Please check the examination det	ails below	before ente	ring your candidate information					
Candidate surname			Other names					
Pearson Edexcel International Advanced Level	Centre	Number	Candidate Number					
Wednesday 15 May 2019								
Afternoon (Time: 1 hour 15 minu	ıtes)	Paper Re	eference WCH06/01					
Chemistry Advanced Unit 6: Chemistry Laboratory Skills II								
Candidates must have: Scientific calculator Total Marks								

Instructions

- Use **black** ink or **black** 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.
- Show all your working in calculations and include units where appropriate.
- Check your answers if you have time at the end.

Turn over ▶



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Answer ALL the questions. Write your answers in the spaces provid	ed.
1 This question is about five inorganic compounds (A, B, C, D and E).	
(a) Compounds A and B contain s-block elements.	
(i) In flame tests, A gave a yellow colour and B gave a yellow-red colour.	
Identify the s-block metal ions in A and B .	
identity the s-block metal ions in A and B .	(1)
The metal ion in A	
The metal ion in B	
(ii) Give the colour of the precipitate formed when concentrated sodium hydroxide solution is added to an aqueous solution of B .	(1)
(iii) Compound A is a carbonate.	
Write an ionic equation for the reaction that takes place when dilute hydrochloric acid is added to an aqueous solution of A . Include state symbols.	(2)
(iv) Compound B is a halide. Identify, by name or formula, a reagent that may be used to test for	
halide ions in an aqueous solution of B .	(1)

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(b) Cor	mpounds C , D and E are nitrates of d-block elements.	
	ueous sodium hydroxide is added, drop by drop, until in excess to separate utions of C , D and E .	
(i)	Compound C forms an off-white precipitate which darkens on standing in air.	
	Identify the precipitate, by name or formula, and explain why it darkens.	(2)
(11)	Compound D forms a white precipitate which dissolves in excess sodium hydr to form a colourless solution containing a complex ion.	oxide
	Write the formula of this complex ion.	(1)
(iii)	Compound E forms a green precipitate which does not dissolve in excess sodium hydroxide.	
	The precipitate turns brown on standing in air.	
	Identify, by name or formula, the compound E and the brown solid.	(2)
Compound	d E	
Brown soli	d	
	(Total for Question 1 = 10 ma	rks)



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2 This question is about three organic compounds: X, Y and Z. X, Y and Z have the same molecular formula, $C_6H_{12}O$.

The table shows the observations made in some chemical tests on X, Y and Z.

			Observations with reagent											
Compou	und	Sodium metal	Bromine water	Acidified sodium dichromate(VI)	Brady's reagent (2,4-DNPH)	lodine in aqueous sodium hydroxide								
Х	X No change Y Effervescence Z Effervescence		No change	No change	Orange precipitate	Pale yellow precipitate								
Υ			Decolourises	Turns green	No change	No change								
Z			No change	No change	No change	No change								

(a)	Use information	from the	table to	answer the	following	questions
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(i)	State what can be deduced about X from the positive test results.	
		(2)

•••••	 • • • • • • •	 	 	 	 ••••	 	•••••	 	 •••••	 	•••••	 	 •••••	•••									

(ii)	Name the functi	ional groups pre	esent in Y .
(11)	Name the famet	ionai gioaps pio	JCIIC III II.





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(iii) Complete the equation for the reaction between **Z** and sodium metal. State symbols are not required.

(1)

$$C_6H_{12}O + Na \rightarrow$$

- (b) The **high** resolution proton nmr spectrum of compound **X** has only two peaks which are singlets with relative peak areas of 1:3.
 - (i) State what can be deduced from the presence of only two peaks in the nmr spectrum.

(1)

(ii) State what can be deduced from the fact that these peaks are singlets.

(1)

(iii) Use the nmr information, your answer to (a)(i) and the molecular formula to deduce the structure of **X**.

(1)



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(c) Compound Y is straight-chained and does not have geometric or optical isomers.(i) State what can be deduced from the fact that Y does not exist as geometric iso	mers. (1)
(ii) State what can be deduced from the fact that Y does not have optical isomers.	(1)
(iii) Use information about Y , your answer to (a)(ii) and the molecular formula to deduce the structure of Y .	(1)
(d) (i) Deduce the type and classification of the functional group present in Z , using observations from the table.	(1)
(ii) Compound Z contains a five-membered carbon ring. Deduce the structure of Z using this information, your deduction in (d)(i) and the molecular formula.	(1)

(Total for Question 2 = 13 marks)

3 This question is about the analysis of iron supplements used to prevent or treat iron deficiency anaemia.

A student used the following procedure to analyse iron tablets containing iron in the form of hydrated iron(II) sulfate, $FeSO_4.7H_2O$.

Procedure

- Step **1** Grind up **two** iron tablets with a little dilute sulfuric acid using a pestle and mortar.
- Step 2 Transfer the resulting paste into a 100.0 cm³ volumetric flask. Rinse the apparatus used with dilute sulfuric acid, transferring all washings to the volumetric flask.
- Step **3** Add sufficient dilute sulfuric acid to the volumetric flask to make up the solution to exactly 100.0 cm³. Stopper the flask and invert it several times.
- Step **4** Using a pipette, transfer 10.0 cm³ of the solution to a conical flask and titrate it with 0.00500 mol dm⁻³ potassium manganate(VII) solution.
- Step **5** Repeat Step **4** until concordant results are obtained.

The overall equation for the reaction occurring in the titration is

$$MnO_4^-(aq) + 8H^+(aq) + 5Fe^{2+}(aq) \rightarrow Mn^{2+}(aq) + 5Fe^{3+}(aq) + 4H_2O(l)$$

(a) (i) Give the reason why the titration in Step **4** does **not** require the addition of an indicator.

(1)

(ii) Give the colour **change** at the end-point.

(1)

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(b) The student decided to take the burette readings from the top of the liquid level rather than from the bottom of the meniscus.

Suggest the effect of this, if any, on the titre values. Justify your answer.

(2)

(c) Results of the titrations are given in the table.

Titration number	1	2	3	4
Burette reading (final) / cm ³	10.85	21.40	31.60	42.40
Burette reading (initial) / cm ³	0.00	10.85	21.40	32.10
Titre / cm ³	10.85			

(i) Complete the table and use the concordant values to calculate the mean titre.

(2)



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(ii) Use your mean titre and information from the procedure to calculate the mass of hydrated iron(II) sulfate, FeSO₄.7H₂O, present in **one** iron tablet.

Give your answer to an appropriate number of significant figures.

(5)

- (d) The uncertainties in the burette and pipette measurements are $\pm 0.05\,\text{cm}^3$ and $\pm 0.06\,\text{cm}^3$ respectively.
 - Calculate which of these pieces of apparatus gives the greater percentage uncertainty in this experiment.

(2)

(Total for Question 3 = 13 marks)

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4 This question is about the laboratory preparation of 3-methylbutyl ethanoate, an ester used as a banana flavouring in foods.

Procedure

- Step **1** Add 7.5 cm³ of 3-methylbutan-1-ol, 10 cm³ of ethanoic acid and 2 cm³ of concentrated sulfuric acid to a round-bottom flask.
- Step **2** Add a few anti-bumping granules and heat the mixture under reflux for 35 minutes.
- Step **3** Transfer the cooled reaction mixture to a separating funnel. Add 30 cm³ of distilled water and washings from the flask. Shake the mixture, allow to separate and discard the aqueous layer.
- Step **4** Wash the organic layer with 15 cm³ of sodium hydrogencarbonate solution, releasing the build up of pressure. Discard the aqueous layer and repeat until the aqueous layer is slightly alkaline.
- Step **5** Transfer the organic layer to a boiling tube and dry with anhydrous magnesium sulfate.
- Step **6** Decant the organic layer into a clean round-bottom flask and distil.

 Collect the fraction boiling between 140 °C and 144 °C in a pre-weighed test tube.

Data

Compound	Molar mass / g mol ⁻¹	Density / g cm ⁻³	Boiling temperature / °C
3-methylbutan-1-ol	88.0	0.81	131
ethanoic acid	60.0	1.05	118
3-methylbutyl ethanoate	130.0	0.88	142

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(a) State the purpose of the concentrated sulfuric acid and of the anti-bumping granules added to the round-bottom flask.	(2)
Concentrated sulfuric acid in Step 1	
Anti-bumping granules in Step 2	
(b) Draw a labelled diagram of the apparatus used to heat the reaction mixture under reflux in Step 2 .	(2)

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(c) Draw a diagram of the separating funnel in Step 3, clearly labelling the aqueous and organic layers.

(2)

(d) Give the reason why the organic layer is washed with sodium hydrogencarbonate solution in Step **4** and suggest how the alkalinity of the aqueous layer should be confirmed.

(2



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	(2)
A student prepared 4.75 g of 3-methylbutyl ethanoate starting with 7.5 cm ³ of 3-methylbutan-1-ol and excess ethanoic acid.	
(i) Calculate the percentage yield of 3-methylbutyl ethanoate.	(2)
	(3)
(ii) Give the main reason why the yield is significantly less than 100%.	
Do not consider errors in the experimental procedure or transfer losses.	
	(1)
(Total for Question 4 = 14 r	marks)
TOTAL FOR PAPER = 50 N	IARKS



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No Lr nobelium lawrencium

103

102

101

100

66

86

6

95

4

93

92

6

uranium 238 **U**

protactinium [231] **Pa**

58 232 **Th** thorium 90

mendelevium [256] **Md**

fermium [253] **Fm**

 [245]
 [251]
 [254]

 Bk
 Cf
 Es

 berkelium
 californium einsteinium

(247) **Cm** curium 96

[257]

[254]

The Periodic Table of Elements

	_				<u> </u>						Ι.			Т			1					
0 (8)	4.0 He hetium 2	20.2	Re	neon 10	39.9	Ar	41gon 18	83.8	궃	krypton 36	131.3	Xe	xenon 54	[222]	R	radon 86		ted		_		
7	(17)	19.0	L	fluorine 9	35.5	ָב פֿיִּ	17 17	79.9	Ŗ	bromine 35	126.9	Ι	iodine 53	[210]	Αt	astatine 85		seen repor		175	ב	lutetium 71
9	(16)	16.0	0	oxygen 8	32.1	S	16 16	79.0	Se	selenium 34	127.6	<u>e</u>	tellurium 52	[209]	8	polonium 84		116 have t	nticated	173	ΥÞ	ytterbium 70
2	(15)	14.0	z	nitrogen 7	31.0	₽	prospriorus 15	74.9	As	arsenic 33	121.8	Sb	antimony 51	209.0	Bi	bismuth 83		Elements with atomic numbers 112-116 have been reported	but not fully authenticated	169	T	thulium 69
4	(14)	12.0	U	carbon 6	28.1	Si	14	72.6	Ge	germanium 32	118.7	Sn	ti. 20	207.2	Pb	lead 82		atomic nu	but not f	167	百	erbium 68
m	(13)	10.8	В	boron 5	27.0	ΙΑ	atuminium 13	69.7	Ga	gallium 31	114.8	In	indium 49	204.4	F	thallium 81		nents with		165	유	holmium 67
							(12)	65.4	Zn	zinc 30	112.4	В	cadmium 48	200.6	Hg	mercury 80				163	Dy	dysprosium 66
							(11)	63.5	J	copper 29	107.9	Ag	silver 47	197.0	Αu	gold 79	[272]	Rg	roentgenium 111	159	₽ P	terbium 65
							(10)	58.7	Έ	nickel 28	106.4	Pq	palladium 46	195.1	7	platinum 78	[271]	Ds	darmstadtium 110	157	PS	gadolinium 64
							(6)	58.9	ပ	cobalt 27	102.9	몺	rhodium 45	192.2	Ir	iridium 77	[368]	Μt	meitnerium 109	152	Eu	europium 63
	1.0 H hydrogen 1						(8)	55.8	Fe	iron 26	101.1	Ru	ruthenium 44	190.2	o	osmium 76	[277]	Ŧ	hassium 108	150		samarium 62
							(7)	54.9	W	manganese 25	[86]	2	technetium 43	186.2	Re	rhenium 75	[264]		bohrium 107	[147]	Pm	promethium 61
		mass	pol	number			(9)	52.0	ъ	chromium 24	95.9	Wo	molybdenum 42	183.8	>	tungsten 74	[596]	Sg	seaborgium 106	144	P	praseodymium neodymium 59 60
	Key	relative atomic mass	atomic symbol	name atomic (proton) number			(2)	50.9	>	vanadium 23	92.9	å	niobium 41	180.9	Та	tantalum 73	[797]	В	dubnium 105	141	P	praseodymium 59
		relat	atc	atomic			(4)	47.9	F	titanium 22	91.2	Zr	zirconium 40	178.5	Ŧ	hafnium 72	[261]	쪼	rutherfordium 104	140	Ç	cerium 58
							(3)	45.0	Sc	scandium 21	88.9		yttrium 39		La*	lanthanum 57	[227]	Ac*	actinium 89	•	es	•
7	(2)	9.0	Be	beryllium 4	24.3	Mg	magnesium 12	40.1	Ca	calcium 20	~	Sr	strontium 38	137.3	Ва	barium 56	[526]	Ra	radium 88		* Lanthanide series	* Actinide series
-	(1)	6.9	Ë	lithium 3	23.0	Na Fa		39.1	¥	potassium 19	85.5	&	rubidium s	132.9	CS	caesium 55	[223]	F	francium 87		* Lant	* Actin