Write your name here

Surname	Other names

Edexcel GCE

Centre Number	Candidate Number

Chemistry

Advanced

Unit 6B: Chemistry Laboratory Skills II Alternative

Thursday 10 January 2013 – Afternoon
Time: 1 hour 15 minutes

Paper Reference
6CH08/01

Candidates may use a calculator.

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.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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P 4 1 2 1 7 A 0 1 1 6

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

1 The table shows a series of tests carried out on a soluble crystalline compound **A**, which contains one anion and one cation. For each test, complete the table by filling in the inference column.

	Test	Observation	Inference
(a)	Observe the appearance of **A**.	**Pale** green solid.	..... **(1)**
(b)	Measure the pH of a dilute aqueous solution of **A** using a pH meter.	The pH is 6.0.	The type of reaction that has occurred when **A** dissolved in water is ..... **(1)**
(c)	Add a few drops of dilute sodium hydroxide solution to a solution of **A**.	A green precipitate forms.	The sodium hydroxide is acting as ..... The **formula** of the green precipitate is ..... **(2)**
(d)	Leave a sample of the green precipitate formed in (c) to stand in air.	The green precipitate turns brown on the surface.	The type of reaction that has occurred is ..... The **formula** of the brown precipitate is ..... **(2)**
(e)	Add excess sodium hydroxide solution to a sample of the green precipitate formed in (c).	The green precipitate does not dissolve.	..... **(1)**
(f)	Add barium chloride solution, $BaCl_2(aq)$, acidified with hydrochloric acid, to a solution of **A**.	A white precipitate forms.	The white precipitate is ..... **(1)**

(g) Identify compound **A** by name or formula.

(1)

.....

(Total for Question 1 = 9 marks)

2 Two organic compounds, **X** and **Y**, are colourless liquids. Both compounds contain four carbon atoms and one functional group.

(a) A series of tests was carried out on compound **X**.

(i) When a few drops of 2,4-dinitrophenylhydrazine solution were added to **X**, an orange precipitate was formed. What deduction can be made from the result of this test alone?

(1)

.....

.....

(ii) When **X** was warmed with Fehling's solution, a red precipitate was formed. What further deduction can be made from the result of this test?

(1)

.....

.....

(b) Give the two possible displayed formulae of **X**.

(2)

(c) A series of tests was carried out on compound **Y**.

(i) A dry sample of **Y** reacted with phosphorus(V) chloride, producing steamy fumes. What deduction can be made from the result of this test alone?

(1)

.....

.....

(ii) No reaction was observed when **Y** was added to sodium carbonate solution, $Na_2CO_3(aq)$. What further deduction can be made from the result of this test?

(1)

.....

.....

(iii) A sample of **Y** rotated the plane of plane-polarized light. What deduction can be made about the structure of **Y** from the result of this test?

(1)

.....

.....

(iv) Use your answers to parts (i), (ii) and (iii), and the fact that each molecule of **Y** contains four carbon atoms, to deduce the displayed formula of **Y**.

(1)

(v) Describe what you would expect to **see** if a sample of compound **Y** was added to iodine, I_2, in alkaline conditions.

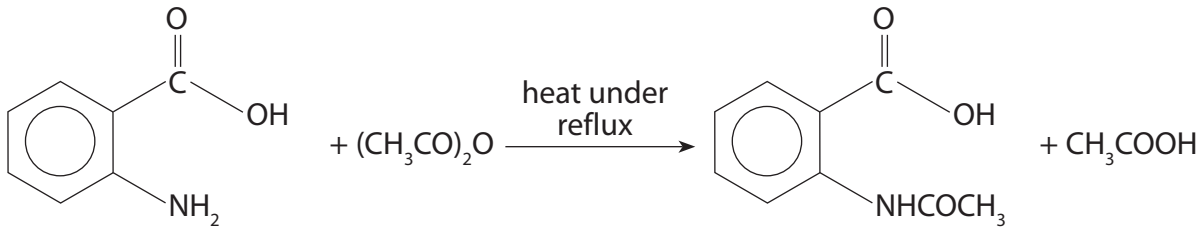
(1)

.....

.....

(Total for Question 2 = 9 marks)

3 The compound 2-ethanoylaminobenzoic acid can be made by reacting 2-aminobenzoic acid with ethanoic anhydride.



2-aminobenzoic acid ethanoic anhydride 2-ethanoylaminobenzoic acid

The steps of the experimental procedure are as follows:

1. Measure out 4.00 g of 2-aminobenzoic acid into a pear-shaped flask. Add ethanoic anhydride.
2. Add anti-bumping granules to the flask, fit a reflux condenser and bring the mixture slowly to the boil. Heat under reflux for 15 minutes.
3. Allow the reaction mixture to cool and add 5 cm^3 of water. Bring the contents of the flask back to the boil and then remove from the heat.
4. Let the reaction mixture cool to room temperature. A pale brown crystalline solid will form.
5. Collect the solid by suction filtration.
6. Purify the solid by recrystallization using ethanoic acid as the solvent.
7. Determine the melting temperature of the dry solid.

(a) (i) Calculate the minimum **volume**, in cm^3, of ethanoic anhydride needed for 4.00 g of 2-aminobenzoic acid to react completely.

[Molar masses / g mol^{-1}: $(CH_3CO)_2O$ = 102; $C_6H_4(NH_2)COOH$ = 137
Density $(CH_3CO)_2O$ = 1.082 g cm^{-3}.]

(3)

(ii) A student obtained 2.97 g of 2-ethanoylaminobenzoic acid from 4.00 g of 2-aminobenzoic acid. Calculate the percentage yield obtained by this student. Give your answer to **two** significant figures.

(3)

(b) (i) When this experiment is carried out, the actual volume of ethanoic anhydride used is greater than that calculated in (a). Suggest why this is so.

(1)

(ii) Anti-bumping granules are added in **step 2**. What would be observed if 'bumping' occurred?

(1)

(iii) Ethanoic anhydride is corrosive to both the skin and the respiratory system. Suggest **two** precautions to minimise the risks when using ethanoic anhydride, other than wearing eye protection and a lab coat.

(2)

(iv) Outline how you would carry out the recrystallization in **step 6**.

(4)

(v) Suggest a reason why the recrystallization will slightly reduce the yield of 2-ethanoylaminobenzoic acid.

(1)

(vi) Draw a labelled diagram of the apparatus that could be used to find the melting temperature of the dry solid in **step 7**.

(2)

(vii) State **two** ways you would use the results from (vi) to check the identity and purity of the product.

(2)

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(Total for Question 3 = 19 marks)

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4 The concentration of a solution of sodium dichromate(VI), $Na_2Cr_2O_7$, can be found by titration with a solution containing $Fe^{2+}(aq)$ ions in acidic conditions.

A 20.0 cm^3 sample of a solution of sodium dichromate(VI), of unknown concentration, was titrated with a solution of $Fe^{2+}(aq)$ ions, of concentration 0.0500 mol dm^{-3}. An indicator, diphenylamine, was used. This turned an intense violet colour at the end point.

The titration was repeated several times and some of the results are shown in the table below.

Titration number	1 (trial)	2	3	4
Burette reading (final) / cm^3	21.45	41.35	21.95	
Burette reading (initial) / cm^3	1.20	21.45		21.95
Volume of $Fe^{2+}(aq)$ used / cm^3			20.00	19.80
Titre used to calculate mean (✓)				

(a) Explain why a trial titration (titration 1) is carried out.

(1)

.....

.....

(b) (i) Complete the table and indicate with a tick (✓) those titres most suitable for calculating a mean titre.

Use the titres you have chosen to calculate the mean titre.

(4)

Mean titre = ... cm^3

(ii) Use the equation below, and your mean titre, to calculate the concentration of the sodium dichromate(VI) solution, in mol dm^{-3}.

(3)

$$Cr_2O_7^{2-}(aq) + 6Fe^{2+}(aq) + 14H^+(aq) \rightarrow 2Cr^{3+}(aq) + 6Fe^{3+}(aq) + 7H_2O(l)$$

orange green

(c) Assuming the accuracy of the burette is ± 0.05 cm^3 each time the burette is read, calculate the % error of the titre in **titration 3**.

(1)

(d) Suggest one reason why the indicator diphenylamine is needed, even though the solution in the titration flask changes colour from orange to green when no indicator is used.

(1)

.....

.....

.....

(e) A student carrying out one titration left an air bubble in the tip of the burette before taking the initial reading. This bubble was no longer present when the student took the final reading.

State and explain what effect, if any, this would have on the titre value. What effect would the use of this titre have on the calculated concentration of sodium dichromate(VI)?

(3)

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.....

.....

.....

(Total for Question 4 = 13 marks)

TOTAL FOR PAPER = 50 MARKS

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The Periodic Table of Elements

1	2											3	4	5	6	7	0 (8)
							1.0 H hydrogen 1										(18)
(1)	(2)		Key									(13)	(14)	(15)	(16)	(17)	4.0 He helium 2
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

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

* Lanthanide series

* Actinide series