



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

CHEMISTRY N4

26 March 2024

This marking guideline consists of 5 pages.

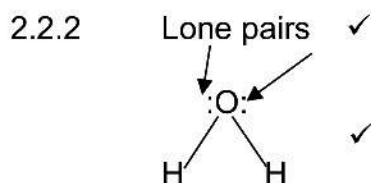
QUESTION 1

- | | | | | |
|-----|-------|--|---------|------|
| 1.1 | 1.1.1 | True ✓✓ | | |
| | 1.1.2 | False.✓ Bonds are weak by comparison with conventional chemical bonds.✓ | | |
| | 1.1.3 | True ✓✓ | | |
| | 1.1.4 | False.✓ A covalent bond is polarized when two atoms making up a molecule have different electronegativities.✓ | | |
| | 1.1.5 | True ✓✓ | (5 × 2) | (10) |
| 1.2 | 1.2.1 | Metallic bonding | | |
| | 1.2.2 | Ionic/electrovalent bonding | | |
| | 1.2.3 | Van der Waal's forces | | |
| | 1.2.4 | Covalent compounds | | |
| | 1.2.5 | Ionic/electrovalent bonding | (5 × 1) | (5) |
| 1.3 | 1.3.1 | The solution is an electrolyte. | | (1) |
| | 1.3.2 | The covalent bond in the hydrogen chloride molecule is broken✓ by chemical interaction with water to form ions in solution.✓ | | (2) |
| | 1.3.3 | $\text{H}_2\text{O}(\ell) \checkmark + \text{HCl}(\text{g}) \checkmark \rightarrow \text{H}_3\text{O}^+(\text{aq}) \checkmark + \text{Cl}^-(\text{aq}) \checkmark$ | | (3) |
| 1.4 | | The progressive increase in nuclear charge✓ exerts a contracting effect on the electron shells, and an increase in the power to attract electrons.✓ | | (2) |
| 1.5 | | The phenomenon is explained by postulating✓ the formation of hydrogen bonds.✓ | | (2) |

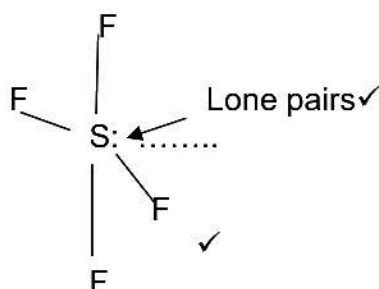
[25]

QUESTION 2

- | | | | | |
|-----|-------|---|---------|-----|
| 2.1 | 2.1.1 | Na has a larger radius than Na^+ .✓ The removed electron in Na^+ led to a decrease in the number of electronic shells.✓ | | |
| | 2.1.2 | Isoelectronic negative ions are anions✓ with the same number of electrons.✓ | (2 × 2) | (4) |
| 2.2 | 2.2.1 | <div style="text-align: center;"> $\checkmark \quad \checkmark$
 $\text{H}-\text{C}\equiv\text{N}:\leftarrow$ lone pairs </div>
A linear molecule✓ | | |



A tetrahedral molecule ✓

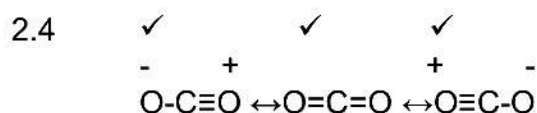


A trigonal bipyramidal molecule ✓

(3 × 3) (9)

- 2.3
- CH_4 , NH_3 and H_2O have respectively none, one and two lone pairs of electrons ✓
 - Repulsion between electron pairs decreases in the order: ✓
Lone pair-lone pair > lone pair-bond pair > bond pair-bond pair
 - Lone pairs are closer to the nucleus than bonding pairs ✓
 - Lone pairs repel each other more strongly and force together the bonding pairs, decreasing the bond angle ✓

(4)



(3)

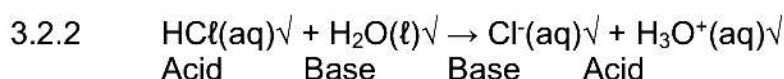
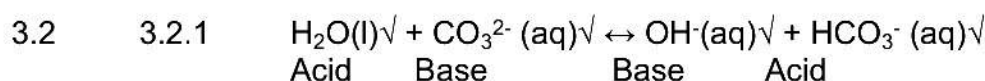
[20]

QUESTION 3

3.1 3.1.1 An acid is a substance existing as molecules or ions that can donate protons.

3.1.2 A base is a substance existing as molecules or ions that can accept protons.

(2 × 1) (2)



(2 × 2)

3.3 H_2SO_4 is expected to be a stronger acid.✓ It contains the higher number of oxygen atoms.✓ (2)

3.4 $\text{CaO(s)} + \text{SO}_3\text{(s)} \rightarrow \text{CaSO}_4\text{(s)}$ (2)
[10]

QUESTION 4

4.1 4.1.1 $\text{Zn(s)}\checkmark + 2\text{H}^+\text{(aq)}\checkmark \rightarrow \text{Zn}^{2+}\text{(aq)}\checkmark + \text{H}_2\text{(g)}\checkmark$
4.1.2 $\text{Zn(s)}\checkmark + 2\text{OH}^-\text{(aq)}\checkmark + 2\text{H}_2\text{O(l)} \rightarrow \text{Zn(OH)}_4^{2-}\text{(aq)}\checkmark + \text{H}_2\text{(g)}\checkmark$
4.1.3 $\text{Mg(s)}\checkmark + \text{H}_2\text{O(g)}\checkmark \rightarrow \text{MgO(s)}\checkmark + \text{H}_2\text{(g)}\checkmark$ (3 × 2) (6)

4.2 $\text{H}_2\text{C} = \text{CH}_2\text{(g)} + \text{H}_2\text{(g)} \rightarrow \text{H}_3\text{C-CH}_3\text{(g)}$ (1)

4.3 4.3.1 Ionic bonding
4.3.2 Covalent bonding
4.3.3 Covalent bonding (3 × 1) (3)

4.4 $2\text{Na(s)}\checkmark + 2\text{D}_2\text{O(l)}\checkmark \rightarrow 2\text{NaOD(aq)}\checkmark + \text{D}_2\text{(g)}\checkmark$ (2)
[12]

QUESTION 5

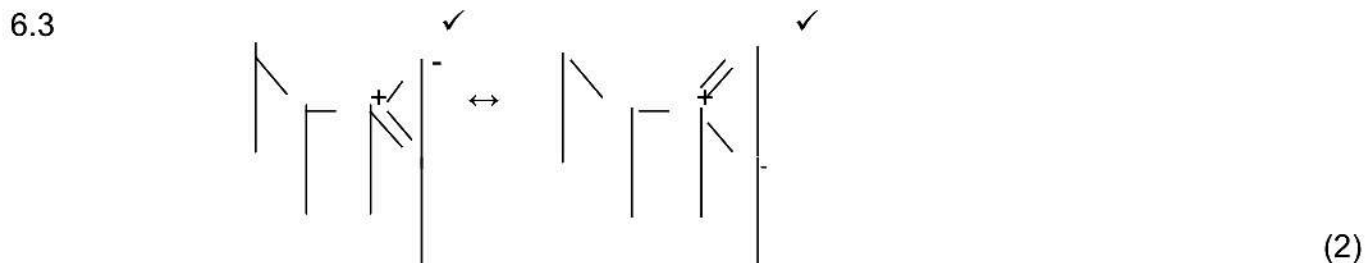
5.1 5.1.1 Monotropy (1)
5.1.2 Acheson process (1)
5.1.3 $\text{C(Diamond)}\checkmark + \text{O}_2\text{(g)}\checkmark \rightarrow \text{CO}_2\text{(g)} ; \Delta H^\circ = -395.4 \text{ kJ/mol}\checkmark$
 $\text{C(Graphite)}\checkmark + \text{O}_2\text{(g)}\checkmark \rightarrow \text{CO}_2\text{(g)} ; \Delta H^\circ = -393.5 \text{ kJ/mol}\checkmark$ (3)

5.2 5.2.1 Made by heating wood or sugar in a limited supply of oxygen.
5.2.2 Obtained from coal by heating to high temperatures in a limited supply of oxygen.
5.2.3 Obtained by burning hydrocarbons in a deficiency of oxygen. (3 × 1) (3)

5.3 $\checkmark \quad \checkmark \quad \checkmark$
 $:\text{C}^{\ominus} \equiv \text{O}^{\oplus}: \longleftrightarrow :\text{C}=\text{O}: \longleftrightarrow :\text{C}^{\oplus}-\text{O}^{\ominus}: \quad (3)$
[11]

QUESTION 6

- 6.1
- Easily liquefiable gas with a characteristic smell
 - Readily soluble in water and the solution turns red with litmus blue
- (2)



- 6.4 Yes. ✓ It contains the element N, a non-metal (more electronegative) which is bonded to the OH-. ✓ (2)

- 6.5 Interstitial nitride. (1)
[11]

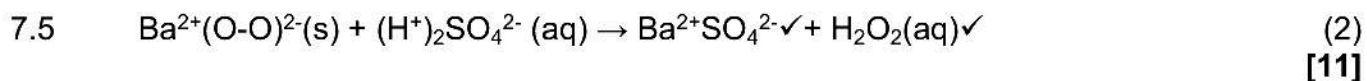
QUESTION 7

- 7.1
- Treatment of domestic water supplies
 - Production of pharmaceuticals
- (2)

- 7.2
- 7.2.1
- MgO
 - CO₂
 - (SiO₂)_n
- 7.2.2
- BaO₂
 - H₂O₂
- 7.2.3
- C₃O₂
 - C₂O
- 7.2.4
- Pb₃O₄ (2PbO:PbO₂)
 - Fe₃O₄ (Fe₂O₃:FeO)
- (4 × 1) (4)

- 7.3 SO₃ (1)

- 7.4 Titration with ethylenediamine tetra acetic acid ✓ in the presence of an indicator. ✓ (2)



TOTAL: ---