## CHEMISTRY DEPARTMENT OF SCIENCE



ANSWERS Class: SEC 3 Name: ) (

## CHEMICAL BONDING – ASSIGNMENT

## Multiple-Choice Questions [20 Marks] TOTAL SCORE / 30 Write in your selected answer for the multiple-choice questions in the boxes provided. 10 1 2 3 4 5 6 7 8 9 B С D R С D D 11 12 13 14 15 16 17 18 19 20 В В В В В D С D D

- 1. Metals are defined as elements which
  - **A** are shiny in appearance.
  - **B** are malleable and ductile.
- **C** can conduct electricity when solid.
- **D** readily give away electrons.
- 2. Two non-metals can form a chemical bond
  - **A** by delocalizing their valence electrons. **C** by overlapping their valence shells.
    - **B** by generating a magnetic attraction.
- **D** by transferring electrons to each other.
- 3. Which of the following elements does **not** form an ion which has the same electronic configuration as an argon atom?
  - **A** chlorine **B** phosphorus **C** potassium **D** sodium
- 4. The element **X** has an electronic configuration of 2, 8, 18, 6. What ion will it form?

| <b>A</b> ) | <b>K</b> <sup>2+</sup> | В | <b>X</b> <sup>6+</sup> | С | <b>X</b> <sup>2-</sup> | D | <b>X</b> <sup>4-</sup> |
|------------|------------------------|---|------------------------|---|------------------------|---|------------------------|
|------------|------------------------|---|------------------------|---|------------------------|---|------------------------|

- 5. When magnesium forms a compound with oxygen, each magnesium atom
  - **A** gives four electrons to oxygen. **C** shares four electrons with oxygen.
  - **B** gives two electrons to oxygen. **D** shares two electrons with oxygen.
- 6. The element Y is highly unreactive, and does not form any chemical bonds under normal circumstances. Which of the following is a possible electronic configuration of **Y**?
  - **B** 2, 2 **C** 2, 6 **D** 2, 8, 8, 2 **A** 2

- 7. A 'triple covalent bond' refers to the
  - **A** sharing of six electrons between a metal and a non-metal.
  - **B** sharing of six electrons between two non-metals.
  - **C** sharing of three electrons between two metals.
  - **D** sharing of three electrons between two non-metals.
- 8. Which of the following statements pertaining to compounds of calcium is true?
  - **A** Calcium atoms have a tendency to gain two electrons during bonding.
  - **B** Calcium bonds with other metallic atoms by sharing electrons.
  - **C** Calcium bonds with other non-metallic atoms by transferring electrons.
  - **D** Calcium can form simple molecules which have a low melting point.
- 9. A molecule of ammonia is shown below.

How many bonded electrons are there surrounding the nitrogen atom?

**A** 1 **B** 3 **C** 6 **D** 8

10. A molecule of sulfur trioxide is shown below.

How many <u>bonded</u> electrons are there surrounding the sulfur atom?

**A** 2 **B** 6 **C** 8 **D** 12

11. Which of the following best illustrates the bonding present in water?



12. Which of the following statements about ionic compounds is incorrect?

- A Ionic compounds are generally more soluble in water than covalent compounds.
- **B** Ionic compounds can conduct electricity at room temperature.
- **C** Ionic compounds form giant ionic lattices.
- **D** Ionic compounds have high boiling points.

- 13. Which pair of elements below is most likely to form a compound with a low melting point?
  - A calcium, silicon B carbon, hydrogen C fluorine, sodium D barium, zinc
- 14. An element **Q**, found in Group V of the periodic table, forms a compound with element **R**, found in Group VII of the periodic table. It hence can be deduced that the compound
  - **A** has a formula of  $Q_3R$ .
  - **B** has a low boiling point.

- **C** is soluble in water.
- **D** is able to conduct electricity when liquid.
- 15. A diagram illustrating the bonding in a molecule of XY<sub>2</sub>, showing only the valence electrons, is shown below. What could elements X and Y be?

|   | Element X | Element Y |       |
|---|-----------|-----------|-------|
| Α | oxygen    | fluorine  |       |
| В | potassium | sulfur    | · · · |
| С | sulfur    | oxygen    | ( Y   |
| D | sulfur    | sodium    | • •   |
|   |           |           | •     |

16. Which substance in the table could be ethanol, CH<sub>3</sub>CH<sub>2</sub>OH?

|   | т.р. / °С | b.p. / °C | electrical conductivity |
|---|-----------|-----------|-------------------------|
| Α | - 114     | - 85      | good when liquid        |
| В | - 114     | 78        | none when liquid        |
| С | 580       | 718       | none when liquid        |
| D | 808       | 1465      | good when liquid        |

17. What are the forces that hold together a crystal of table salt (solid sodium chloride) and dry ice (solid carbon dioxide)?

| table salt                 | dry ice   |
|----------------------------|---|
| attraction of charged ions | covalent bonds  |
| attraction of charged ions | intermolecular forces   |
| covalent bonds             | attraction of charged ions  |
| covalent bonds             | intermolecular forces   |
|                            | <i>table salt</i><br>attraction of charged ions<br>attraction of charged ions<br>covalent bonds<br>covalent bonds |

18. The table gives information about the ability of three substances to conduct electricity.

| Substance | Property |
|-----------|----------|
|-----------|----------|

- X does not conduct under any conditions
- Y conducts in both molten and solid states
- Z conducts in both molten and aqueous states

What could these three substances be?

|   | Х    | Y    | Ζ    |
|---|------|------|------|
| Α | NaCl | S    | Pb   |
| В | Pb   | NaCl | S    |
| С | S    | NaCl | Pb   |
| D | S    | Pb   | NaCl |

- 19. A molten sample of zinc chloride is able to conduct electricity because
  - **A** it possesses a metallic element.
- **C** its ions are free to move.
- **B** it possesses mobile electrons.
- **D** its molecules are free to move.



20. The diagram below shows part of a crystal of calcium sulfide (CaS).

How many sulfide ions is each calcium ion attached to?



## Structured Questions [10 Marks]

- 21. Explain, in terms of structure and bonding, why
  - (a) ionic compounds have higher boiling points than simple covalent compounds, [2]

A larger amount of energy is required to overcome the strong electrostatic forces

of attraction (1) in ionic compounds than the weak intermolecular forces in covalent

(b) ionic compounds can conduct electricity when molten, but not when solid. [2]

compounds (2).

When solid, the ions are held in fixed positions and hence are unable to move (1).

When molten, the ions are free to move and hence may act as mobile charge

carriers and carry an electric current (2).

- 22. Scientists are studying a new element Ze. It does not conduct electricity, and is able to combine with other elements to make covalent and ionic compounds. It forms the ion Ze<sup>2-</sup>. Give three reasons why the element should be classified as a **non-metal**. [2]
  - 1. Only non-metals can form covalent compounds.
  - 2. Ze is unable to conduct electricity, while metals can.
  - 3. Ze forms negative ions.

- 23. Draw 'dot-and-cross' diagrams, showing only valence electrons, to illustrate the bonding in
  - (a) magnesium chloride (MgCl<sub>2</sub>)

$$\begin{bmatrix} \mathbf{M}_{g} \\ \mathbf{M}_{g} \end{bmatrix}^{2^{+}} 2 \begin{bmatrix} \mathbf{X} \\ \mathbf{X} \\ \mathbf{X} \\ \mathbf{X} \end{bmatrix}^{-1}$$

[1]

[1]

[1]



END