Please check the examination details belo	w before ente	ntering your candidate information											
Candidate surname		Other names											
Centre Number Candidate Nu	imber												
Pearson Edexcel International Advanced Level													
Thursday 17 October 2024													
Morning (Time: 1 hour 20 minutes)	Paper reference	ce WCH13/01											
Chemistry		O •											
International Advanced Su		•											
UNIT 3: Practical Skills in	Chemist	stry l											
You must have: Scientific calculator, ruler		Total Marks											

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **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.
- Show all your working in calculations and include units where appropriate.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶







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

1 (a) Solutions of three Group 2 chlorides, **X**, **Y** and **Z**, were treated with solutions containing different anions. The results are shown.

	Addition of NaOH solution	Addition of Na ₂ CO ₃ solution	Addition of Na ₂ SO ₄ solution
X	no visible change	white precipitate	white precipitate
Υ	white precipitate	white precipitate	no visible change
Z	partial white precipitate	white precipitate	partial white precipitate

(i) Flame tests can be used to confirm the identity of the cations.

Complete the table to show a possible identity for the cations in **X**, **Y** and **Z**, and the colours of flame tests produced by each cation.

(4)

	Identity of cation	Colour of flame test
Х		
Υ		
Z		

(ii)	Describe how the presence of chloride ions in the solutions of X, Y and Z
	could be identified and confirmed.

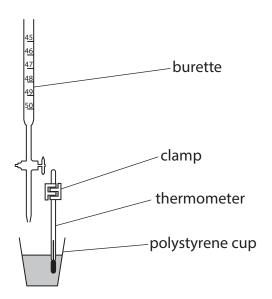
(3)

|
 |
|------|------|------|------|------|------|------|
| | | | | | | |
|
 |
| | | | | | | |
|
 |
| | | | | | | |
| | | | | | | |

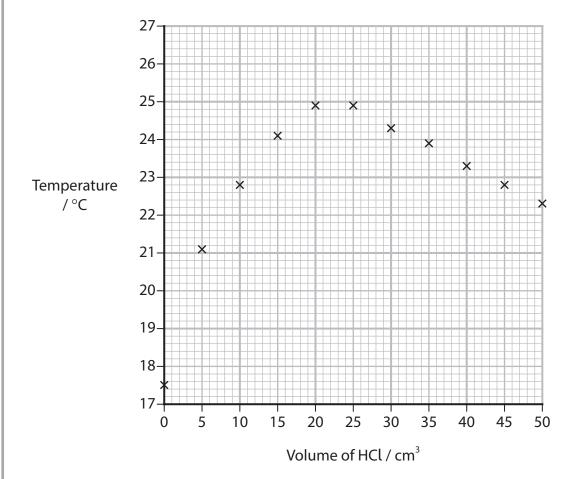
(b) (i) Describe in outline an experiment to compare the thermal stability	of
Group 2 carbonates.	
You may wish to include a diagram.	(4)
(ii) Give a reason why the experiment described in (b)(i) may not produ	uce the
expected results for all the Group 2 carbonates in a school laborato	ry. (1)
(Total for Question	n 1 = 12 marks)



2 A student carried out an experiment to find the enthalpy change of neutralisation between a solution of sodium hydroxide and hydrochloric acid. 25.00 cm³ of sodium hydroxide solution was pipetted into a polystyrene cup. 5.00 cm³ portions of 2.00 mol dm⁻³ hydrochloric acid were added at regular intervals and the maximum temperature of the reaction mixture measured after each addition.



A graph of the results is shown.



(a) (i) Draw two lines of best-fit to determine the maximum temperature change at the point of neutralisation.

(3)

- Volume of hydrochloric acid at neutralisation cm³

 Maximum temperature change
- (ii) Calculate the concentration of the sodium hydroxide solution, using an answer from (a)(i) and information from the procedure.

(2)

(iii) Calculate the enthalpy change of neutralisation, in **kJ mol**⁻¹.

(4)

Assume the value of the specific heat capacity of the solution is $4.18 \, \text{Jg}^{-1} \, ^{\circ}\text{C}^{-1}$ and the density of the solution is $1.00 \, \text{g cm}^{-3}$.

Include a sign in your answer.

	(Total for Question 2 = 13 ma	ırks)
	(ii) Give an improvement to the experimental method that will increase the accuracy of the calculated enthalpy change of neutralisation.	(1)
(c)	(i) Give an improvement to the experimental method that will increase the accuracy of the calculated titre value.	(1)
	Give two reasons why the maximum temperature is not reached in this experiment.	(2)
(b)	The published value for the enthalpy change of neutralisation is -55.84 kJ mol ⁻¹ . The student's value is significantly different from the published value. This is because the procedure does not allow the maximum possible temperature to be reached.	

- **3** A student purified a sample of an organic liquid by distillation.
 - (a) Draw a labelled diagram of the distillation apparatus including a thermometer.

(3)

(b) (i) The purified product was treated with a small volume of bromine water and shaken. The bromine water was **not** decolourised.

State the most likely conclusion that can be made from this information.

(1)

(ii) The purified product was also treated with Fehling's reagent. No colour change was observed.

State the most likely conclusion that can be made from this information.

(1)



		(Total for Question 3 = 11 m	arks)
	(ii)	Explain how information, easily obtained from the distillation experiment, could be used to confirm the identity of the final product.	(2)
		giving an alternative identity for the final product.	(4)
		Discuss why the student is incorrect, using all the information above, and	
		The student concluded that the final product must be a ketone.	
		A colour change was observed while refluxing. The resulting solution was distilled.	
(c)	(i)	The purified organic liquid was refluxed with acidified potassium dichromate(VI) solution.	

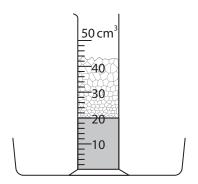


4 Hydrogen peroxide slowly decomposes to form oxygen and water. Many different compounds can act as a catalyst for the reaction.

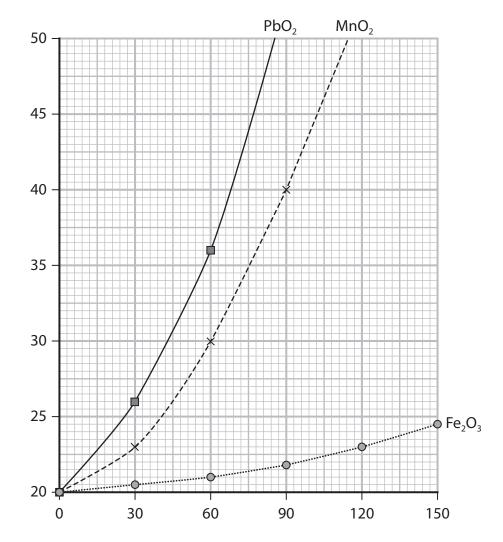
In order to compare the catalytic effect of different compounds, an experiment was carried out by a student.

0.5 g of each solid catalyst powder and a drop of washing up liquid were added to separate 50 cm³ measuring cylinders.

20 cm³ of hydrogen peroxide solution was then added to each measuring cylinder. At 30 s intervals, the volume reached by the foam was recorded.



The results are displayed in a graph.

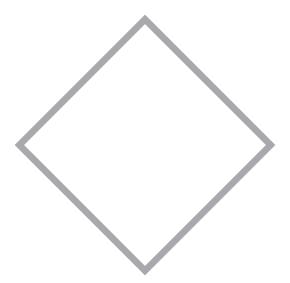


(a) Lal	bel the axes of the graph.	
(4) 24	ser the tixes of the graph.	(2)
(b) (i)	State how PbO_2 can be identified as the best catalyst under these conditions.	(1)
(ii)	Calculate the maximum rate of foam production measured for PbO_2 . Include units with your answer.	(3)
	Units	
(iii)	Suggest why the value calculated from the graph may not be accurate.	(1)
(c) (i)	In most kinetics experiments the rate of reaction decreases with time.	
	Suggest a reason why the rate of reaction seems to increase in this experiment.	
	'	(1)
(ii)	In a repeat experiment, a larger measuring cylinder was used so that it contained all the foam produced.	
	Sketch the expected graph of the volume reached by the foam until the reaction is complete, using MnO_2 as the catalyst.	
	You do not need to label the axes.	(2)
		(4)



- (d) The hydrogen peroxide used is corrosive.
 - (i) Draw the hazard symbol that should be displayed on the bottle of hydrogen peroxide.





(ii) State **one** safety precaution that should be taken when using the hydrogen peroxide, other than wearing a lab coat and safety spectacles.

(1)

(iii) The risk of harm to students needs to be reduced before they carry out this experiment in class.

Suggest another control measure to reduce the risk for students.

(1)

(iv) Give a reason why, during the experiment, the measuring cylinders should be placed in a tray.

(1)

(Total for Question 4 = 14 marks)

TOTAL FOR PAPER = 50 MARKS









102

101

100

66

86

4

95

94

93

92

9

8

The Periodic Table of Elements

0 (8)	(18)	4.0	H	helium	2
7					(17)
9					(14)
2					(15)
4					(14)
Ж					(13)
		1.0	Ŧ,	nyarogen	-
					>
					Κρ
					Ϋ́
					KP
2					(2)
1 2					(7) (7)

	_			_						_	_								_				_						
(01)	4.0	He	netium 2	20.2	Ne	neon	10	39.9	Ar	argon	18	83.8	궃	krypton	36	131.3	Xe	xenon	24	[222]	R	radon	86						
			(17)	19.0	L	fluorine	6	35.5	บ	chlorine	17	79.9	Br	bromine	35	126.9	П	iodine	53	[210]	At	astatine	85					17E	
			(16)	16.0	0	oxygen	8		S		16	79.0	Se	selenium	34	127.6	<u>e</u>	tellurium	52	[506]	Po	polonium	84					473	
			(15)	14.0	z	nitrogen	7	31.0	۵	shosphorus	15	74.9	As	arsenic	33			_	51	209.0	Bi	bismuth	83					140	
			(14)	12.0			9		Si			72.6	g	germanium	32	118.7	Sn			207.2								147	
			(13)	10.8	8	poron	2	27.0	¥	aluminium	13	69.7	Ga		31	114.8	٦	indium	46	204.4	F	thallium	81					145	
											(12)	65.4	Zu	zinc	30	112.4	В	cadmium	48	200.6	Ϋ́	mercury	80					163	
											(11)	63.5	J	copper	59	107.9	Ag	silver	47	197.0	PΠ	plog	79	[272]	Rg	oentgenium	111	150	
											(10)	58.7	ź	nickel	28	106.4	Pd	palladium	46	195.1	₹	platinum	78	[271]	Mt Ds Rg	darmstadtium	110	157	
											(6)	58.9	ဝ	cobalt	27	102.9	뫈		45	192.2			77	[398]	Mt	meitnerium	109	453	
	?:	hvdrogen	-								(8)	55.8	Fe	iron	56	101.1	Ru	ruthenium	4	190.2	S	osmium	9/			hassium	108	450	
											(7)	54.9	W	manganese	25	[86]	ပ	technetium	43	186.2	Re	rhenium	75	[264]		Ă	107	[4.47]	
				mass	loc		nmper				(9)	52.0	ڻ	chromium manganese	24	95.9	Wo	molybdenum technetium ruthenium	42	183.8	>	tungsten	74	[596]	Sg	seaborgium	106	135	
			Key	relative atomic mass	e atomic r	atomic symbol	пате	atomic (proton) number			9	(5)	50.9	>	vanadium	23	92.9	Q	niobium	41	180.9	Та	tantalum	73	[797]		Ε	105	1
				relati	ato		atomic				(4)	47.9	ï	titanium	22	91.2	Zr	zirconium	40	178.5	Ŧ	hafnium	72	[261]	¥	rutherfordium	104	9,7	
											(3)	45.0	Sc	scandium	21	88.9	>	yttrium	39	138.9	La*	lanthanum	27	[227]	Ac*	E	88		
			(2)	9.0	Be	beryllium	4	24.3	W	magnesium	12	40.1	Ca	calcium	70	97.6	S	strontium	38	137.3	Ba	parinm	26	[526]	Ra	radium	88		
			\mathcal{E}	6.9	:=	lithium	ж	23.0	N	mnibos	1	39.1	¥	potassium	19	85.5	8	rubidium	37	132.9	ప	caesium	22	[223]	ᅩ	francium	87		

* Lanthanide series

* Actinide series

Lr lawrencium Lu 175 [257] 173 **Yb** ytterbium nobelium [254] **Tm** thulium mendelevium 169 [256] PΨ 69 167 **Er** erbium fermium Fm [253] 89 [254] Es 165 Ho holmium 49 **Dy** dysprosium californium 163 [251] Cf 99 terbium berkelium 159 [245] **Bk** 65
 144
 [147]
 150
 152
 157

 Nd
 Pm
 Sm
 Eu
 Gd

 neodymium promethium promethium promethium promethium promethium samarium
 europium padotinium
 aurium [247] **Cm** 2 americium [243] Am 63 Np Pu neptunium plutonium [242] Pu 62 [237] uranium 9 raseodymium protactinium [231] 141 P Pa 59 232 **Th** thorium **Ce** cerium 58