Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International Advanced Level

Time 1 hour 20 minutes

Paper reference **WCH13/01**

Chemistry

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

You must have:
Scientific calculator, ruler

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.
- 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 ▶

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B:1/1/1/1/

P 7 1 8 6 2 A 0 1 1 2

Pearson

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

1 (a) In the test for sulfate ions, an acid is added, followed by aqueous barium chloride.

(i) Give a reason why the mixture needs to be acidified.

(1)

(ii) Identify, by name or formula, a **suitable** acid. Justify your answer.

(2)

(iii) A student is given a sample of white crystals to test for sulfate ions.

Describe how the test should be carried out, including the positive result.

(2)

(b) A student is given a solid known to be either sodium bromide or barium chloride.

(i) State the test you would carry out on separate solid samples of sodium bromide and barium chloride to show the **cations** present. Include the positive result for each cation.

(3)

(ii) State the test you would carry out on separate solutions of sodium bromide and barium chloride to show the **anions** present. Include the positive result for each anion.

(3)

(Total for Question 1 = 11 marks)

2 Some antacid medications to treat acid indigestion contain magnesium carbonate, $MgCO_3$.

A student investigates how much magnesium carbonate is in an antacid tablet.

Procedure

- crush a 1.30 g tablet to form a powder
- add the powder to 75.0 cm^3 of 0.200 mol dm^{-3} sulfuric acid
- stir the mixture until the reaction is complete
- make up to 250.0 cm^3 with distilled water
- titrate 25.0 cm^3 samples of the solution against 0.0250 mol dm^{-3} NaOH to determine the number of moles of sulfuric acid that did not react.

The results are shown.

Burette reading	Rough	1	2	3
Final reading / cm^3	13.45	25.60	37.85	12.35
Initial reading / cm^3	0.00	13.45	25.60	0.15
Titre / cm^3				

(a) (i) Complete the table.

(1)

(ii) Calculate the mean titre for the titration.

(1)

(b) The equation for the titration reaction is

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

(i) Calculate the number of moles of sulfuric acid that reacted with the sodium hydroxide in the mean titre, using your answer from (a)(ii).

(2)

(ii) Calculate the total number of moles of sulfuric acid used at the start of the experiment.

(1)

(iii) Calculate the percentage of magnesium carbonate in the antacid tablet, using your answers to (b)(i) and (b)(ii). You **must** show all your working.

(4)

$$MgCO_3 + H_2SO_4 \rightarrow MgSO_4 + H_2O + CO_2$$

[M_r $MgCO_3$ = 84.3 Mass of tablet = 1.30 g]

(c) (i) Give **one** possible reason for carrying out a rough titration.

(1)

.....

.....

(ii) Phenolphthalein indicator was used in the titration.

State the colour change seen at the end-point.

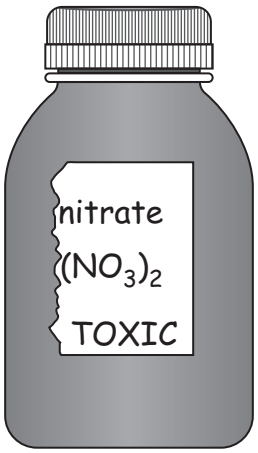
(2)

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

(Total for Question 2 = 12 marks)

3 Precipitation reactions can be used to determine the formulae of compounds.

A bottle has a torn label which shows that it contains a nitrate with the formula $X(NO_3)_2$.



Procedure

- a technician dissolved a sample of 12.41 g of the nitrate in deionised water to make 100 cm^3 of solution
- the technician pipetted 5.0 cm^3 of 1.50 mol dm^{-3} potassium iodide into each of a series of test tubes
- each test tube then had a volume of the nitrate solution added to it as shown in the table
- a cloudy yellow solution formed, and the precipitate was allowed to settle
- the height of the precipitate was then measured.

The equation for the reaction is

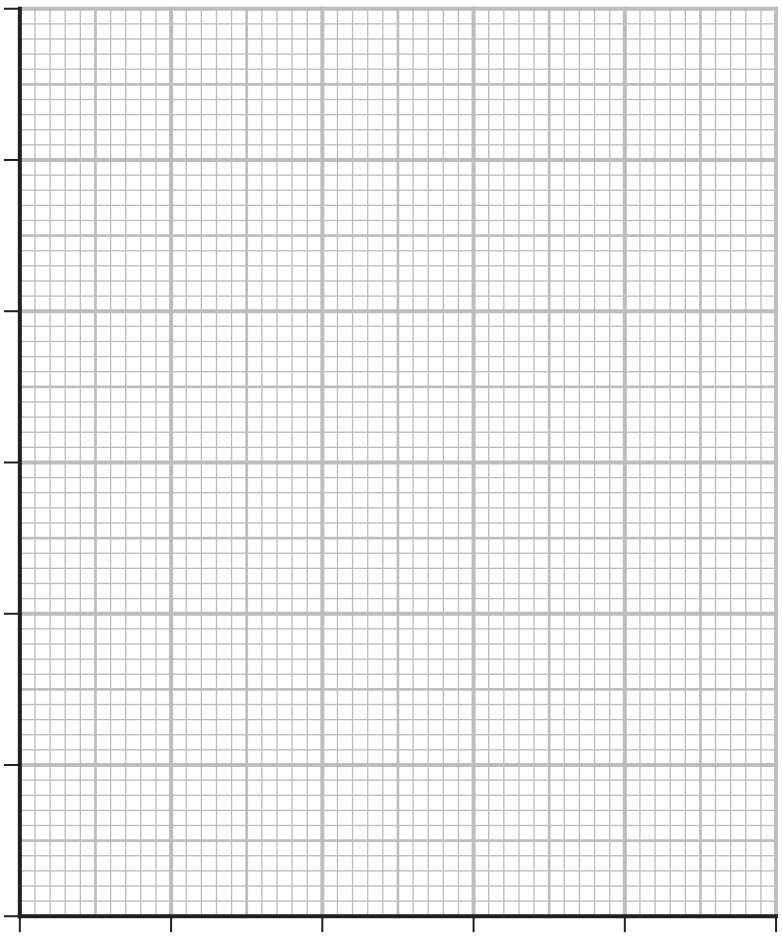
$$X(NO_3)_2(aq) + 2KI(aq) \rightarrow XI_2(s) + 2KNO_3(aq)$$

The results of the experiment are shown.

Volume of $X(NO_3)_2$ solution added / cm^3	Height of precipitate / mm
0	0
4	4
8	8
12	10
16	11
20	10

(a) (i) Plot the data on the grid.

(2)



(ii) State why the height of the precipitate becomes approximately constant.

(1)

.....

.....

(b) (i) Determine the minimum volume of nitrate solution needed to react completely with 5.0 cm^3 of potassium iodide solution.
You must show your working on the graph.

(2)

.....

(ii) Calculate the number of moles of potassium iodide in each test tube.

(1)

(iii) Calculate the concentration of the metal nitrate solution in g dm^{-3} using the information given in the procedure.

(1)

(iv) Identify X by using your answers to (b)(i), (b)(ii) and (b)(iii) to determine the M_r of the metal nitrate.
You **must** show all your working.

(4)

(v) Deduce the **ionic** equation for the formation of XI_2, using your answer to (b)(iv).
Include state symbols in your answer.

(1)

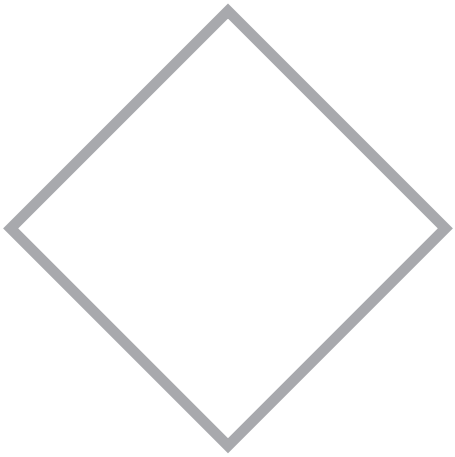
(c) Suggest why some of the precipitate heights may be above the maximum height expected. Assume there were no measurement errors.

(1)

(d) The metal nitrate is toxic.

Draw the hazard symbol that should be displayed on the bottle.

(1)



(Total for Question 3 = 14 marks)

4 Propan-1-ol, propan-2-ol and 2-methylpropan-2-ol are all alcohols commonly used in school laboratories.

Acidified potassium dichromate(VI) is used to oxidise alcohols.

(a) State the colour change seen when an alcohol is oxidised with acidified potassium dichromate(VI).

(2)

.....

(b) Draw a labelled diagram of the apparatus that is required to prepare and collect a sample of propanal by heating propan-1-ol with acidified potassium dichromate(VI).

(4)

(c) An electric heater may be used to heat a sample of an alcohol with acidified potassium dichromate(VI).

(i) State why an electric heater should be used rather than a Bunsen burner to heat these reaction mixtures.

(1)

.....

.....

DO NOT WRITE IN THIS AREA

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(ii) State why there is no reaction when 2-methylpropan-2-ol is heated with acidified potassium dichromate(VI).

(1)

(iii) Identify, by name or formula, **all** the possible oxidation **products** of propan-1-ol and propan-2-ol.

(1)

(iv) Give a **further** chemical test and the positive result for each of the oxidation products of **propan-1-ol**.

(4)

(Total for Question 4 = 13 marks)

TOTAL FOR PAPER = 50 MARKS

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)		Key									(13)	(14)	(15)	(16)	(17)	
6.9 Li lithium 3	9.0 Be beryllium 4		relative atomic mass atomic symbol name atomic (proton) number									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							

Elements with atomic numbers 112-116 have been reported but not fully authenticated

* Lanthanide series

* Actinide 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
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