WJEC CBAC

GCE AS/A level

1092/01

CHEMISTRY – CH2

P.M. TUESDAY, 4 June 2013

1½ hours plus your additional time allowance

Surname _____

Other Names _____

Centre Number _____

Candidate Number 2 _____

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, black ball-point pen or your usual method.

Write your name, centre number and candidate number in the spaces provided on the front cover.

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.

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]

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

Species	$Cl\bullet$	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]

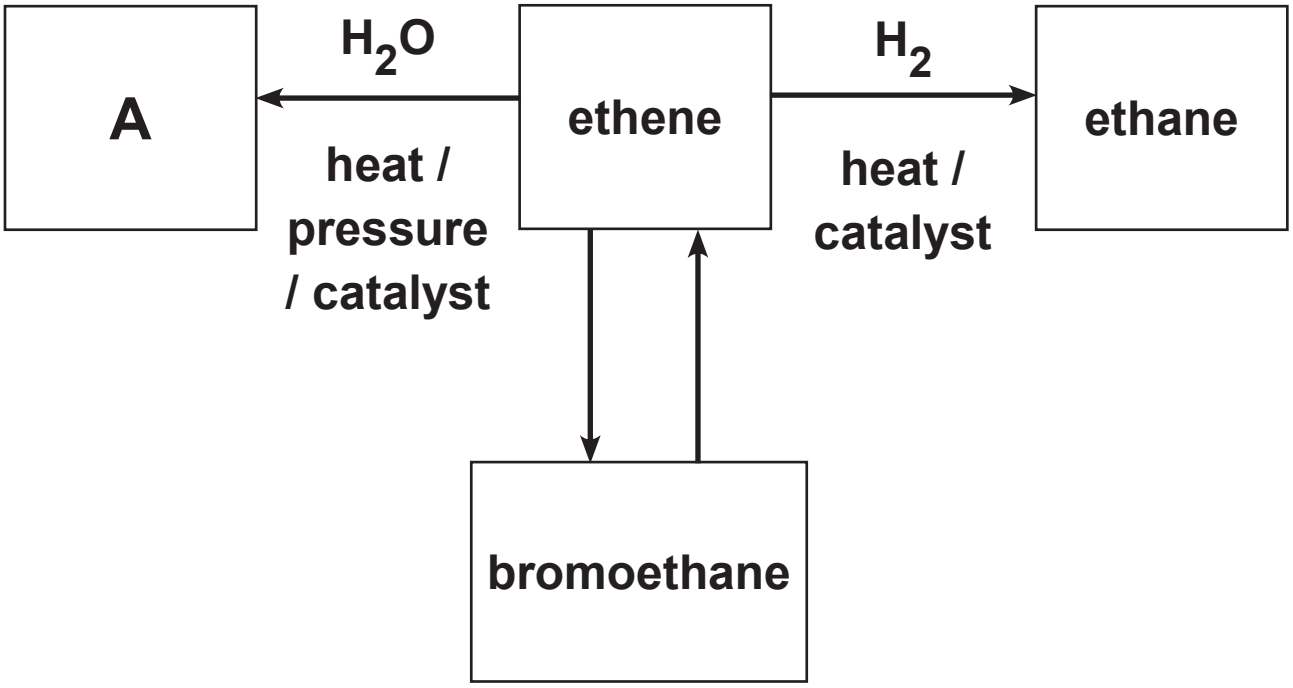
chlorine

magnesium

potassium

sulfur

TOTAL SECTION A [10]


A
H_2O
heat / pressure / catalyst
ethene
H_2
heat / catalyst
ethane
bromoethane

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 opposite then answer the following questions.**

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

7(a) (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]

7(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 = _____

7(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]

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

8(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]

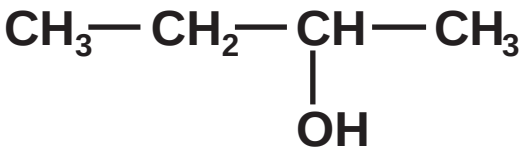
Reaction type _____

Mechanism

8(b) (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]**

8(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]

8(c) (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

_____

_____

8(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]**

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

Total [16]

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—$\overset{\frown}{\text{C}}$—H bond angle in a methane molecule. [1]**

9(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]

9(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]**

9(e) (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]

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 _____

10(a) (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) _____

_____

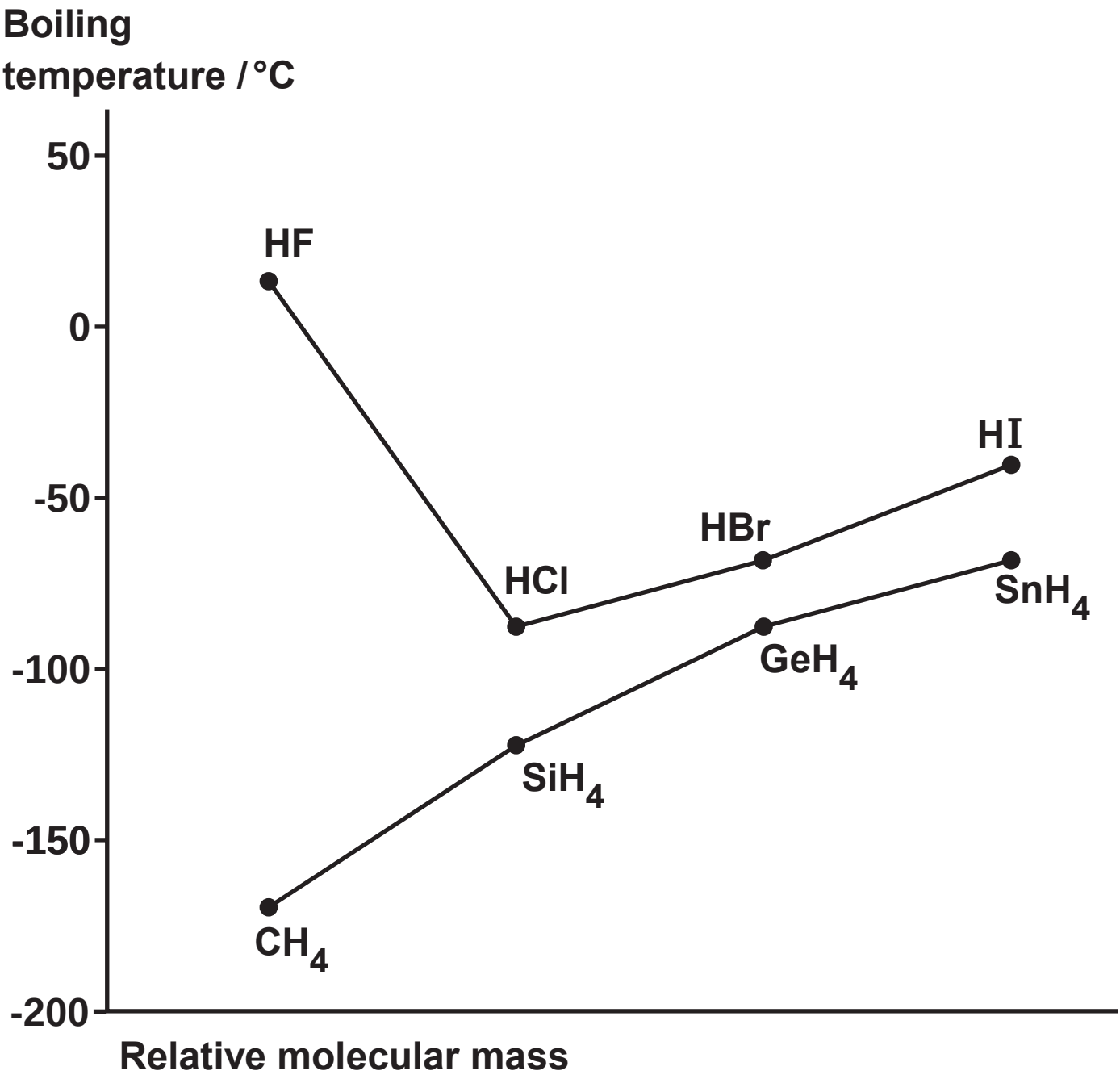
_____

_____

10(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]


Boiling
temperature / °C
50
0
-50
-100
-150
-200
HF
HCl
HBr
HI
SnH4
GeH4
SiH4
CH4
Relative molecular mass

10(c) The diagram opposite 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]

10(c) (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]

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

Total [13]

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]

_____

_____

11(a) (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]**

11(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]

11(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]

_____

_____

_____

_____

11(d) (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

11(d) (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**

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

11(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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