Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel
International Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Friday 17 January 2020

Afternoon (Time: 1 hour 20 minutes) | Paper Reference **WCH13/01**

Chemistry

International Advanced Subsidiary/Advanced Level
Unit 3: Practical Skills in Chemistry I

Candidates must have: Scientific calculator
Ruler

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.
- There is a Periodic Table 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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Pearson

Answer ALL the questions.

Write your answers in the spaces provided.

1 Tests were carried out on some pairs of compounds.

(a) (i) Bromine water was added to separate solutions of sodium chloride and sodium iodide.

State **one** different observation for each reaction.

(2)

sodium chloride .....

.....

sodium iodide .....

.....

(ii) Name a test, with the expected observation, to confirm the presence of the sodium ion in these compounds.

(2)

Test	Observation

(b) (i) Barium chloride solution and hydrochloric acid were added to separate aqueous solutions of ammonium sulfate and ammonium nitrate.

State what would be **seen** for each compound which would allow you to distinguish between them.

(2)

ammonium sulfate .....

ammonium nitrate .....

(ii) Give a test, with the expected result, to confirm the presence of the ammonium ion (NH_4^+) in the ammonium compounds.

(2)

Test	Result

(c) (i) Acidified potassium dichromate(VI) solution was added to two test tubes each containing a different alcohol. The test tubes were placed in a warm water bath.

The alcohols were propan-1-ol and 2-methylpropan-2-ol.

State what would be **seen** for each alcohol which would allow you to distinguish between them.

(2)

propan-1-ol .....

2-methylpropan-2-ol .....

(ii) Give a **chemical** test, with the expected observation, to confirm the presence of the hydroxy group.

(2)

Test	Observation

(d) Acidified potassium manganate(VII) solution was added to separate test tubes containing samples of hexane and hexene. The test tubes were shaken gently.

State what would be **seen** for each compound which would allow you to distinguish between them.

(2)

hexane .....

hexene .....

(Total for Question 1 = 14 marks)

2 A class of students carried out experiments to determine the enthalpy change for the reaction of magnesium metal with hydrochloric acid.

The following method was used.

Step **1** A 1.00 m length of magnesium ribbon was cleaned using sandpaper, weighed and cut into 10 cm lengths.

Step **2** 50 cm^3 of dilute hydrochloric acid (an excess) was placed into a polystyrene cup and the temperature measured.

Step **3** A 10 cm length of magnesium ribbon was added to the hydrochloric acid. The solution was stirred gently and the maximum temperature recorded.

$$Mg + 2HCl \rightarrow MgCl_2 + H_2$$

Results

Measurement	Value
Mass of 1.00 m of magnesium ribbon / g	0.86
Initial temperature of hydrochloric acid before addition of magnesium ribbon / °C	21.4
Final temperature of solution / °C	29.2

(a) (i) Calculate the number of moles of magnesium in the 10 cm length of ribbon used in this experiment. [A_r value: Mg = 24.3]

(2)

(ii) Calculate the enthalpy change for this reaction including a sign and units. Give your answer to an appropriate number of significant figures.

Data:

Specific heat capacity of the solution = $4.2\,J\,g^{-1}\,°C^{-1}$

The density of the reaction mixture = $1.0\,g\,cm^{-3}$

(4)

(b) (i) The maximum uncertainty each time the thermometer was read was ± 0.1 °C. Calculate the percentage uncertainty in measuring the temperature change in this experiment.

(1)

(ii) Suggest **one** way of reducing the percentage uncertainty in measuring the temperature change without changing the apparatus or just repeating the experiment. Justify your answer.

(2)

.....

.....

.....

.....

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(c) One student carried out the same experiment but used a glass beaker instead of a polystyrene cup.

State how this would affect the value of the enthalpy change obtained.
Justify your answer.

(2)

(d) Explain why the magnesium ribbon was cleaned with sandpaper before being weighed.

(2)

(Total for Question 2 = 13 marks)

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3 An experiment was carried out to determine the purity of solid sodium carbonate, Na_2CO_3. The following procedure was used.

4.89 g of impure sodium carbonate was weighed and dissolved in distilled water.

The solution and washings were transferred to a 250.0 cm^3 volumetric flask, and the liquid level made up to the mark with distilled water and the flask shaken.

A pipette was used to transfer 25.0 cm^3 portions of the solution to conical flasks.

Each portion of the solution was then titrated with hydrochloric acid of concentration 0.200 mol dm^{-3}.

$$Na_2CO_3(aq) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2O(l) + CO_2(g)$$

(a) The indicator used was methyl orange. State the colour change at the end-point.

(2)

From ..... to .....

(b)

Results

Number of titration	1	2	3	4
Burette reading (final) / cm^3	27.55	26.25	28.30	26.15
Burette reading (start) / cm^3	0.00	0.05	1.05	0.05
Volume of HCl(aq) / cm^3				

(i) Complete the table and, using appropriate titrations, calculate the mean titre.

(2)

.....

(ii) Calculate the percentage purity, by mass, of the sodium carbonate.

(5)

(Total for Question 3 = 9 marks)

4 Bromoethane can be prepared by reacting ethanol with a mixture of sodium bromide and concentrated sulfuric acid.

(a) Step **1** 5 cm^3 of ethanol and 5 cm^3 of water are added to a round-bottomed flask. The flask is placed in an ice bath and 5 cm^3 of concentrated sulfuric acid is added slowly. During this process the flask is shaken gently.

Explain why the sulfuric acid must be added slowly.

(2)

(b) Step **2** 6.0 g of solid potassium bromide is ground up into a fine powder using a pestle and mortar. The powder is then added to the round-bottomed flask containing the ethanol and concentrated sulfuric acid. The mixture is heated.

State why the potassium bromide is ground up to a fine powder. Justify your answer.

(2)

(c) Step **3** The crude bromoethane formed in Step **2** is distilled off.

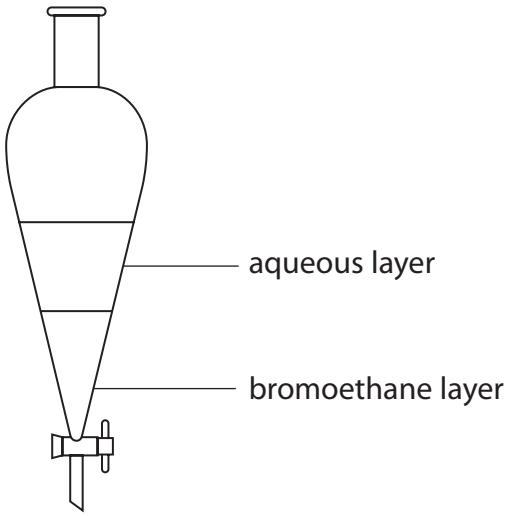
(i) Draw a labelled diagram to show the apparatus suitable for this distillation. Include a thermometer but no clamps or stands.

(3)

(ii) State how anti-bumping granules prevent bumping in the distillation flask.

(1)

(d) Step **4** The distillate from Step **3** is transferred to a separating funnel where it separates into an aqueous layer and a layer containing impure bromoethane.



(i) State **two** physical properties of bromoethane that can be deduced from this diagram.

(2)

(ii) Describe how the aqueous layer could be removed from the separating funnel.

(1)

(e) Step **5** After removing the aqueous layer, sodium hydrogencarbonate solution is added to the impure bromoethane in a separating funnel and the two layers separated again.

State why sodium hydrogencarbonate solution is added to the impure bromoethane.

(1)

.....

.....

.....

(f) Step **6** The bromoethane is placed into a sample bottle and a drying agent is added.

(i) Identify, by name or formula, a suitable drying agent.

(1)

.....

.....

(ii) Describe how the appearance of the bromoethane changes after the drying agent has been added and the mixture allowed to stand.

(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	0 (8)
																(18)
							1.0 H hydrogen 1									4.0 He helium 2
(1)	(2)										(13)	(14)	(15)	(16)	(17)	
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	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(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	58.9 Co cobalt 27	58.7 Ni nickel 28	63.5 Cu copper 29	65.4 Zn zinc 30	69.7 Ga gallium 31	72.6 Ge germanium 32	74.9 As arsenic 33	79.0 Se selenium 34	79.9 Br bromine 35	83.8 Kr krypton 36
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	102.9 Rh rhodium 45	106.4 Pd palladium 46	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	127.6 Te tellurium 52	126.9 I iodine 53	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	192.2 Ir iridium 77	195.1 Pt platinum 78	197.0 Au gold 79	200.6 Hg mercury 80	204.4 Tl thallium 81	207.2 Pb lead 82	209.0 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[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	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111							

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

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