Surname	Centre Number	Candidate Number
Other Names		2

GCE AS/A level

1092/01

CHEMISTRY – CH2

P.M. TUESDAY, 4 June 2013

1½ hours

FOR EXAMINER'S USE ONLY		
Section	Question	Mark
A	1-6	
B	7	
	8	
	9	
	10	
	11	
TOTAL MARK		

ADDITIONAL MATERIALS

In addition to this examination paper, you will need a:
- calculator;
- **Data Sheet** containing a **Periodic Table** supplied by WJEC. Refer to it for any **relative atomic masses** you require.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

Write your name, centre number and candidate number in the spaces at the top of this page.

Section A Answer **all** questions in the spaces provided.
Section B Answer **all** questions in the spaces provided.

Candidates are advised to allocate their time appropriately between **Section A (10 marks)** and **Section B (70 marks)**.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

The maximum mark for this paper is 80.

Your answers must be relevant and must make full use of the information given to be awarded full marks for a question.

The *QWC* label alongside particular part-questions indicates those where the Quality of Written Communication is assessed.

If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

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SECTION A

Answer **all** *questions in the spaces provided.*

1. State which **one** of the following formulae represents an **alkane**. [1]

A C_8H_{16}

B C_8H_{17}

C C_8H_{18}

D C_8H_{20}

2. In order to form a magnesium atom, a magnesium ion must: [1]

A gain one electron

B gain two electrons

C lose two electrons

D lose two protons

3.

ammonium nitrate	calcium chloride	magnesium carbonate
potassium hydroxide	sodium sulfate	

From the list of compounds above choose one that

(a) gives a brick-red flame test, [1]

.....

(b) is insoluble in water, [1]

.....

(c) in solution forms a white precipitate with aqueous barium chloride. [1]

.....

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4. Classify the following species as electrophile, nucleophile or radical by completing the table below. [2]

Species	Cl•	NH_3
Classification		

5. Nanoscience involves the study of very small particles. Nano-sized silver particles have antibacterial and antifungal properties. Give **one** use of nano-sized silver particles. [1]

.....

.....

6. State and explain which two of the following elements combine to form the **most** ionic bond. [2]

chlorine magnesium potassium sulfur

.....

.....

Total Section A [10]

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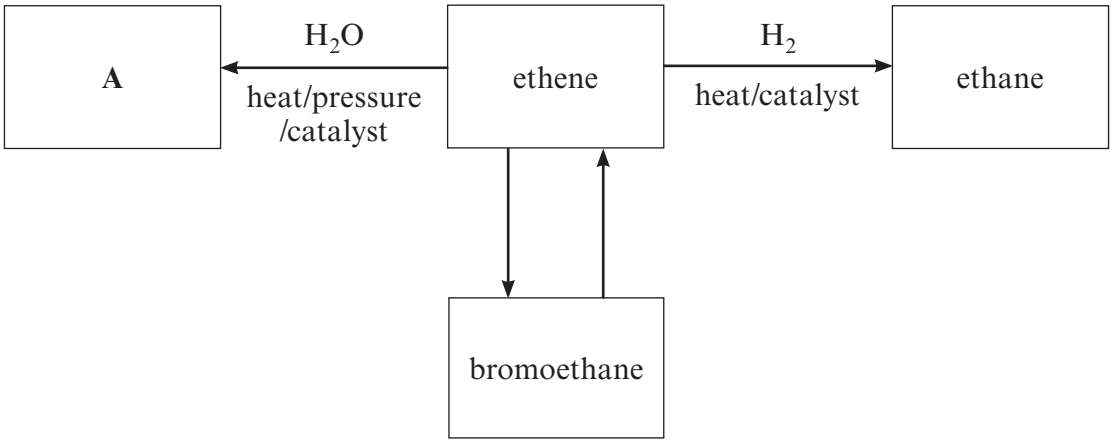
SECTION B

Answer **all** *questions in the spaces provided.*

7. *(a)* Ethene can be used to make many useful compounds. Study the reaction scheme shown below then answer the following questions.



(i) Draw the **displayed** formula of compound **A**. [1]

(ii) Name the catalyst used in the conversion of ethene to ethane. [1]

.....

(iii) Name the reagent(s) and condition(s) necessary to convert bromoethane to ethene. [2]

.....

.....

(iv) Classify the type of reaction taking place when ethene is formed from bromoethane. [1]

.....

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(b) In the same way that ethene can be polymerised to give the polymer poly(ethene), propene can form poly(propene).

(i) Draw the repeating unit in poly(propene). [1]

(ii) Calculate how many monomer units are joined together to give poly(propene) if it has a relative molecular mass of 1.05×10^6. [2]

Number of monomer units = ...

(c) (i) A bromoalkane was shown to contain 22.0% carbon and 73.4% bromine by mass. Calculate the **empirical** formula of the compound. [3]

Empirical formula .....

(ii) State what other information would be needed to be able to deduce the **molecular** formula of this compound. [1]

.....

Total [12]

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8. *(a)* In March 2012 the UK Government proposed a minimum price of 40p per unit of alcohol in an effort to 'turn the tide' against binge drinking.

State **one** effect on the human body and **one** effect on society of the excessive use of alcoholic drinks. [2]

Effect on the human body .....

.....

Effect on society .....

.....

(b) Butan-1-ol can be prepared by warming 1-chlorobutane with aqueous sodium hydroxide.

(i) Classify the type of reaction occurring and give the mechanism for the reaction. [4]

Reaction type .....

Mechanism

(ii) Use the infrared absorption frequencies given in the Data Sheet to explain how you would know if all the 1-chlorobutane has been converted into butan-1-ol. [2]

.....

.....

.....

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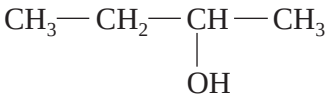
(c) Butan-1-ol has the molecular formula $C_4H_{10}O$.

Two other isomers of $C_4H_{10}O$ are butan-2-ol and methylpropan-1-ol.



butan-2-ol

(i) Draw the **skeletal** formula of methylpropan-1-ol. [1]

(ii) Name the type of isomerism shown by these isomers. [1]

.....

(iii) Butan-1-ol can be oxidised by acidified potassium dichromate(VI) to form butanoic acid. State what you would **observe** during this reaction. [1]

.....

(iv) Butan-1-ol can also be dehydrated. Name a suitable dehydrating agent and write an equation for this reaction. [2]

Dehydrating agent .....

Equation

.....

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(d) 1-Chlorobutane is an example of a halogenoalkane. One group of halogenoalkanes (CFCs) has been shown to play a role in ozone depletion. Most of these ozone-depleting substances contain chlorine. Halogenoalkanes containing only fluorine do not harm the ozone layer.

Due to the Montreal Protocol of 1987, CFCs have been largely banned and have been replaced in many applications by HFCs, which contain fluorine as the only halogen.

(i) Explain why CFCs deplete the ozone layer, but HFCs do not. [2]

.....

.....

.....

.....

(ii) Suggest a reason why there is still concern about ozone depletion. [1]

.....

.....

Total [16]

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9. *(a)* Petroleum is one of the most important resources in the world. It is estimated that we consume about 88 million barrels each day. Describe the general chemical composition of petroleum. [1]

.....

.....

(b) Butane is a useful fuel obtained from petroleum. Write an equation for the complete combustion of butane. [1]

.....

(c) Another fuel is methane. Give the H—$\hat{C}$—H bond angle in a methane molecule. [1]

.....

(d) Explain why the H—$\hat{O}$—H bond angle in water is less than the H—$\hat{C}$—H bond angle in methane. [3]

QWC [1]

.....

.....

.....

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.....

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(e) Covalent compounds like methane and butane are gases at room temperature, however metals are generally solids with high melting temperatures.

(i) State, giving a reason, whether you would expect butane to have a higher or lower boiling temperature than methane. [1]

.....

.....

.....

(ii) Describe briefly the nature of metallic bonding and use this to explain why metals are malleable (can be hammered into shape) and conduct electricity. [4]
QWC [1]

.....

.....

.....

.....

.....

.....

.....

Total [13]

Examiner only

10. *(a)* The Group 7 elements chlorine and iodine can both be produced from brine and can be used as disinfectants.

(i) Give the physical states of chlorine and iodine at room temperature. [1]

chlorine .....

iodine .....

(ii) State what is **observed** (if anything) when chlorine and iodine are added separately to potassium bromide solution. Write an equation for any reaction. [3]

Observations .....

.....

.....

Equation(s) .....

.....

(b) Chlorine can react with water to produce oxygen.

$$2Cl_2 + 2H_2O \longrightarrow 4HCl + O_2$$

Explain why this reaction is classified as a redox reaction. [2]

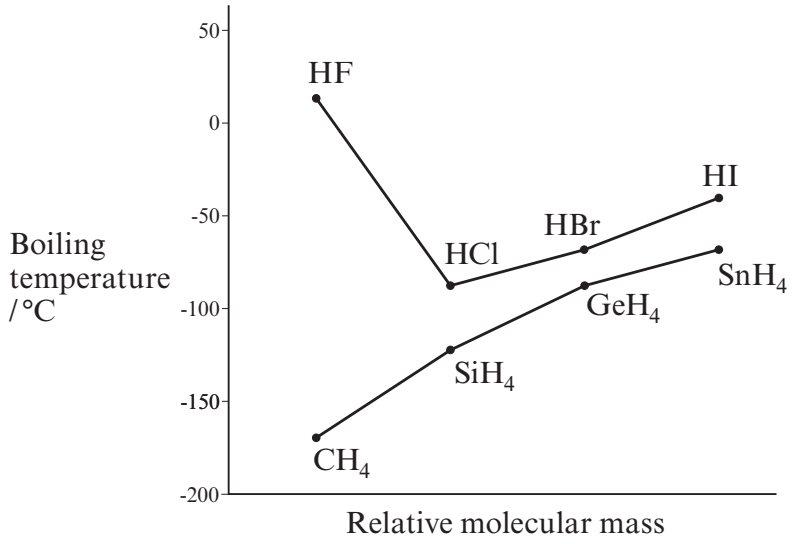
.....

.....

.....

Examiner only

(c) The diagram below shows a plot of boiling temperature against relative molecular mass for the hydrides of Group 7 and Group 4.



(i) Describe the trends in boiling temperatures for the hydrides of Group 7 and Group 4, noting any anomalies. [2]

.....

.....

.....

.....

(ii) By reference to the types of intermolecular force present, explain the shape of the plot for the hydrides of Group 7. [3]

QWC [1]

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.....

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.....

.....

QUESTION 10 CONTINUES ON PAGE 14

Examiner only

(iii) Suggest why the boiling temperature of HCl is greater than that of SiH_4. [1]

.....

.....

.....

Total [13]

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11. Jennifer and Marged carry out some experiments with Group 2 metals.

(a) In the first experiment, Jennifer reacts calcium with oxygen to form calcium oxide.

(i) Write an equation for the reaction. [1]

.....

(ii) Using outer electrons only, draw a dot and cross diagram to show the transfer of electrons involved in the formation of calcium oxide. Show the charges on the ions formed. [2]

(b) Jennifer then adds water to the calcium oxide. Some of it reacts to form a solution of calcium hydroxide.

(i) Write the formula of calcium hydroxide. [1]

.....

(ii) Suggest the pH of this solution. [1]

.....

(c) Jennifer reacts the solution of calcium hydroxide with an aqueous solution of sodium carbonate and a white precipitate is seen. Write the **ionic** equation for this reaction. Include the relevant state symbols in the equation. [1]

.....

Examiner only

(d) Marged adds a strip of magnesium to dilute hydrochloric acid.

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

(i) State what she would **observe** as this reaction proceeds. [2]

.....

.....

(ii) If the mass of the magnesium strip is 0.503 g and the concentration of the acid is 1.60 mol dm^{-3}, calculate the minimum volume of acid required to react completely with the magnesium, giving your answer to **three** significant figures. [3]

Volume of acid = ... cm^3

(iii) Calculate the volume at room temperature of the hydrogen produced in this reaction. [1]

[1 mol of gas occupies 24.0 dm^3 at room temperature]

Volume of hydrogen = ... dm^3

(iv) Give a test which would confirm the presence of chloride ions in aqueous magnesium chloride, stating the result of the test. [2]

.....

.....

QUESTION 11 CONTINUES ON PAGE 18

Examiner only

(e) Marged repeats the experiment with beryllium. State whether you would expect beryllium to be more or less reactive than magnesium. Explain your answer clearly. [2]

.....

.....

.....

Total [16]

Total Section B [70]

END OF PAPER

Question number	**Additional page, if required. Write the question numbers in the left-hand margin.**

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1092/01-A

CHEMISTRY – DATA SHEET
FOR USE WITH CH2

P.M. TUESDAY, 4 June 2013

Infrared Spectroscopy characteristic absorption values

Bond	Wavenumber / cm^{-1}
C—Br	500 to 600
C—Cl	650 to 800
C—O	1000 to 1300
C═C	1620 to 1670
C═O	1650 to 1750
C≡N	2100 to 2250
C—H	2800 to 3100
O—H	2500 to 3550
N—H	3300 to 3500

THE PERIODIC TABLE