· · · · · · · · · · · · · · · · · · ·			
Surname		Other name	s
Pearson Edexcel International Advanced Level	Centre Number		Candidate Number
Chemistry Advanced Subsidial Unit 3: Chemistry Lal	ry	ills I	
Monday 7 November 2016 Time: 1 hour 15 minutes	– Morning		Paper Reference WCH03/01

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.

P 5 0 7 0 5 A 0 1 1 6

Turn over ▶



(2)

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

- 1 A white solid, **A**, has one metal cation and an anion consisting of two or more elements.
 - (a) A flame test is carried out on compound **A** by mixing the solid with concentrated hydrochloric acid and using a wire to place some of the mixture formed in the hottest part of a Bunsen flame.
 - (i) The wire is made from a metal or an alloy. Name a suitable material for the wire and give **one** reason why this material is used.

Material	
Reason	
(ii) Suggest one reason for using hydrochloric acid in this test, rather than another strong acid.	
another strong acid.	(1)
(iii) In a flame test for solid A , a red colour is observed. Identify, by name or formula	ı
one Group 1 metal ion and one Group 2 metal ion that could be present.	(2)
Group 1 metal ion	
Group 2 metal ion	

(b) When solid A is added to water, some dissolves to form a colourless solution.

When phenolphthalein is added to this mixture, it turns pink.

When dilute hydrochloric acid is added to the mixture, the temperature increases and a colourless solution forms, but no gas is given off.

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

(1)

(ii) Write the ionic equation for the reaction that causes the temperature to increase. State symbols are not required.

(1)

(c) When dilute sulfuric acid is added to the solution of A, a white precipitate forms.

(i) Name the white precipitate.

(1)

(ii) Write the **ionic** equation, including state symbols, for the formation of this precipitate.

(1)

(d) Give the formula of the white solid, A.

(1)

(Total for Question 1 = 10 marks)



2	${\bf P}$, ${\bf Q}$ and ${\bf R}$ are different halogenoalkanes with the general formula C_3H_7X .	
	(a) 2 cm³ of ethanol is added to three test tubes in a water bath at 50°C.	
	Three drops of $\bf P$ are added to the first test tube, three drops of $\bf Q$ to the second three drops of $\bf R$ to the third.	cond
	2 cm ³ portions of aqueous silver nitrate solution are added to each test tub	e.
	Explain why ethanol is added to each test tube.	(1)
	(b) Cream coloured precipitates form in the test tubes containing P and Q . These precipitates are soluble in concentrated ammonia solution.	
	A yellow coloured precipitate forms in the test tube which contains R . This precipitate is insoluble in concentrated ammonia solution.	
	Deduce the identity of the halogen present in each halogenoalkane.	(2)
P a	and Q	
R		
	(c) The mass spectrum of P includes a peak at $m/e = 29$ but neither Q nor R has peak at this value.	as a
	(i) Suggest the identity of the positive ion responsible for this peak at m/ϵ	? = 29.

(ii) Deduce the structural formulae of the three halogenoalkanes. (3)

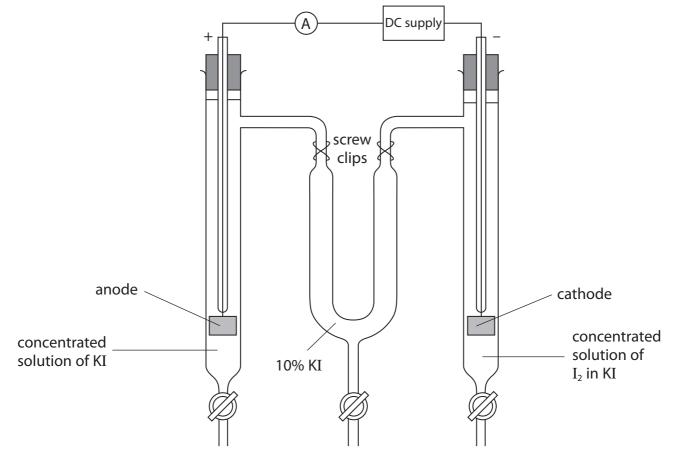
P

Q

R

(Total for Question 2 = 7 marks)

An iodine coulometer can be used to find the equation for the reaction between iodine and sodium thiosulfate.



An iodine coulometer

The DC supply is switched on for 15.0 minutes.

The constant current, measured by the ammeter, is 0.200 A.

The screw clips are closed, the left-hand bung is removed and the contents of the anode (positive electrode) tube are run into a 100 cm³ volumetric flask. The tube and electrode are rinsed with a little distilled water and the washings added to the volumetric flask. The solution in the volumetric flask is made up to the mark with distilled water and mixed thoroughly.

 10.0 cm^3 portions of the contents of the volumetric flask are now titrated with $0.0100 \text{ mol dm}^{-3}$ sodium thiosulfate solution.

(a) (i) Name the indicator used for the titration, and give the colour change seen at the end-point.

Indicator	
Colour change from	to

(ii) State the appearance of the titration mixture just before the indicator is added.

(1)

(b) Calculate the number of moles of electrons transferred from the iodide ions to form iodine in the experiment. Use the expression

number of moles of electrons =
$$\frac{\text{current (A)} \times \text{time (s)}}{96500}$$

(1)

(c) The total volume of solution in the volumetric flask is 100 cm³.

10.0 cm³ portions of the mixture are titrated with 0.0100 mol dm⁻³ sodium thiosulfate solution.

The results are given in the table below.

Titration number	1	2	3	4
Second reading / cm ³	19.45	38.05	19.05	38.25
First reading / cm ³	0.00	19.45	0.00	19.55
Titre / cm³				

(i) Complete the tabl	e
-----------------------	---

(1)

(ii) Which result(s) should be discarded? Give a reason for your answer.

(2)

(iii) Calculate the mean titre for the remaining values.

(1)

(iv) Calculate the number of moles of thiosulfate ions in this mean titre.

(1)

(v) Calculate the number of moles of thiosulfate ions needed to react with the total amount of iodine in the 100 cm³ of solution in the flask.

(1)



(d) (i) Complete the ionic half-equations for the oxidation of thiosulfate ions and the oxidation of iodide ions.

(2)

$$2S_2O_3^{2-}(aq)$$

$$\rightarrow$$
 S₄O₆²⁻(aq)

$$\rightarrow$$
 $I_2(aq)$

(ii) In part (b), you calculated the number of moles of electrons lost when the iodide ions are oxidised to form the amount of iodine in the flask.

In part (c)(v), you calculated the number of moles of thiosulfate ions required to reduce this iodine back to iodide ions.

Show that the results calculated from the two experiments are consistent with your ionic half-equations.

(1)

(e) (i)	The uncertainty in each burette reading is ±0.05 cm ³ and the uncertainty in
	the volume reading for the pipette is ± 0.04 cm ³ . Calculate the percentage
	uncertainties for the first burette titre and for the pipette volume of 10.0 cm ³ .

(2)

(ii) Explain whether these uncertainties are significant in this experiment.

(1)

(Total for Question 3 = 16 marks)



- **4** A student investigates the oxidation of the alcohol, propan-1-ol.
 - (a) To oxidise propan-1-ol to form propanal, the following procedure is used.
 - Place about 20 cm³ of dilute sulfuric acid in a boiling tube.
 - Add about 3 g of sodium dichromate(VI) and 2–3 anti-bumping granules.
 - Shake the contents of the boiling tube until the solid is fully dissolved.
 - Place about 1 cm³ of propan-1-ol in a pear-shaped flask.
 - Keep the pear-shaped flask cool and slowly add the contents of the boiling tube.
 - Add the apparatus needed for immediate distillation of the product.
 - Gently distil the product directly from the reaction mixture.
 - (i) Sodium dichromate(VI) is a carcinogen.

It is often supplied as a fine powder.

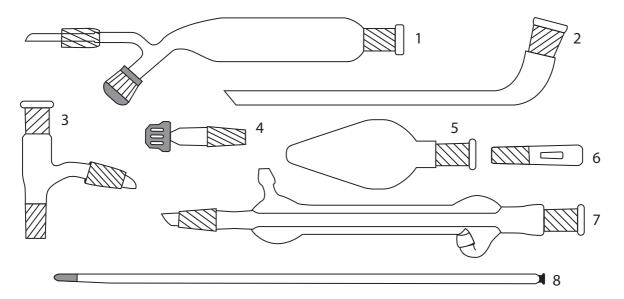
Suggest the particular hazard associated with the compound being a fine powder.

Give a suitable safety precaution.

	(2)
(ii) Explain why anti-bumping granules are added and how they work.	(2)



(iii) Select from the apparatus below, the apparatus you would use for distillation.



You should identify each piece of apparatus by number or name and state how you would connect them together for the preparation of propanal.

You should also name a suitable collecting vessel not shown above.

You sho	uld no	t draw	\prime a diagran	n.
---------	---------------	--------	--------------------	----

(3)

(b)	The oxidati	ion of propa	n-1-ol to for	m propano	oic acid is a re	action wh	ich invo	lves
	two steps.	These are h	eating unde	r reflux an	d distillation.			

Differences in the quantities and concentrations of the reactants are also involved, compared to the preparation of propanal.

(i) Give these differences in the quantities and concentrations of reactants. Precise amounts and concentrations are not required.

Justify your answer.	(2)
(ii) When carrying out the heating under reflux step, a Liebig condenser is used in the top of a pear-shaped flask.	
State the direction of water flow in the reflux condenser and what will happen if the water flows in the wrong direction.	(1)
 (iii) Explain why the condenser is needed in the reflux process and how it works.	(2)

(c) (i) Describe the appearance of propanal and of propanoic acid.

(1)

Propanal

Propanoic acid



(ii) Suggest a chemical test that would positively identify the functional group of each product after purification. Give the result of each test.	(4)
Test for propanal	
Test for propanoic acid	
(Total for Question 4 = 17 m	arks)
TOTAL FOR PAPER = 50 MA	\RKS



BLANK PAGE



BLANK PAGE



lawrencium

102

Md No mendelevium nobelium

Fm

Cf Es Californium einsteinium f

[245]
Bk
berkelium
97

Cm curium 96

Np Pu Am neptunium plutonium americium 93 95

uranium 92

6

[254]

[256]

[253]

[243] 63

[242] 62

[237] 19

[231]
Pa

232 Th thorium

11	•
ř	1
-	5
٠,	
Q	3
Flaments	-
~	-
7	7
U	,
-	٠
ш	4
of	
4	-
C)
a	1
_	5
Table	۲
=	3
,11	2
-	-
<i>5</i> 0.	ž.
·	J
+	-
Pariodic	3
6	Ş
_	٥
	-
ñ	7
a	,
Δ	_
The)
-	=
-	-
-	-

.	C & E	2 44 5	6 . 5	æ , s		er .	, u	2]	1		
0 (8)	4.0 Hellum 2	20.2 Ne neon	39.9 Ar argon 18	83.8 Kr krypton	36	131.3 XA	xenon 54	[222] Rn radon 86	ted		
,	(17)	19.0 F fluorine	35.5 CI chlorine 17	79.9 Br bromíne	35	126.9 I	todine 53	[210] At astatine 85	een repor	175 Lu lutetium	
0	(16)	16.0 O oxygen 8	32.1 S sulfur 16	79.0 Se selenium	34	127.6 To	tellurium 52	Po Po potamium 84	Elements with atomic numbers 112-116 have been reported but not fully authenticated	173 Yb ytterbium	
n	(15)	14.0 Nitrogen	31.0 P phosphorus 15	74.9 As	33	121.8	antimony 51	209.0 Bi bismuth 83	tomic numbers 112-116 hav but not fully authenticated	169 Tm thu(ium	
4	(14)	12.0 C carbon 6	Si Silicon 14	72.6 Ge germanium	32	118.7 Co	20 ti	207.2 Pb lead lead 82	atomic nun but not fi	167 Er erbium	
7	(13)	10.8 B boron 5	27.0 Al aluminium 13	Ga gallium	31	114.8	indium 49	204.4 TI thallium 81	ents with	165 Ho holmium	
			(12) 65.4 Zn Zinc 30 112.4 Cd Cadmium 48 mercury 80				Elem	163 Dy dysprosium			
(9) (11)				63.5 Cu	53	107.9	silver 47	197.0 Au gold 79	Rg roentgenium	159 Tb	
				58.7 Ni	28	106.4 Dd	patladium 46	Pt Pt platinum 78	Ds damstadtum 110	157 Gd gadolinium	
				Co Cobalt	27	102.9	rhodium 45	192.2 Ir iridium 77	[268] Mt meitnerium 109	152 Eu europium	
,	1.0 Hydrogen		(8)	55.8 Fe iron	56	101.1	ruthenium 44	190.2 Os osmium 76	Hs Hassium r 108		
			0	Mn Manganese	25	[98]	_	Re rhenium 75	[264] Bh bohrium 107	141 144 [147] 150 Pr Nd Pm Sm proseodymium promethium samarium samarium	
Key	mass sol umber	(9)	52.0 54.9 Cr Mn chromium manganese	24	95.9	molybdenum technetium 42 43	183.8 W tungsten 74	Sg seaborgium 106	Nd Nd neodymium		
	relative atomic mass atomic symbol name atomic (proton) number	(5)	50.9 V vanadium	23	92.9 NA	E	180.9 Ta tantalum 73	[262] Db dubnium 105	Pr Praseodymium		
	relati ato	(4)	47.9 Ti	7.7	91.2	zirconium 40	Hf hafmium 72	[261] Rf utherfordium 104	Cerium		
			(3)	Sc scandium	21	88.9	yttrium 39	La* La* tanthanum 57	[227] Ac* actinium 89	8	
7	(2)	9.0 Be beryllium 4	Mg magnesium 12	Ca calcium	20	87.6 Sr	strontium 38	137.3 Ba barium 56	[226]	*Lanthanide series *Actinide series	
-	(1)	6.9 Li lithium	Na sodium 11	39.1 K potassium	19	85.5 Ph	rubidium 37	CS caesium 55	[223] Fr francium 87	*Lanth	