

Group 7

Question Paper 5

Level	International A Level
Subject	Chemistry
Exam Board	CIE
Topic	Group 7
Sub-Topic	
Paper Type	Theory
Booklet	Question Paper 5

Time Allowed: 51 minutes

Score: /42

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	77.5%	70%	62.5%	57.5%	45%	<45%

- 1 (a) Describe and explain how the boiling points of the tetrachlorides of the Group IV elements vary down the group.

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..... [3]

- (b) The tetrachlorides are all covalent compounds. Draw a diagram showing the shape of a molecule of silicon tetrachloride, including values for bond angles.

[2]

- (c) The noble gas xenon forms a tetrafluoride, XeF_4 . Only four of xenon's outer shell electrons are used in bonding to the fluorine atoms.

- (i) Draw a dot-and-cross diagram showing how the outer-shell electrons are arranged in XeF_4 .

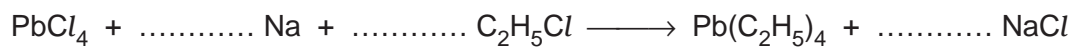
- (ii) Predict the shape and the bond angles in XeF_4 .

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..... [4]

- (d) Describe and explain how the reactions of CCl_4 and SiCl_4 with water differ. Write an equation for any reaction that occurs.

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..... [3]

- (e) Many tonnes of lead tetrachloride used to be produced to make the anti-knock petrol additive tetraethyl-lead, $\text{Pb}(\text{C}_2\text{H}_5)_4$, by the following reaction.



Balance this equation and use it to calculate the mass of sodium needed to produce 1.0 kg of tetraethyl-lead.

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..... [3]

[Total: 15]

2 A number of organic compounds containing the halogens fluorine and/or chlorine are commercially important because of their chemical inertness.

(a) Name **three** such compounds, and for each state a use where its inertness is important.

(i)

.....

(ii)

.....

(iii)

.....[6]

(b) Under certain conditions in the upper atmosphere, some of these compounds break down.

(i) Explain how this happens and what effects this has, in chemical terms.

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(ii) Suggest alternative compounds, which do not contain a halogen, for **two** of the uses you have given in (a).

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.....[5]

[Total : 11]

3 Chlorine gas is manufactured by the electrolysis of brine using a diaphragm cell.

(a) (i) Write half-equations, including state symbols, for the reactions occurring at **each** of the electrodes of a diaphragm cell.

anode

cathode

(ii) In the diaphragm cell, the anode is made of titanium and the cathode is made of steel.

Suggest why steel is never used for the anode.

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.....

[3]

(b) Chlorine is very reactive and will form compounds by direct combination with many elements.

Describe what you would see when chlorine is passed over separate heated samples of sodium and phosphorus.

In **each** case write an equation for the reaction.

sodium

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phosphorus

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.....
..... [4]

- (c) Chlorine reacts with aqueous sodium hydroxide in two different ways, depending on the conditions used. In each case, water, sodium chloride and one other chlorine-containing compound are formed.

For **each** condition below, give the formula of the **other** chlorine-containing compound and state the oxidation number of chlorine in it.

condition	formula of other chlorine-containing compound	oxidation number of chlorine in this compound
cold dilute NaOH(aq)		
hot concentrated NaOH(aq)		

[4]

- (d) Magnesium chloride, $MgCl_2$, and silicon tetrachloride, $SiCl_4$, each dissolve in or react with water.

Suggest the approximate pH of the solution formed in **each** case.

$MgCl_2$ $SiCl_4$

Explain, with the aid of an equation, the difference between the two values.

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..... [5]

[Total: 16]