Anglo-Chinese School
(Barker Road)
A Methodist Institution
Founded in 1886

CHEMISTRY
DEPARTMENT OF SCIENCE

Name: ANSWERS ( ) Class: SEC 3

CHEMICAL BONDING (EXTENSIONS) – ASSIGNMENT

Multiple-Choice Questions [20 Marks]

TOTAL SCORE / 30

Write in your selected answer for the multiple-choice questions in the boxes provided.

1	2	3	4	5	6	7	8	9	10
D	C	C	B	A	C	B	A	B	A

11	12	13	14	15	16	17	18	19	20
C	B	B	D	B	D	D	B	C	B

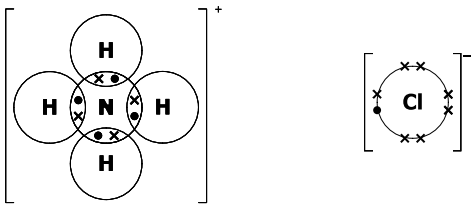
1. How many chloride ions are adjacent to each sodium ion in a crystal of sodium chloride?

   A 1 **B** 2 **C** 4 **D** 6

2. An element **Q** reacts with chlorine to form a liquid of formula **Q**Cl_2. What could be the electronic configuration of **Q**?

   A 2, 8, 1 **B** 2, 8, 2 **C** 2, 8, 6 **D** 2, 8, 8

3. A 'dot and cross' diagram showing the bonding in ammonium chloride (NH_4Cl) is shown.



   From the above diagram, we can tell that ammonium chloride contains

   A covalent bonds only.
   B ionic bonds only.
   C both covalent and ionic bonds.
   D neither covalent nor ionic bonds.

4. In a molecule of methane (CH_4), how many pairs of electrons are **not** involved in bonding?

   A 0 **B** 1 **C** 2 **D** 4

5. Which one of the following solids does **not** contain covalent bonds?

   A copper **B** diamond **C** methane **D** ice

6. Which one of the following solids does **not** contain intermolecular forces?

A graphite **B** iodine **C** sand **D** sulfur

7. Which of the following substances would best be used as a refractory material, i.e. able with withstand very high temperatures?

A a metal
B a metallic oxide
C a non-metallic oxide
D a plastic

8. Which of the following is **not** a property of pure calcium?

A It has a hard, strong texture.
B It is able to conduct electricity.
C It is shiny in appearance.
D It is solid at room temperature.

9. Which of the following elements would we expect to have the highest melting point?

A argon **B** carbon **C** chlorine **D** mercury

10. Graphite can be used for all of the following **except**

A as a drill bit and in heavy-duty cutting.
B as a dry lubricant in industrial applications.
C as a lead in pencils.
D as an electrode to conduct electricity.

11. In the structure of graphite, sheets of carbon atoms are able to slide over each other easily

A due to the presence of delocalized electrons between the sheets of carbon atoms.
B due to the regular hexagonal arrangement of each sheet of carbon atoms.
C due to the weak intermolecular forces between the sheets of carbon atoms.
D due to the weak single covalent bond between the carbon atoms.

12. The structure of diamond can best be described as

A a macromolecular structure with a hexagonal arrangement of carbon atoms.
B a macromolecular structure with a tetrahedral arrangement of carbon atoms.
C a simple molecular structure with a octahedral arrangement of carbon atoms.
D a simple molecular structure with a trigonal arrangement of carbon atoms.

13. Silicon dioxide (SiO_2) has a higher melting point than sodium chloride (NaCl) because the

A covalent bonds within SiO_2 are stronger than the covalent bonds within NaCl.
B covalent bonds within SiO_2 are stronger than the electrostatic forces within NaCl.
C electrostatic forces within SiO_2 are stronger than the intermolecular forces within NaCl.
D intermolecular forces within SiO_2 are stronger than the electrostatic forces within NaCl.

14. Which of the following is **not** a similarity between diamond and oxygen?

A They are both elements.
B They both contain covalent bonds.
C They are both non-metals.
D They both have simple molecular structures.

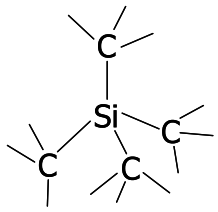
15. Aluminium and sodium are both in Period 3 of the Periodic Table. It is observed that aluminium is a significantly better conductor of electricity compared to sodium. Which of the following statements best explains this observation?

A Aluminium atoms are in a regular arrangement, whereas sodium atoms are not.
B Aluminium atoms have a greater number of valence electrons compared to sodium.
C Aluminium contains both positive and negative ions, unlike sodium.
D Aluminium is a solid at room temperature while sodium is a liquid.

16. Bromine and chlorine are both in Group VII of the Periodic Table, and exist as diatomic molecules. However, the melting point of bromine is -7 °C, while the melting point of chlorine is significantly lower at -102 °C. Which of the following statements best explains this observation?

A The covalent bonds in bromine require a larger amount of energy to overcome, compared to the electrostatic forces of attraction between chlorine molecules.
B The double covalent bonds present between the bromine atoms is stronger than the single covalent bond present between the chlorine atoms.
C The electrostatic forces of attraction between bromine molecules is stronger than the intermolecular forces of attraction between chlorine molecules.
D The intermolecular forces of attraction between bromine molecules is stronger than the intermolecular forces of attraction between chlorine molecules.

17. The structure of silicon carbide (SiC) can be represented as follows:



Which of the following is most likely to be a physical property of silicon carbide?

A It has a low melting and boiling point.
B It has a soft, slippery texture.
C It is able to conduct electricity at room temperature.
D It is insoluble in water.

18. Three new substances were discovered to have the following physical properties.

Substance	**Melting Point**	**Electrical Conductivity**	
		when solid	*when aqueous*
Aktize	71 °C	good	(insoluble)
Bygnit	2512 °C	poor	good
Ceevii	216 °C	poor	poor

Deduce the structures of the three substances.

	aktize	*bygnit*	*ceevii*
A	metallic lattice	giant molecular	ionic lattice
B	metallic lattice	ionic lattice	simple molecular
C	simple molecular	ionic lattice	giant molecular
D	simple molecular	metallic lattice	ionic lattice

19. An unknown element **X** was found to be liquid at room temperature, immiscible with water, and able to conduct electricity even when frozen. Which of the following could be **X**?

A bromine **B** calcium **C** mercury **D** water

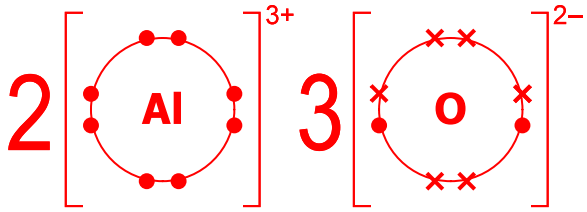
20. An unknown substance **Y** was found to be solid at room temperature, soluble in water, and unable to conduct electricity under any circumstances. Which of the following could be **Y**?

A carbon dioxide **B** iodine **C** lithium chloride **D** magnesium

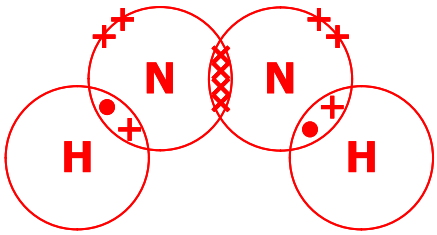
Structured Questions [10 Marks]

21. Draw 'dot-and-cross' diagrams, showing only valence electrons, to illustrate the bonding in

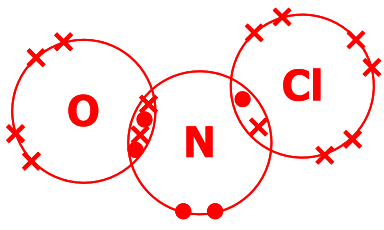
(a) aluminium oxide [1]



(b) diazene (N_2H_2) [1]



(c) nitrosyl chloride (NOCl) [1]



22. (a) Describe the structure of a metal. [1]

A lattice of positive ions in a 'sea' of delocalised electrons.

(b) Graphite is a non-metal which has a macromolecular structure. However, some of its *physical properties* resemble that of a metal. State two of these properties. [1]

High melting point.

Able to conduct electricity in solid state.

(c) Under certain circumstances, both metals and ionic compounds are able to conduct electricity. Describe how the conduction of electricity in a metal differs from that of an ionic compound. [2]

A metal can conduct electricity when solid, whereas an ionic compound can only conduct electricity when molten (or aqueous) (1). A metal conducts electricity through the movement of mobile electrons while an ionic compound conducts electricity through the movement of mobile ions (2).

23. Silicon and carbon are both in Group IV of the Periodic Table. However, silicon dioxide has a melting point of 1650 °C, while carbon dioxide is gaseous at room temperature. With reference to the bonding and structure, account for this difference. [3]

Silicon dioxide has a macromolecular structure while carbon dioxide has a simple covalent structure (1). More energy is needed to overcome the strong covalent bonds in silicon dioxide (2) than the weak intermolecular forces in carbon dioxide (3).

END