EXAM PAPERS PRACTICE

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Level: CIE AS and A Level (9701)
Subject: Chemistry
Topic: CIE Chemistry
Type: Topic Question

Chemistry CIE AS & A Level
To be used for all exam preparation for 2025+

CHEMISTRY AS and A

This to be used by all students studying CIE AS and A level Chemistry (9701) But students of other boards may find it useful

Question 1.

(a) This question is about electronegativity.

Define the term electronegativity.

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(2 marks)

(b) A bond between nitrogen and hydrogen can be represented as $\overset{\delta-}{\mathrm{N}}\ \overset{\delta+}{\mathrm{H}}$.

i) In this representation, state the meaning of the symbol δ+.

[1]

ii) From this bond representation, state what can be deduced about the electronegativity of nitrogen relative to that of hydrogen.

[1]

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(2 marks)

(c) State **three** factors which affect the electronegativity of an element.

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(3 marks)

(d) i) Identify the element in Period 4 with the highest electronegativity value.

[1]

ii) Explain why chlorine is more electronegative than oxygen.

[2]

(3 marks)

Question 2.

(a) This question is about electronegativity.

The electronegativities of some elements are shown in Table 3.1 below.

Table 3.1

Element	Electronegativity
Li	1.0
H	2.1
C	2.5
N	3.0
Cl	3.0

Define the term electronegativity.

(2 marks)

(b) Use Table 3.1 to explain the trend in electronegativity across the Periodic Table.

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(3 marks)

(c) Explain how the carbon-hydrogen bond (such as in CH_4) differs from the nitrogen-hydrogen bond (such as in NH_3) in terms of the bond polarity.

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(2 marks)

(d) Explain, in terms of electronegativity, why the bonding in ammonia (NH_3) is covalent but the bonding in lithium chloride (LiCl) is ionic.

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(4 marks)

Question 3.

(a) Chlorine (Cl) reacts with boron (B) to form boron trichloride (BCl_3).

i) What type of bond is the B-Cl bond?

ii) How is this bond formed?

iii) The electronegativities of boron, chlorine and hydrogen are 2.0, 3.2 and 2.2 respectively. Is the B-Cl more or less polar than a B-H bond in borane (BH_3)? Explain your answer.

(4 marks)

(b) Molecules and separate atoms (such as noble gases) are attracted to one another by intermolecular forces.

i) What is the strongest type of intermolecular force that takes place between water (H_2O) molecules?

ii) Draw a diagram that illustrates the interaction between two water molecules. Indicate any lone pairs of electrons and partial charges in your diagram.

(4 marks)

(c) The boiling point of tetrachloromethane (CCl_4) is 77 °C whereas the boiling point of water (H_2O) is 100 °C.

i) Suggest why the boiling point of H_2O is higher than that of CCl_4.

ii) Predict whether the boiling point of methane (CH_4) is higher or lower than the boiling point of CCl_4. Explain your answer.

(6 marks)

Question 4.

(a) Define the term *electronegativity*.

(1 mark)

(b) The periodic table displays the chemical elements, arranged in order of increasing atomic number. It is made up of groups and periods of elements.

State and explain the general trend in electronegativity across a period.

(4 marks)

(c) Chlorine, Cl_2, reacts with boron, B, to form boron trichloride, BCl_3.

i) What type of bond is the B-Cl bond?

[1]

ii) How is this bond formed?

[1]

iii) The electronegativities of boron, chlorine and hydrogen are 2.0, 3.2 and 2.2 respectively. Is the B-Cl more or less polar than a B-H bond in borane, BH_3? Explain your answer.

[2]

(4 marks)

Question 5.

(a) The Pauling electronegativity values of different elements are shown in Fig 3.1.

H 2.1																
Li 1.0	Be 1.6											B 2.0	C 2.5	N 3.0	O 3.5	F 4.0
Na 0.9	Mg 1.3											Al 1.5	Si 1.9	P 2.2	S 2.6	Cl 3.0
K 0.8	Ca 1.0	Sc 1.4	Ti 1.5	V 1.6	Cr 1.7	Mn 1.5	Fe 1.8	Co 1.9	Ni 1.9	Cu 1.9	Zn 1.6	Ga 1.8	Ge 2.0	As 2.2	Se 2.6	Br 2.6

Fig. 3.1

A compound formed from magnesium and oxygen has a different structure to a compound formed from phosphorus and oxygen.

Predict the type of bonds that will occur in each compound. Explain your answer.

(4 marks)

(b) Explain why the melting point of phosphorus(III) oxide, P_4O_6, is lower than that of magnesium oxide in terms of their bonding and structure.

(2 marks)

(c) Phosphorus(III) oxide, P_4O_6, contains no P–P or O–O bonds.

In the P_4O_6 molecule, all oxygen atoms are bonded to two other atoms and all phosphorus atoms are bonded to three other atoms.

Sketch a structure for P_4O_6.

(1 mark)

(d) Explain the difference in electronegativity shown in Fig. 3.1 between magnesium and calcium.

(3 marks)