide series		232	Th	thorium	90	[231]	Pa	protactinium	91	238	U	uranium	92	[237]	Np	neptunium	93	[242]	Pu	plutonium	94	[243]	Am	americium	95	[247]	Cm	curium	96	[245]	Bk	berkelium	97	[251]	Cf	californium	98	[254]	Es	einsteinium	99	[253]	Fm	fermium	100	[256]	Md	mendelevium	101	[254]	No	nobelium	102	[257]	Lr	lawrencium	103										

