Write your name here Surname	Other no	ames
Edexcel GCE	Centre Number	Candidate Number
Chemistr Advanced Subsidi Unit 3B: Chemistry	ary	I Alternative
Monday 9 January 2012 - Time: 1 hour 15 minute	•	Paper Reference 6CH07/01
Candidates may use a calcu	ılator.	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 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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Turn over ▶



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

1 A series of tests was carried out on A, a white powder, which is known to contain one cation and one anion. Complete the table below. You may use names or formulae in your answers.

	Test	Observations	Inferences	
(a)	Carry out a flame test on A .		Cation is potassium	
				(1)
(b)	Add a mixture of dilute nitric acid and aqueous silver nitrate to an aqueous solution of A.	A yellow precipitate forms.	Anion is	
	Then add an excess of dilute aqueous ammonia to the mixture.	When excess dilute aqueous ammonia is added		(2)
(c)	Add an aqueous solution of bromine to an aqueous solution of A .	The colour of the solution of bromine is When bromine is added to	The change in colour is due to	
		an aqueous solution of A the colour of the mixture is	the formation of	(3)



	Test	Observations	Inferences	
(d)	Add concentrated sulfuric acid to a solid sample of A.	A vigorous reaction occurs producing a black solid, a yellow solid, a gas with an unpleasant smell and some coloured fumes.	The black solid is and the yellow solid is	
				(2)

(Total for Question 1 = 8 marks)

2 A series of tests was carried out on a compound, **B**, which is known to contain **either** carbonate **or** sulfate (sulfate(VI)) ions as well as one cation.

Complete the inferences column. You may use names or formulae in your answers.

	Test	Observations	Inferences	
(a)	Carry out a flame test on B .	Yellow flame.	The cation in B is	(1
(b)	Add aqueous barium chloride solution to an	A white precipitate forms.	The precipitate could be either	
	aqueous solution of B .		or	(2
(c)	Add dilute hydrochloric acid to the mixture	Some fizzing occurs and the precipitate dissolves.	The anion in B is	
	formed in (b) until there is no further change.		and the fizzing is due to formation of	
				(2

	(4)	The	formul	l۵	of R	10
(\mathbf{u}) Ine	formul	la	01 D	18

(1)

(Total for Question 2 = 6 marks)

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3 Magnesium carbonate reacts with dilute nitric acid as shown in the equation below.

$$MgCO_3(s) + 2HNO_3(aq) \rightarrow Mg(NO_3)_2(aq) + CO_2(g) + H_2O(l)$$

The enthalpy change for this reaction can be determined as follows:

Procedure

- 1. Weigh 3.50 g of finely powdered magnesium carbonate.
- 2. Transfer 50.0 cm³ of 2.00 mol dm⁻³ nitric acid into a polystyrene cup and record the temperature of the acid.
- 3. Add the magnesium carbonate to the nitric acid.
- 4. Stir the mixture and record the maximum temperature reached.

Results

Temperature of nitric acid before addition of magnesium carbonate	21.0 °C
Final temperature of solution	29.7 °C

(a) Explain why the magnesium carbonate used in this experiment should be finely powdered rather than in lumps.

(1)

(b) (i) Calculate the number of moles of magnesium carbonate in $3.50\ \mathrm{g}$.

[Assume the molar mass of magnesium carbonate is 84 g mol⁻¹.]

(1)

(ii) The volume of dilute nitric acid used contained 0.100 mol of HNO₃. Suggest why this amount is suitable.

(1)

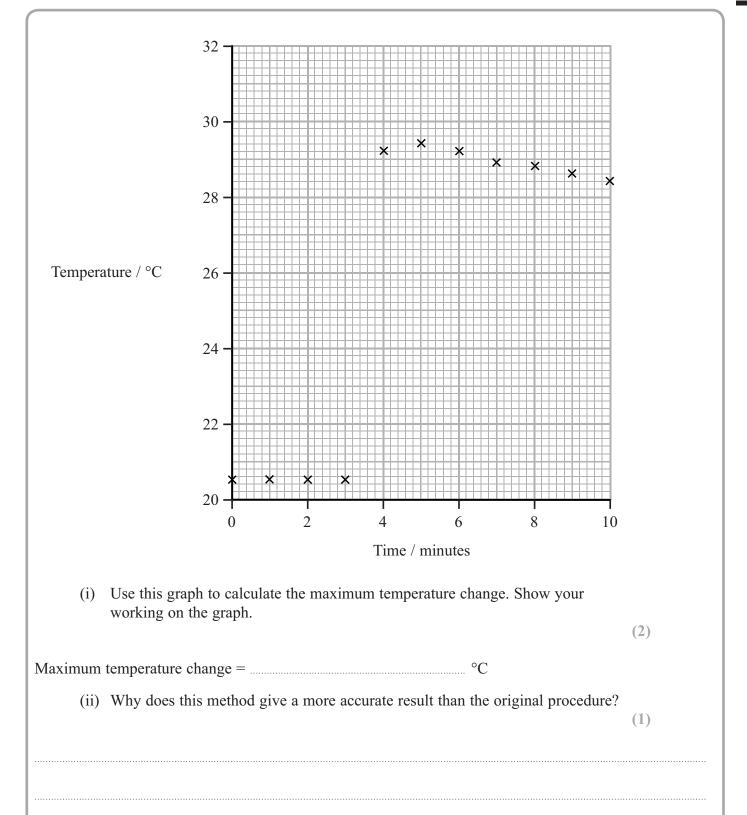


(c) (i)	Calculate the heat energy transferred, in joules, in this reaction between magnesium carbonate and nitric acid.					
	Use the expression					
	$\begin{array}{llllllllllllllllllllllllllllllllllll$					
	[Assume the mass of solution is 50 g and its specific heat capacity is 4.18 J $g^{-1} {}^{\circ}C^{-1}$.]					
		(1)				
(ii)	Calculate the enthalpy change, ΔH , for the reaction of one mole of magnesium carbonate with nitric acid. Your answer should be in units of kJ mol ⁻¹ ,					
	expressed to three significant figures, and include a sign.	(2)				
(d) (i)	The nitric acid for this experiment could be measured using either a pipette or a					
	measuring cylinder. Give one practical advantage of using each piece of appara	tus. (2)				
Pipette						
Measuring	cylinder					



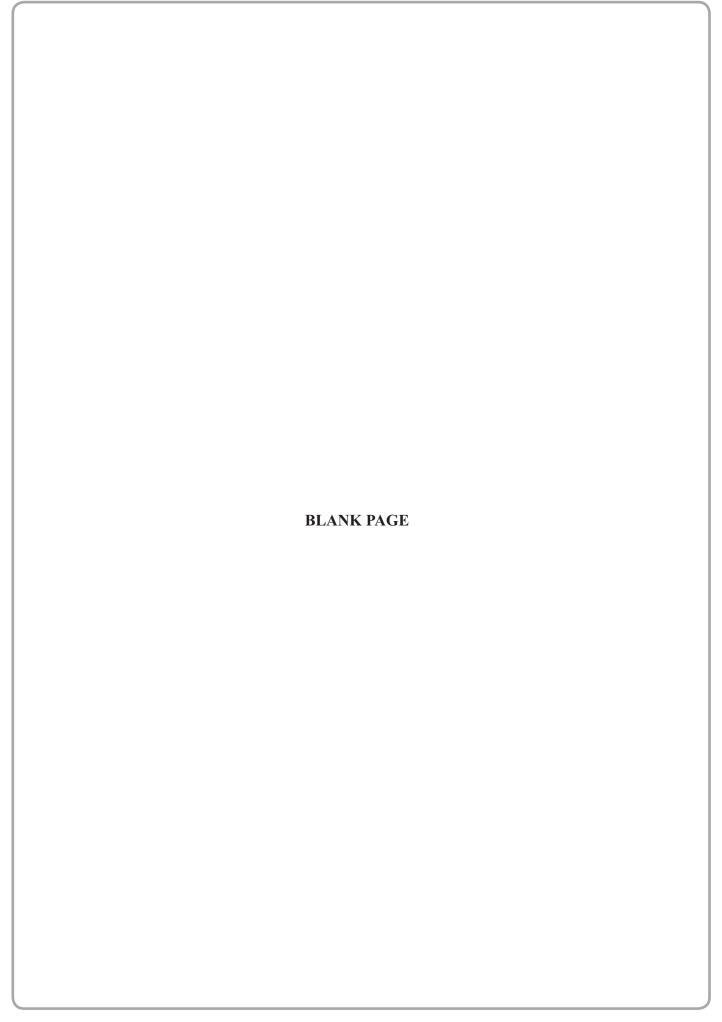
(ii) The total error in measuring the mass of the magnesium carbonate was a Calculate the percentage error in the weighing.	±0.01 g. (1)
(e) State and explain the effect, if any, on the calculated enthalpy change, ΔH , if	
(i) a copper calorimeter were used instead of the polystyrene cup.	(2)
(ii) 3.50 g of damp magnesium carbonate were used.	(2)
(f) The experiment was repeated with a change in the procedure. The temperatur dilute nitric acid was measured every minute for three minutes. After exactly and a half minutes, the magnesium carbonate was added and the mixture was The temperature of the mixture was then taken every minute for another six magnesium. A graph of the temperature readings against time using this procedure is show opposite.	three stirred. ninutes.





(Total for Question 3 = 16 marks)

This qu	nestion is about the alcohol, propan-1-ol.	
(a) Giv	re two observations when propan-1-ol reacts with a small piece of sodium.	(2)
oservatio	on 1	
servatio	on 2	
(b) A st	tudent investigated the rate of reaction of propan-1-ol with sodium.	
	gest one suitable measurement which could be made to determine the rate of thi etion.	s
1040	ALOII.	(1)
	mall amount of phosphorus(V) chloride (phosphorus pentachloride), PCl ₅ , is ed to propan-1-ol in a test tube. Describe the appearance of the fumes at the mouth of the test tube.	(1)
(ii)	An open bottle of concentrated ammonia is held near the mouth of the tube. Describe what would be seen at the mouth of the test tube.	(1)



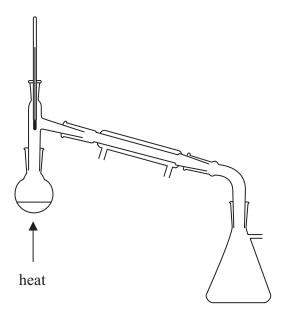


5 Propanoic acid may be prepared by oxidizing propan-1-ol in acidic conditions.

$$X + H_2SO_4$$
 $CH_3CH_2CH_2OH$
 CH_3CH_2COOH

Procedure

- 1. Pour 10 cm³ of distilled water into a boiling tube and add 12 g of oxidizing agent **X**. Shake the mixture and leave **X** to dissolve.
- 2. Pour 3 cm³ of propan-1-ol into a round-bottom flask and add 10 cm³ of distilled water and a few anti-bumping granules. Set up the apparatus for heating under reflux.
- 3. Add 4 cm³ of concentrated sulfuric acid, drop by drop, to the propan-1-ol. While the mixture is still warm, add the solution of oxidizing agent **X**, drop by drop. The energy released from the reaction should cause the mixture to boil without external heating.
- 4. When all of the solution of **X** has been added, use a low Bunsen burner flame to keep the mixture boiling for 10 minutes, not allowing any vapour to escape.
- 5. Distil the mixture in the flask using the apparatus shown below. Collect 5–6 cm³ of distillate, which is an aqueous solution of propanoic acid.



(a) Suggest, by name or formula, a suitable oxidizing agent, X, for this reaction.

(1)



(b) What colour change does 24	Cundergo when it oxidizes propan-1-ol?	(1)
From	to	
(c) Draw a labelled diagram sh	nowing the apparatus for heating under reflux.	(2)
(d) Give two reasons why the e	escape of vapour in step 4 should be prevented.	(2)
eason 1		
eason 2		
(e) How does the reflux appara	itus prevent escape of vapour?	(1)



(f)	Some	water	can be	removed	d from	the dist	illate i	in ste	p 5 by	adding	a soli	id dryir	ıg
	agent.	The	solution	n of prop	anoic a	icid can	then	be de	ecanted	leaving	g the	drying	agent
	behind	1.											

(i) Suggest a suitable solid drying agent.

(1)

(ii) Suggest why removing excess solid drying agent by decanting, rather than filtering through filter paper, improves the yield.

(1)

- (g) In a larger scale preparation of propanoic acid, 10.0 g of propan-1-ol was used.
 - (i) Calculate the maximum mass of propanoic acid which could be formed from 10.0 g of propan-1-ol.

	Propan-1-ol	Propanoic acid
Molar mass / g mol ⁻¹	60.1	74.1

(2)



	IOIAL FOR PAPER = 50	UWAKKS
	(Total for Question 5 = TOTAL FOR PAPER = 5	
planation	1	
sulf	nother experiment, the same reaction mixture (propan-1-ol, X and concentric acid) was heated in the apparatus shown in step 5. Identify the main uct which would be collected and explain why propanoic acid is not produced.	organic
		(2)
	The density of propanoic acid is 0.99 g cm ⁻³ .	(2)



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7		(17)	19.0	L	fluorine 9	35.5	บ	chlorine 17	79.9	B	bromine	3	126.9	_	iodine 53	[210]	Αt	astatine 85		een repor				
9		(16)	16.0	0	oxygen 8	32.1	s	sulfur 16	79.0	Se	selenium	5	127.6	<u>Б</u>	tellurium 52	[506]	8	polonium 84		116 have b	ticated			
2		(15)	14.0	z	nitrogen 7	31.0	۵	phosphorus 15	74.9	As	arsenic	3	121.8	S	antimony 51	209.0	Bi	bismuth 83		nbers 112-	but not fully authenticated			
4		(14)	12.0	U	carbon 6	28.1		silicon p	72.6	g	germanium	70	118.7	S	ti 20	207.2	Ъ	lead 82		Elements with atomic numbers 112-116 have been reported	but not fu			
3		(13)	10.8	ω	boron 5	27.0	A	aluminium 13	69.7	g	gallium	5	114.8	드	indium 49	204.4	F	thallium 81		ents with				
		95	8:					(12)	65.4	Zu	zinc	2	112.4	8	cadmium 48	200.6	Hg	mercury 80		Elem				
								(11)	63.5	J	copper	67	107.9	Ag	silver 47	197.0	Ρn	gold 79	[272]	Rg	oentgenium 111			
								(10)	58.7	ź	nickel	97	106.4	Б	palladium 46	195.1	꿑	platinum 78	[271]	Os	meitnerium damstadtium roentgenium 109 111 111			
								(6)	58.9	ვ	cobalt	/7	102.9	윤	rhodium 45	192.2	느	iridium 77	[398]	۸t	meitnerium 109			
	1.0 H	-						(8)	55.8	Fe	iron	07	101.1	Ru	ruthenium 44	190.2	o	osmium 76	[277]		hassium 108			
								(2)	54.9	۸	manganese	C7	[86]	բ	technetium 43	186.2	Re	rhenium 75		絽	bohrium 107			
			mass	lod	umber			(9)	52.0	ъ	chromium	47	95.9	Wo	molybdenum 42	183.8	≥	tungsten 74	[592]	Sg	seaborgium 106			
	Key	ve atomic	relative atomic mass	atomic symbol	mic sym	name (proton) n	name (proton) n	name atomic (proton) number			(2)	50.9	>	Ę	57	92.9		niobium 41	180.9	Тa	tantalum 73	۱_	В	dubnium 105
			relati	ato	atomic			(4)	47.9	j۲	titanium	77	91.2	Zr	zirconium 40	178.5	Ŧ	hafnium 72	[261]	¥	rutherfordium 104			
								(3)	45.0	S	scandium	17	88.9	>	yttrium 39	138.9	La*	lanthanum 57	[227]		actinium 89			
7		(2)	0.6	Be	beryllium 4	24.3	W	magnesium 12	40.1	S	calcium	07	87.6	'n	strontium 38	137.3	Ba	barium 56	[326]	Ra	radium 88			
•		(1)	6.9	:5	lithium 3	23.0	Š		39.1	¥	potassium	4	85.5	&	rubidium 37	132.9	ర	caesium 55	[223]	<u></u>	francium 87			

^{*} Lanthanide series

^{*} Actinide series

		39,022	-	_		F	
175	3	lutetium	71	[257]	۲	lawrenciur	103
173	χ,	ytterbium	70	[254]	ž	nobelium	102
169	Ē	thulium	69	[256]	Þ₩	mendelevium	101
167	ы	erbium	68	[253]	F	fermium	100
165	유	holmium	67	[254]	E	einsteinium	66
163	ð	dysprosium	99	[251]	ប	californium	86
159	T	+		[245]	쑮	berkelium	26
157	В	gadolinium	64	[247]	5	curium	96
152	E	europium	63	[243]	Am	americium	95
150	Sm	samarium	62	[242]	P	plutonium	94
[147]	Pm	promethium	61	[237]	ď	neptunium	93
14	P	neodymium	09	238	_	uranium	92
141	F	praseodymium	26	[231]	Pa	protactinium	9
140	S	cerium	58	232	£	thorium	%