Candidate Name	Centre Number	Candidate Number
		2

GCE AS/A level

1092/01

CHEMISTRY CH2

P.M. THURSDAY, 21 January 2010

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

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.

You are reminded that marking will take into account the Quality of Written Communication used in all written answers.

Page 14 may be used for rough work.

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SECTION A

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

1. State which **one** of the following bonds is generally the **weakest**. [1]

A Covalent

B Hydrogen

C Ionic

D Van der Waals .....

2. State which **one** of the following formulae represents a compound that can show hydrogen bonding. [1]

A CH_3CH_3

B CH_3OCH_3

C HCl

D HF .....

3. Complete the table below by inserting the number of bonding pairs of electrons and name the shapes of the molecules involved. [3]

Molecule	*Number of bonding pairs of electrons in outer shell*	*Number of lone pairs of electrons in outer shell*	*Shape*
$BeCl_2$		0	Linear
PCl_3	3	1	
CCl_4	4	0	

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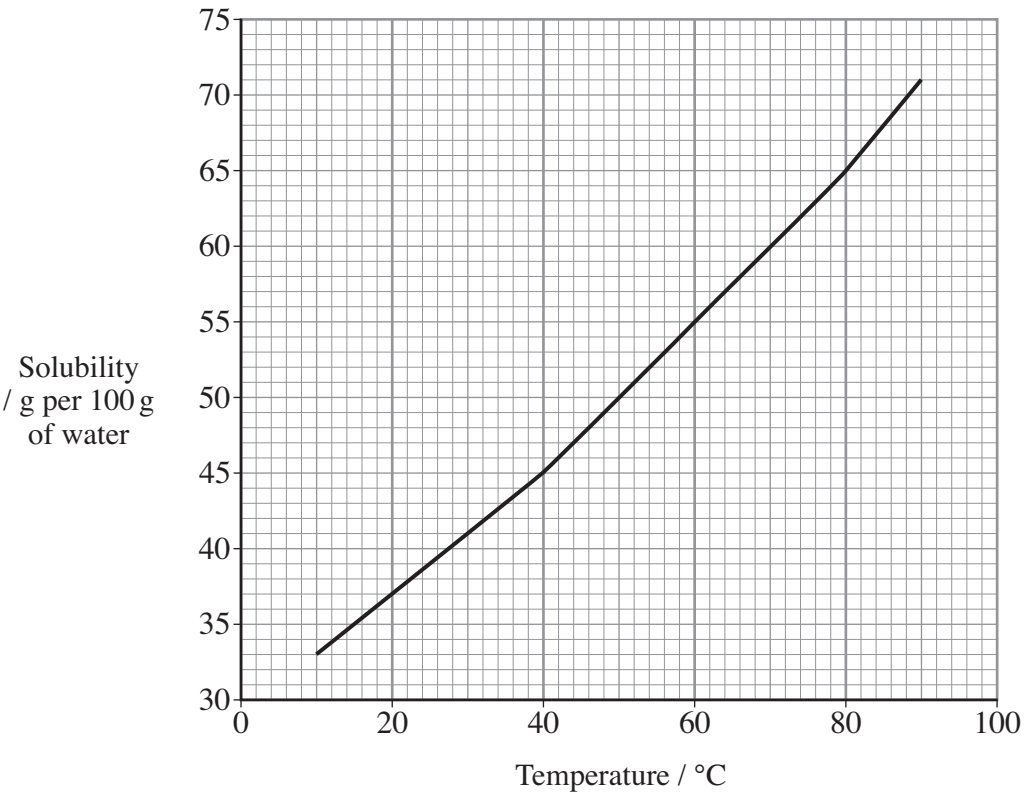
4. Using **outer** electrons only, draw a dot and cross diagram to show the bonding in sodium oxide. Show the charges on the ions formed. [2]

5. The solubility curve for ammonium chloride is shown below.



Calculate the mass of ammonium chloride that dissolves in 50 g of water to form a saturated solution at 30 °C. [2]

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6. Draw the skeletal formula of 2-chloro-3-methylhexane. [1]

Section A Total [10]

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SECTION B

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

7. Petroleum, which is a mixture of hydrocarbons, is an important source of chemicals. These chemicals can be obtained by fractional distillation and further processing such as cracking and isomerisation.

(a) During fractional distillation, explain why hydrocarbons containing few carbon atoms distil at lower temperatures than hydrocarbons with many carbon atoms. [3]
QWC [1]

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(b) Pentane is one of the hydrocarbons obtained from petroleum.

(i) Name the homologous series of which pentane is a member. [1]

.....

(ii) Pentane has two structural isomers.

I. Explain the meaning of the term ***structural isomer***. [2]

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II. Draw the displayed formulae of the **structural isomers** of pentane and name them. [4]

Isomer 1 Isomer 2

....

(c) State what is meant by the term ***cracking*** and explain why this process is important. [2]

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Total [13]

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8. *(a)* In 1928 an American engineer, Thomas Midgley, developed a CFC as a replacement for chloromethane and sulfur dioxide, which were in common use as refrigerants despite being toxic. He showed that the new compound was both non-flammable and non-toxic by inhaling it and using it to blow out a lighted candle.

(i) State the name of the group of compounds often abbreviated to CFC. [1]

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(ii) State another use to which CFCs have been put. [1]

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(iii) In the stratosphere, chloromethane breaks down to give chlorine radicals whereas fluoromethane does not break down.

I. Explain what the term ***radical*** means. [1]

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II. Give a reason why chloromethane breaks down but fluoromethane does not. [1]

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(iv) In the 1960s other halogenoalkanes such as $CBrF_3$ were developed as effective fire-fighting materials.

When $CBrF_3$ reacts with aqueous sodium hydroxide, bromide ions are produced. To test for the presence of these ions, dilute nitric acid has to be added first, followed by an appropriate reagent.

I. State why nitric acid has to be added. [1]

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II. Name the reagent that you would add to test for the bromide ions. [1]

.....

III. State what you would see after the addition of the reagent. [1]

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IV. Write an **ionic equation** for the reaction that confirms the presence of bromide ions. [1]

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(b) Draw the mechanism for the reaction of bromoethane and OH^-(aq). [3]

Assume the mechanism is the same as for the reaction of 1-chlorobutane and OH^-(aq).

(c) Bromoethane can also undergo an elimination reaction with OH^-.

(i) Name the organic product of this reaction. [1]

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(ii) State the conditions required. [1]

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Total [13]

Examiner only

9. *(a)* Compound **A** contains carbon, hydrogen and oxygen only. It has a molar mass of 88.1 g mol^{-1}. Quantitative analysis of the compound shows that its percentage composition by mass contains 54.5% carbon and 9.10% hydrogen.
Calculate both the empirical and molecular formulae of compound **A**. [4]

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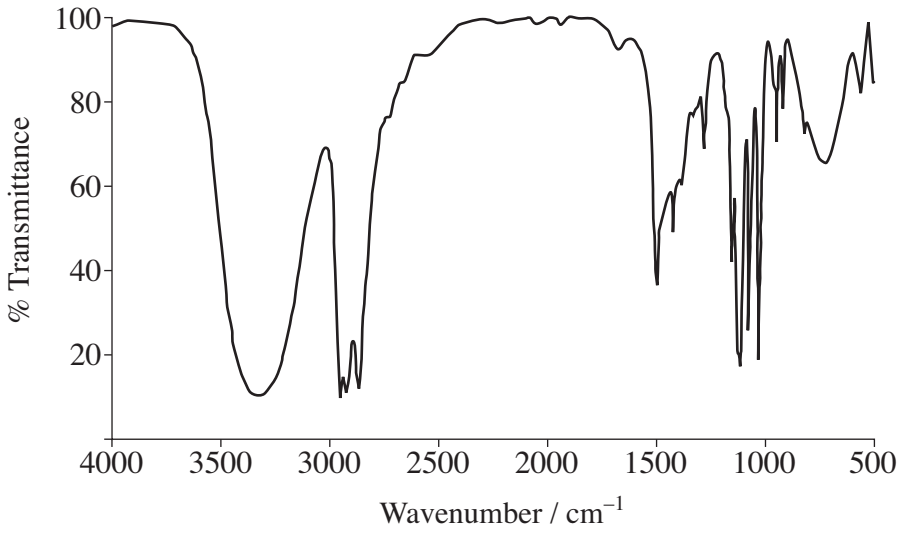
(b) Propan-1-ol has the infrared spectrum below.



(i)Using the data sheet, state how this spectrum confirms which functional group is present in propan-1-ol. [1]

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(ii) Propan-1-ol can be completely oxidised to form compound **B**.
Name compound **B** and state how you would expect its infrared spectrum to differ from that of propan-1-ol. [2]

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(c) Propan-1-ol can also form propene by a dehydration reaction.
Name a suitable reagent for this reaction. [1]

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(d) Describe a test, including reagents and expected observations, to show that propene contains a C = C double bond. [2]

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(e) Propene can be polymerised to form poly(propene).
Give the formula of the repeating unit in poly(propene). [1]

(f) Substituted alkenes can also be polymerised to give useful polymers.
Name an important polymer formed from a substituted alkene. [1]

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Total [12]

Examiner only

10. The electronegativities and melting temperatures of some of the elements in Groups 1-7 of the Periodic Table are shown in the table below.
Some values have been omitted.

		Group						
		1	2	3	4	5	6	7
Period 2	Element	Li	Be	B	C graphite	N	O	F
	Electronegativity	1.0	1.5	2.0	2.5	3.0	3.5	4.0
	Melting temperature / K	453	1550	2600	3730	63	54	53
Period 3	Element	Na	Mg	Al	Si	P	S	Cl
	Electronegativity	0.9	1.2	1.5	1.8	2.1	2.5	3.0
	Melting temperature / K	371	923		1680	317	392	172
Period 4	Element	K						Br
	Electronegativity	0.8						2.8
	Melting temperature / K	337						266

(a) (i) Explain the meaning of the term ***electronegativity***. [1]

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(ii) State the trend shown in electronegativity across a period. [1]

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(iii) Explain this trend. [2]

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Examiner only

(b) (i) State the trends shown in melting temperature across Period 2. [2]

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(ii) Suggest a value for the melting temperature of aluminium. [1]

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(iii) Explain why the melting temperature of magnesium is higher than that of sodium. [2]

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(iv) Explain why the melting temperatures of the Group 7 elements increase down the group. [2]

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(c) Explain, in terms of bonding and structure, why graphite has a very high melting temperature. [2]

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Total [13]

Examiner only

11. *(a)* Edmund carries out two experiments with calcium.

(i) In the first experiment, he adds pieces of calcium to water.

I. State what he would **observe** in this reaction. [2]

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II. Write a balanced chemical equation for the reaction. [2]

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III. He repeats the experiment with strontium.

State whether you would expect strontium to be more or less reactive than calcium. Explain your answer clearly. [2]

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(ii) In the second experiment, Edmund reacts pieces of calcium with 20.0 cm^3 of 2.00 mol dm^{-3} hydrochloric acid.

$$Ca(s) + 2HCl(aq) \longrightarrow CaCl_2(aq) + H_2(g)$$

I. Calculate the number of moles of acid used in the experiment. [1]

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II. Calculate the minimum mass of calcium needed to react completely with the acid. [2]

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III. Give a test which would confirm the presence of calcium ions in aqueous calcium chloride, stating the result of the test. [2]

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Examiner only

(b) Edmund wants to prepare aqueous sodium chloride using the same method as in *(a)*(ii) opposite. Explain why he should not use this method and state what reagents he could use to obtain aqueous sodium chloride. [2]

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(c) For both calcium chloride and calcium metal:

- state the conditions necessary for each to conduct electricity;
- explain, in terms of bonding and structure, how this process occurs. [4]

QWC [2]

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Total [19]

Section B Total [70]

Turn over.

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Rough Work