Write your name here

Surname	Other names

Edexcel GCE

Centre Number	Candidate Number

Chemistry

Advanced
Unit 6B: Chemistry Laboratory Skills II
Alternative

Friday 14 May 2010 – Morning
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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Answer ALL the questions. Write your answers in the spaces provided.

1 Compound **A** is a salt containing one cation and one anion. Complete the following table by filling in the **inferences** column.

	Test	Observations	Inferences	
(a)	Observe the appearance of **A**.	**A** is a yellow crystalline solid.		**(1)**
(b)	Carry out a flame test on **A**.	Persistent bright yellow flame colour.		**(1)**
(c)	Add 5 cm^3 of dilute sulfuric acid to 0.5 g of **A**.	**A** dissolves to form an orange solution.	Ions formed are	**(1)**
(d)	To the solution obtained in (c), add about 10 drops of ethanol and warm the mixture gently.	Orange solution turns green.		**(2)**
(e)	Divide the green solution from (d) into two equal portions. To one portion add sodium hydroxide solution a little at a time until in excess.	Green precipitate forms which dissolves in excess sodium hydroxide to form a green solution.	Green precipitate is .... Green ions formed in solution are	**(2)**

	Test	Observations	Inferences	
(f)	To the second portion of the solution, add zinc powder.	The solution turns pale blue.	Pale blue ions formed are ..... Role of zinc	(2)
(g)	Filter the mixture formed in (f) to remove the excess zinc and then shake the filtrate vigorously.	The pale blue solution turns green.	Green ions formed are ..... Explanation	(2)

(Total for Question 1 = 11 marks)

2 **P** and **Q** are different organic compounds, each of which has **three** carbon atoms and only **one** functional group.

(a) Complete the table below by filling in the inferences column. In each case you should state what the test and observation tell you about the **original** compound **P**.

	Test	Observation	Inferences about compound **P**	
(i)	Add a small amount of dry phosphorus(V) chloride to 1 cm^3 of **P**.	Steamy fumes form which turn damp blue litmus paper red.		**(1)**
(ii)	Add about 2 cm^3 of sodium carbonate solution to 1 cm^3 of **P**.	No reaction occurs.		**(1)**
(iii)	Add about 2 cm^3 of sodium hydroxide solution to 10 drops of **P**. Then add a solution of iodine in potassium iodide, drop by drop, until the iodine is just in excess. Warm the mixture in a water bath.	A pale yellow precipitate with an antiseptic smell forms.		**(1)**

(iv) Use the information above to identify, by name or formula, the compound **P**.

(1)

(v) The mass spectrum of **P** has a peak at *m/e* = 45. Identify the species responsible for this peak and explain how this species is formed from **P**.

(2)

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(b) Complete the table below by filling in the inferences column.

	Test	Observation	Inferences
(i)	Add a small amount of dry phosphorus(V) chloride to 1 cm^3 of **Q**.	Steamy fumes form which turn damp blue litmus paper red.	Steamy fumes are ....
(ii)	Add about 2 cm^3 of sodium carbonate solution to 1 cm^3 of **Q**.	Vigorous effervescence occurs and the gas evolved turns limewater milky.	Functional group in compound **Q** is ....

(1)

(1)

(iii) Use the information above to identify, by name or formula, the compound **Q**.

(1)

(Total for Question 2 = 9 marks)

3 The purity of a sample of iron from a blast furnace may be determined by titration. The iron is contaminated with carbon and calcium silicate.

A known mass of the impure iron is dissolved in dilute sulfuric acid to form a solution containing iron(II) ions. Portions of this solution are titrated with a solution of potassium manganate(VII) of known concentration.

The steps of the experimental procedure are as follows.

1. Approximately 1.5 g of a sample of the impure iron, in the form of a fine powder, was accurately weighed. The results are shown in **Table 1**.

2. The iron was transferred to a 250 cm^3 conical flask to which 50 cm^3 of dilute sulfuric acid (an excess) was added. The mixture was warmed to about 60 °C and then allowed to stand until the reaction was complete.

3. The mixture in step 2 was filtered and the residue was washed with a small volume of the dilute sulfuric acid.

4. All of the filtrate in step 3 was transferred to a 250 cm^3 volumetric flask. A further 50 cm^3 of the dilute sulfuric acid was added and then the volume was made up to the mark with distilled water. The resulting solution was mixed thoroughly.

5. 25.0 cm^3 portions of the solution in step 4 were transferred to clean conical flasks and titrated with a potassium manganate(VII) solution of concentration 0.0220 $mol\,dm^{-3}$. The results are shown in **Table 2**.

(a) Write an **ionic** equation for the reaction between iron and dilute sulfuric acid. State symbols are **not** required.

(1)

(b) How would you know when the reaction between the iron and the dilute sulfuric acid was complete?

(1)

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.....

(c) The results of the experiment are given in the tables below.

Table 1

Mass of weighing bottle + impure iron	11.22 g
Mass of empty weighing bottle	9.74 g
Mass of impure iron	1.48 g

Table 2

Solution in the burette: 0.0220 mol dm^{-3} potassium manganate(VII)
Solution in the flask: 25.00 cm^3 of solution containing iron(II) ions (step 5)

Titration number	Trial	1	2	3	4
Burette reading (final) / cm^3	30.00	23.10	24.80	24.45	23.20
Burette reading (initial) / cm^3	6.65	0.05	2.10	1.45	0.25
Titre / cm^3	23.35				
Titres used (✓or ×)	×				

(i) Complete **Table 2** by filling in the missing data. Then mark with a tick (✓) those titres that will be used in the calculation of the mean titre and mark with a cross (×) any titres that will be discarded.

(2)

(ii) Calculate the mean titre in cm^3.

(1)

(iii) The ionic half-equations for the reactions of the iron(II) ions and the manganate(VII) ions are given below.

$$Fe^{2+} \rightarrow Fe^{3+} + e^-$$

$$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$$

Calculate the mass of iron in the original sample of impure iron and hence calculate the percentage by mass of iron in the sample.

[The relative atomic mass of iron is 55.8]

(4)

(d) Name the pieces of apparatus used to measure the 25.0 cm^3 solution containing iron(II) ions in step 5 and the 50 cm^3 sulfuric acid in steps 2 and 4.

Explain why different apparatus is used in each case.

(2)

To measure 25.0 cm^3 of solution .....

To measure 50 cm^3 sulfuric acid .....

Explanation .....

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(e) Suggest why it was necessary to add such a large excess of sulfuric acid.

(1)

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(f) State how you would detect the end-point of the titration.

(1)

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(g) Explain why it is incorrect to use hydrochloric acid instead of sulfuric acid in this titration.

(2)

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(Total for Question 3 = 15 marks)

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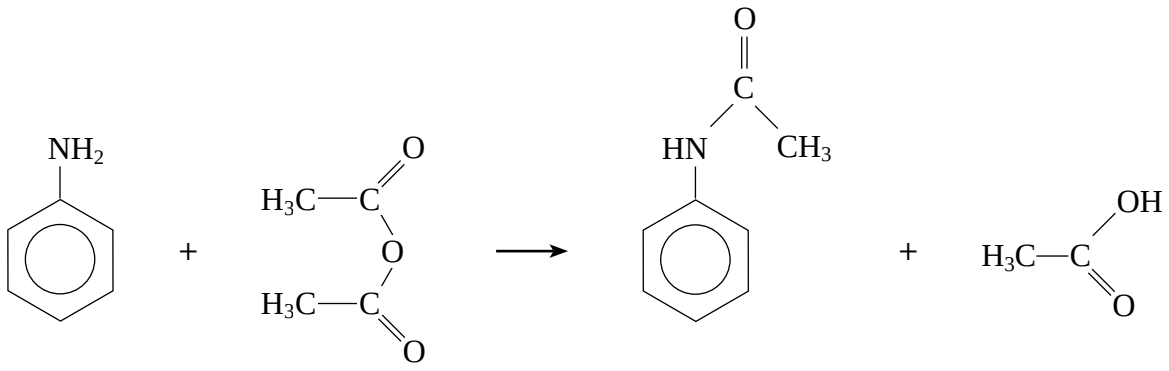
4 *N*-phenylethanamide may be prepared in the laboratory by reacting ethanoic anhydride with phenylamine; both the reactants and the products are flammable. The equation for the reaction is shown below.



***N*-phenylethanamide**

A student is asked to prepare pure *N*-phenylethanamide starting from 9.00 g of phenylamine.

(a) Calculate the minimum mass, in grams, of ethanoic anhydride required to react completely with 9.00 g of phenylamine.

[Molar masses / g mol^{-1}: $C_6H_5NH_2$ = 93.0; $CH_3COOCOCH_3$ = 102]

(2)

(b) **The steps of the experimental procedure are as follows.**

1. Mix the amount of ethanoic anhydride calculated in (a) with 10 g of glacial (pure) ethanoic acid in a round-bottom flask and add a further 1 g of the ethanoic anhydride.
2. Cool the flask from step 1 in a beaker of cold water and add 9.00 g of phenylamine, drop by drop, with gentle shaking.
3. Add anti-bumping granules and reflux the mixture from step 2 for 30 minutes.
4. Pour the liquid from the reflux flask into a beaker containing 100 cm^3 of distilled water and allow the mixture to stand until no more crystals are formed.
5. Filter the crystals under reduced pressure using a Buchner funnel and flask, washing the crystals with cold water.
6. Transfer the crystals to a boiling tube and dissolve them in the minimum volume of boiling water. Filter the hot solution using a glass filter funnel, cool the filtrate in a beaker of ice-cold water and filter the crystals formed using a Buchner funnel and flask.
7. Dry the crystals between filter papers and then by storing them in a desiccator.
8. Weigh the dry crystals and calculate the yield.

(i) Explain why, in step 1, the student is told to add a further 1 g of the ethanoic anhydride to the calculated mass so that it is in excess.

(1)

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(ii) Explain why, in step 2, the phenylamine is added drop by drop and the mixture immersed in cold water.

(1)

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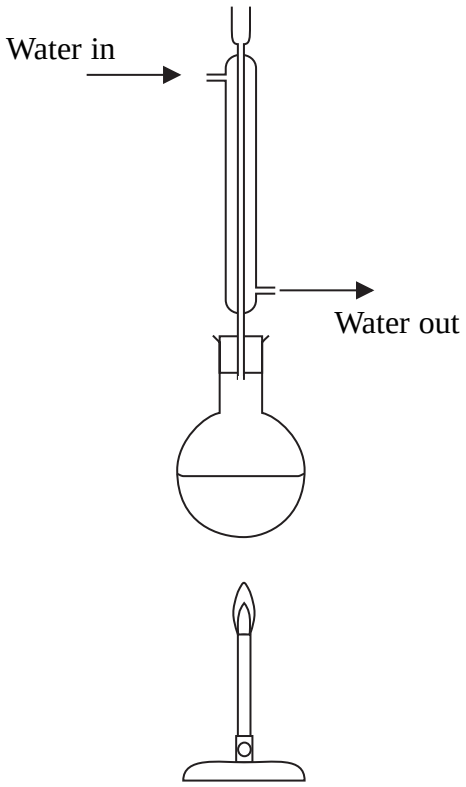
(iii) The student set up the apparatus for the reflux (step 3) as shown in the diagram below.



The apparatus has been incorrectly set up in TWO ways. State and explain these mistakes and how they should be corrected. You may assume that the apparatus is suitably clamped and that the reaction mixture contains anti-bumping granules.

(4)

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(iv) Draw a labelled diagram of a Buchner funnel and flask (step 5).

State how the reduced pressure is achieved (an explanation of this is **not** required).

(3)

Diagram

Reduced pressure is achieved by .....

.....

.....

(c) A student obtained 7.49 g of *N*-phenylethanamide from 9.00 g of phenylamine. Calculate the percentage yield.

[Molar masses / g mol^{-1}: $C_6H_5NH_2$ = 93.0; $C_6H_5NHCOCH_3$ = 135]

(2)

(d) Yields of less than 100% are often explained as being due to '**transfer losses**'.

Explain this term by referring to the recrystallization of *N*-phenylethanamide in steps 6 and 7.

(1)

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(e) Another student reported a yield of greater than 100%. Assuming that the student used the correct amounts of reagents and carried out the calculation correctly, suggest a reason for this result.

(1)

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(Total for Question 4 = 15 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: relative atomic mass / atomic symbol / name / atomic (proton) number									(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							

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