Write your name here

Surname	Other names

Edexcel GCE

Centre Number	Candidate Number

Chemistry

Advanced

Unit 6B: Chemistry Laboratory Skills II Alternative

Monday 16 January 2012 – 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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7/7/5/5/3/

P 3 5 9 8 8 A 0 1 1 6

PEARSON

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

1 Three compounds **A**, **B** and **C** are subjected to a series of chemical tests. Some information about these compounds is given below.

- The three compounds are isomers with molecular formula C_3H_6O.
- **A** and **B** contain only one functional group, but **C** contains two separate functional groups.
- None of the three compounds contains a ring of atoms.
- In each of the three compounds the oxygen atom is bonded to only one carbon atom.

(a) (i) **A** and **B** are tested separately with 2,4-dinitrophenylhydrazine solution and both give an orange precipitate.

When **A** and **B** are heated separately with a mixture of potassium dichromate(VI) and dilute sulfuric acid, the solution containing **B** turns from orange to green. The solution containing **A** remains orange.

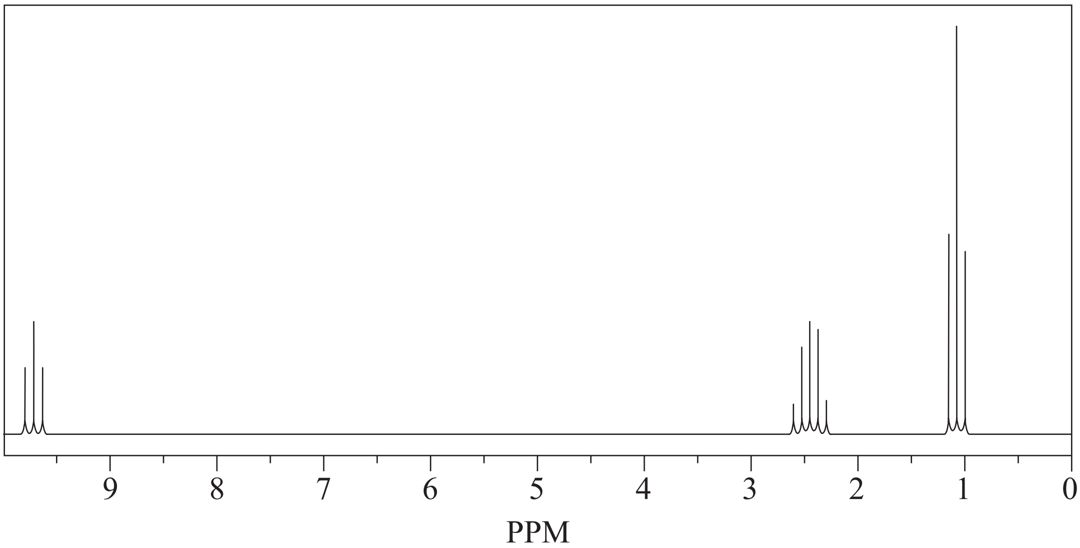
Use these results and the information at the start of the question to deduce displayed formulae for **A** and **B**.

(2)

A

B

(ii)



State whether this is the nmr spectrum of **A** or **B**. Justify your answer.

Explain how the nmr spectrum of the other isomer will differ.

(2)

....

....

....

P 3 5 9 8 8 A 0 3 1 6

(b) (i) **C** does **not** react with 2,4-dinitrophenylhydrazine.

When **C** is heated with acidified potassium dichromate(VI), the solution turns from orange to green.

When **C** is shaken with bromine water, the bromine water quickly turns colourless.

Name the **two** functional groups present in **C**.

(2)

....

....

(ii) State **two** observations you would expect to make when a small piece of sodium is added to **C**.

(2)

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....

....

....

(iii) Draw **two** possible displayed formulae for **C** which are consistent with the above information.

(2)

(Total for Question 1 = 10 marks)

2 A green crystalline solid, **D**, dissolves in water to give a pale green solution.

(a) When dilute sodium hydroxide is added to the solution of **D**, a green precipitate, **E**, is observed.

When ammonia solution is added to the solution of **D**, the same green precipitate, **E**, forms which does **not** dissolve in excess ammonia solution.

Identify, by name or formula, substance **E**.

(1)

....

(b) When a solution of **D** is warmed with dilute sodium hydroxide, a gas, **F**, which turns moist red litmus paper blue, is given off.

Identify, by name or formula, the gas **F**.

(1)

....

(c) When a solution of barium chloride is added to a solution of **D**, a white precipitate, **G**, forms which is insoluble in dilute hydrochloric acid.

Identify, by name or formula, the precipitate **G**.

(1)

....

(d) Deduce the **formulae** of the **three** ions present in the salt, **D**.

(3)

....

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....

(Total for Question 2 = 6 marks)

3 The equation for the reaction of iodine with propanone is

$$CH_3COCH_3(aq) + I_2(aq) \rightarrow CH_3COCH_2I(aq) + H^+(aq) + I^-(aq)$$

An experiment was carried out to find the order of reaction with respect to iodine.

50 cm^3 of iodine solution, concentration 0.020 mol dm^{-3}, was added to 25 cm^3 of sulfuric acid, concentration 2.0 mol dm^{-3}, in a conical flask.

25 cm^3 of propanone solution, concentration 2.0 mol dm^{-3}, was added to the mixture and a timer started.

A 10.0 cm^3 sample was removed after one minute. Further 10.0 cm^3 samples were removed every three minutes.

Immediately, each sample was added to 20 cm^3 of sodium hydrogencarbonate solution (an excess). Each sample was then titrated with sodium thiosulfate solution, concentration 0.010 mol dm^{-3}.

(a) (i) Show, by calculation of the number of moles, whether propanone or iodine was in excess.

(2)

(ii) What would be the most suitable piece of apparatus for removing a 10.0 cm^3 sample from the mixture?

(1)

....

(iii) What would be the most suitable piece of apparatus for measuring 20 cm^3 of the sodium hydrogencarbonate solution?

(1)

....

(iv) Suggest why each sample was added to sodium hydrogencarbonate solution.
Explain your answer.

(2)

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....

....

(b) (i) What colour change would you expect to see as the reaction takes place?

(2)

From .... to ....

(ii) To make the end-point of the titration easier to see, an indicator can be added.

Name the indicator and state the colour change you would expect to see.

(2)

Indicator ....

Colour change from .... to ....

(iii) At what stage in the titration should this indicator be added?

(1)

....

....

(c) The following results were obtained in the experiment.

Time / min	Volume of sodium thiosulfate solution / cm^3
1	19.1
4	15.9
7	13.0
10	9.9
13	7.1
16	3.9
19	1.0

(i) Explain why these results can be used to determine the order of the reaction directly, without calculating the corresponding concentrations of iodine in the solution.

(1)

....

....

....

(ii) Plot a graph of the volume of sodium thiosulfate solution on the vertical axis against time on the horizontal axis.

(2)

(iii) Use your graph to deduce the order of the reaction with respect to iodine.

Explain how you arrived at your answer.

(2)

(d) The following rate-determining step for the reaction between propanone and iodine is suggested.

$$CH_3COCH_3 + H^+ \rightarrow CH_3\underset{\displaystyle OH}{\underset{|}{C^+}}—CH_3$$

Explain why your order of reaction with respect to iodine is consistent with this rate-determining step.

(1)

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....

(Total for Question 3 = 17 marks)

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4 2-ethanoylaminobenzoic acid, $C_9H_9NO_3$, is a compound which emits flashes of light when its crystals are crushed or scraped. It is prepared under strictly supervised conditions.

The steps of the experimental procedure are as follows.

1. Place 3.5 g of 2-aminobenzoic acid, $C_7H_7NO_2$, in a dry 50 cm^3 flask fitted with a reflux condenser.
2. Add 7.0 cm^3 of ethanoyl chloride (an excess) by pouring it carefully down the condenser.
3. Heat slowly to boiling and reflux for 15 minutes.
4. Allow to cool and then add 5 cm^3 of water.
5. Bring the solution back to boiling by heating slowly.
6. Allow the solution to cool slowly at room temperature.
7. Collect the crystals of 2-ethanoylaminobenzoic acid by suction filtration.
8. Recrystallize the 2-ethanoylaminobenzoic acid from a 50% ethanoic acid/water mixture.

(a) Explain how the process of heating under reflux works and why it is often necessary to heat under reflux, as in **step 3**.

(3)

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(b) (i) Suggest why water was added (step 4).

(1)

....

....

(ii) Suggest why the mixture was cooled before the water was added (step 4).

(1)

....

....

(c) (i) Draw a fully labelled diagram of the apparatus used for suction filtration (step 7).

(3)

(ii) Suggest **two** advantages of suction filtration over normal filtration.

(2)

First advantage ....

....

Second advantage ....

....

(d) (i) Draw a fully labelled diagram of the apparatus you would use to determine the melting temperature of the 2-ethanoylaminobenzoic acid crystals.

(2)

(ii) Give **two** aspects of the melting temperature determination that would indicate the crystals were pure.

(2)

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....

....

....

(e) In the equation for this reaction, the mole ratio of 2-aminobenzoic acid, $C_7H_7NO_2$, and 2-ethanoylaminobenzoic acid, $C_9H_9NO_3$, is 1:1.

In an experiment, 3.5 g of 2-aminobenzoic acid produced 2.35 g of recrystallized 2-ethanoylaminobenzoic acid.

Calculate the percentage yield of the product for this reaction.

(3)

(Total for Question 4 = 17 marks)

TOTAL FOR PAPER = 50 MARKS

The Periodic Table of Elements

Key

relative atomic mass **atomic symbol** name atomic (proton) number

1 (1)	2 (2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	3 (13)	4 (14)	5 (15)	6 (16)	7 (17)	0 (8) (18)
							1.0 **H** hydrogen 1										4.0 **He** helium 2
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											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

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