higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

PHYSICAL SCIENCE
NQF LEVEL 4
(Second paper)

29 November 2024

This marking guideline consists of 7 pages.

Copyright reserved

SECTION A

QUESTION 1

1.1 Becquerel✓
1.2 Endpoint✓
1.3 Functional group✓
1.4 pH scale✓
1.5 Neutral✓

(5 × 1) **[5]**

QUESTION 2

2.1 E✓
2.2 A✓
2.3 I✓
2.4 L✓
2.5 J✓

(5 × 1) **[5]**

QUESTION 3

Marking guidelines: 2 marks for True.NO MARKS for False.
NO MARKS if the statement is written in the NEGATIVE.
2 marks for CORRECTED statement.

3.1 False✓ Alpha particles are so energetic that they can pass through several radiation shielding✓

3.2 True✓✓

3.3 False✓ Hydrocarbons are the principal constituents of petroleum and natural gas ✓

3.4 True✓✓

3.5 False✓ Propanoic acid is an important organic acid with wide industrial applications, especially in the food industry✓

(5 × 2) **[10]**

QUESTION 4

4.1 D✓✓✓
4.2 B✓✓✓
4.3 D✓✓✓
4.4 D✓✓✓
4.5 B✓✓✓

(5 × 3) **[15]**

TOTAL SECTION A: 35

Copyright reserved

SECTION B

QUESTION 5

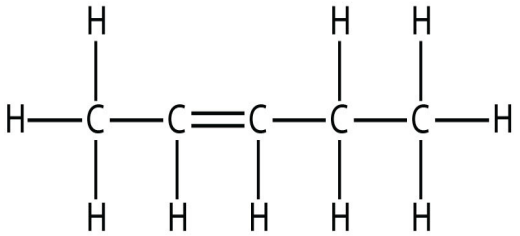
5.1
- The longer hydrocarbon molecules have a stronger intermolecular force. ✓✓
- More energy is needed to move them apart/to separate them so they have higher boiling points than the others that have lower boiling points.✓✓
- The temperatures are different at which substances rapidly change from a liquid to a gas.✓✓
- Hydrocarbon molecules with a higher boiling point are less volatile.

(Any 3 × 2) (6)

5.2 Butane✓✓ (2)

5.3
- Ethane✓✓
- The boiling point of ethane is lower compared to that of butane or it has a smaller mass than butane.✓✓ (2 × 2) (4)

5.4



This Photo by Unknown Author is licensed under CC BY-SA-NC

✓✓✓✓ (4)

5.5
- Methanol✓✓
- Ethanoic acid✓✓ (2 × 2) (4)

5.6 5.6.1 Boiling point is the temperature at which the vapour pressure of a substance is equal to the atmospheric pressure. The stronger the intermolecular forces, the higher the boiling point.✓✓

5.6.2 It is a chemical formula that indicates the type of atoms and the correct number of each in a molecule.✓✓

5.6.3 There are no multiple bonds between the C-atoms in the hydrocarbon chains in saturated compounds.✓✓

(3 × 2) (6)

[26]

QUESTION 6

6.1 6.1.1 CH_3OH✓✓
6.1.2 Ethanol✓✓
6.1.3 CH_3-O-CH_3✓✓
(3 × 2) (6)

6.2 Methanol✓✓ (2)

6.3
- Methanol has a lower boiling point than ethanol.✓✓
- Methanol is less soluble in water than ethanol.✓✓
- Methanol has a small molecular mass. (Any 2 × 2) (4)

6.4 6.4.1 What is the relationship between chain length and boiling point?✓✓ (2)

6.4.2 Chain length✓ (1)

6.4.3 Volume of acid✓ (1)
[16]

QUESTION 7

7.1
- The chemical nature of the reacting substances✓
- The state of subdivision of the reactants✓
- The temperature of the reactants✓
- The concentration of the reactants✓
- The presence of a catalyst✓
- The physical state of the reactants and the surface area (Any 5 × 1) (5)

7.2 A catalyst increases the rate of a reaction in both forward and backward reactions by lowering the activation energy.✓✓ (2)

7.3
- If the pressure is increased, the system will respond by favouring the reaction which produces fewer molecules.✓✓
- That will cause the pressure to fall again, in order to get as much ammonia as possible in the equilibrium mixture.✓✓
- By increasing the pressure, the molecules are squeezed together.✓✓
- Therefore there will be an increase in the frequency of collisions between them.✓✓ (Any 2 × 2) (4)

7.4 7.4.1 $4NH_3(g) + 5O_2(g)$ ✓✓→ $4NO(g) + 6H_2O(g)$✓✓ (4)

7.4.2 Platinum gauze would be heated and has high resistance in ammonia oxidation for nitric acid production. ✓✓ (2)
[17]

QUESTION 8

8.1
- It is the process or result of oxidising or being oxidised.✓✓
- It is the process that occurs when atoms or groups of atoms lose electrons.
- It is when a chemical species gains oxygen or loses hydrogen. (2)

8.2 Cations✓✓ (2)

8.3 8.3.1 Cd✓✓ (2)

8.3.2 $Cd(s) + 2OH^-(aq) \rightarrow Cd(OH)_2(S) + 2e^-$✓ (1)

8.3.3 $Cd(s) + 2OH^-(aq) \rightarrow Cd(OH)_2(S) + 2e^-$ Oxidation✓✓

$2Ni(OH)(s) + 2H_2O(\ell) + 2e^- \rightarrow 2Ni(OH)_2(s) + 2OH^-(aq)$ Reduction✓✓

$Cd(s) + 2NiO(OH)(s) + 2H_2O \rightarrow Cd(OH)_2(S) + 2Ni(OH)_2(s)$ Overall✓✓
(3 × 2) (6)

8.3.4 $E^{\theta}_{CELL} = E^{\theta}_{cathode} - E^{\theta}_{anode}$ ✓

= 0,54 –(-0,81)✓✓

= 1,35 V✓ (4)

8.3.5 Cathode to anode✓✓ (2)
[19]

QUESTION 9

9.1
- Scintillation counter✓
- Ionisation chamber✓
- Proportional counter✓
- Photomultiplier✓
- Geiger Mueller detector
- Dose rate meter
- Alpha radiation survey meter
- Portal monitor
- Personal dosimeter (Any relevant 4 × 1) (4)

9.2
- Radioactive means emitting or relating to the emission of ionising radiation or particles.✓✓
- It is the act of emitting radiation spontaneously. (Any 1 × 2) (2)

Copyright reserved

9.3
- Medicine✓
- Academics✓
- Industry✓
- Generating of electricity✓
- Agriculture
- Archaeology (carbon dating)
- Space exploration
- Law enforcement
- Geology (mining) (Any relevant 4 × 1) (4)

9.4
- Solar energy✓
- Wind turbine✓
- Hydroelectric✓
- Ocean energy
- Biomass
- Geothermal power (Any relevant 3 × 1) (3)

[13]

QUESTION 10

10.1 10.1.1
- An anode is the positive electrode in a cell such as a battery.✓✓
- An anode is the negative or reducing electrode that releases electrons to the external circuit and oxidises during the electrochemical reaction. (Any 1 × 2) (2)

10.1.2
- A cathode is the positive or oxidising electrode that acquires electrons from the external circuit and is reduced during the electrochemical reaction.
- A cathode is the electrode where reduction occurs.✓✓

(Any 1 × 2) (2)

10.2
- Electrolytic.✓✓ (2)

- Electrical energy is converted to chemical energy.✓✓
- An electrolytic cell is an electrochemical cell that utilises an external source of electrical energy to force a chemical reaction that would otherwise not occur. The external energy source is a voltage applied between the cell's two electrodes: an anode and a cathode, which are immersed in an electrolyte solution. (Any 1 × 2) (2)

10.3 A – Copper chloride ✓
B – Aluminium oxide ✓ (2)

10.4 It will decrease.✓✓ (2)

[12]

QUESTION 11

11.1
- Hydraulic brakes✓
- Hydraulic press✓
- Hydraulic jacks✓ (Any 2 × 1) (2)

11.2
- The pressure exerted by a fluid at equilibrium at any point of time due to the force of gravity.✓✓
- Pressure exerted by water on a surface or structure. (Any 1 × 2) (2)

11.3 It works on the principle of Pascal's law.✓✓ (2)

11.4

$P_1 = \rho . g . h$
= 1,2 × 9.8 × 10✓✓
= 117.6 Pa✓

$P_2 = 100\ 000\ Pa$

$P_{NET} = P_1 + P_2$
= 117,6 + 100 000✓✓
= 100 117,6 Pa✓ (6)
[12]

TOTAL SECTION B: 115
GRAND TOTAL: 150

Copyright reserved