higher education
& training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

PHYSICAL SCIENCE
(Second paper)
NQF LEVEL 4

XX February 2020

This marking guideline consists of 8 pages.

SECTION A

QUESTION 1

1.1 Fusion
1.2 pH
1.3 Isotopes
1.4 Van der Waals/London/Dispersion forces
1.5 Activated complex

(5 × 1) **[5]**

QUESTION 2

2.1 B
2.2 H
2.3 E
2.4 F
2.5 A

(5 × 1) **[5]**

QUESTION 3

3.1 True
3.2 False
3.3 True
3.4 True
3.5 False

(5 × 2) **[10]**

QUESTION 4

4.1 D
4.2 A
4.3 B
4.4 C
4.5 B

(5 × 3) **[15]**

TOTAL SECTION A: 35

SECTION B

QUESTION 5

5.1
- Effect of the decrease in pressure with the increase in the speed of fluid in a horizontal pipe
- Reduction of fluid pressure that results when a fluid flows from a constricted section (or choke) of a pipe
- Increase in the velocity of a fluid as it travels through a restricted area

(Any 1 × 2) (2)

5.2 5.2.1 Measuring cylinder (1)

5.2.2

$$\text{density} = \frac{\text{mass}}{\text{volume}} ✓$$

$$= \frac{0,045}{0,050} ✓✓$$

$$= 0,9\ \text{kg.m}^{-3} ✓$$ (4)

5.2.3

$$P = P_{atmos} + \rho gh ✓$$

$$101\ 692 ✓ = 101\ 300 + (0,9)(9,8)h ✓$$

$$h = 44,44\ \text{m} ✓$$ (4)

[11]

QUESTION 6

6.1 6.1.1 Boiling point (of carboxylic acids) increases with chain length. (2)

6.1.2 Chain length (of carboxylic acid) (1)

6.1.3 Propanoic acid (2)

6.1.4
- A
- HCOOH
- Methanoic acid

(Any 1 × 1) (1)

6.1.5
- Smallest molecular mass/chain length
- Weakest intermolecular forces
- Least amount of energy required to break intermolecular force
- Largest amount of vapour particles

(Any 3 × 1) (3)

6.2 6.2.1 Organic compounds made up of carbon and hydrogen only (2)

6.2.2 Butan-2-ol (2)

6.2.3 Secondary (1)

6.2.4 Bubble compound C into bromine water.✓ If bromine water decolourises✓ then C is unsaturated. (2)

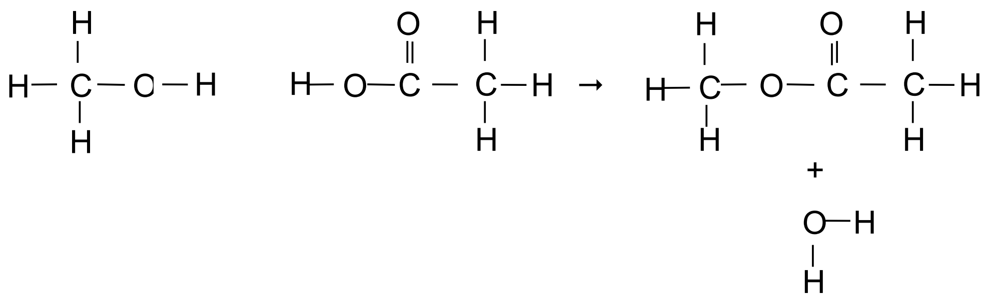
6.2.5 $2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$

Reactants✓ Products✓ Balancing✓ (3)

6.3 6.3.1
- Dehydrating agent
- Catalyst (Any 1 × 2) (2)

6.3.2 Alcohol is flammable/It will catch alight if a direct flame is used. (2)

6.3.3



(1 for each correct structural drawing) (4)

6.3.4
- Food flavouring
- Perfume (Any 1 × 1) (1)

[28]

QUESTION 7

7.1 Slower (2)

7.2
- Gradient less at t = 4 minute
- Surface area of calcium carbonate decreases
- Concentration of HCℓ decreased (Any 1 × 2) (2)

7.3

$n = \frac{m}{M}$ ✓

$= \frac{2,6}{44}$ ✓

$= 0,0591$ mol✓

Mass of $CaCO_3$ used = nM = (0,0591)(100)✓ = 5,91 g✓

OR

Mole mass ratio method:

$CaCO_3 : CO_2$

1 mol:1 mol

100 g:44g✓✓

x:2,6 g✓✓

44x = (100)(2,6)

x = 5,91 g✓ (5)

7.4
- Add a catalyst.✓✓
- Use the same volume✓ of a higher✓ concentration of HCℓ.
- Use the same mass✓ of powdered✓ calcium carbonate. (Any 1 × 2) (2)

[11]

QUESTION 8

8.1 $M((NH_4)_2CO_3) = 2(14) + 8(1) + 1(12) + 3(16) = 96\ g.mol^{-1}$✓

$n = \frac{m}{M}$✓ $= \frac{11,52}{96}$✓ $= 0,12$ mol✓ (4)

8.2 Mole ratio: $NH_3 = 0,24$ mol✓
$H_2O = 0,12$ mol✓
$CO_2 = 0,12$ mol✓

OR

Ratio	$(NH_4)_2CO_3\ _{(s)}$	$2NH_3$	H_2O	CO_2
Initial mol	0,1375	0	0	0
Change	-0,12	0,24✓	0,12✓	0,12✓
Equilibrium	0,175	0,24	0,12	0,12
Equilibrium con	-	0,48	0,24	0,024

(3)

8.3 $K_c = [NH_3]^2[H_2O][CO_2]$✓

$= (0,48)^2(0,24)(0,24)$✓

$= 0,01327$✓ (3)

8.4 Decrease (1)

8.5 According to Le Chatelier's principle, this amounts to a stress.✓ The reaction that opposes the stress will be favoured thus the exothermic/forward reaction will be favoured.✓ The equilibrium position shifts to the left./The concentration of products decreases.✓ (3)

8.6 $K_c = \frac{1}{0,01327}$ ✓ = 75,358✓

OR

$K_c = \frac{1}{[NH_3]^2[H_2O][CO_2]} = \frac{1}{(0,48)^2(0,24)(0,24)}$ ✓ = 75,352✓

(2)

[16]

QUESTION 9

9.1 Solution of accurately known concentration (2)

9.2 n(oxalic acid) = cv✓

= (0,4)(0,016)✓

= 0,0064 mol✓ **OR** $6,4 \times 10^{-3}$ mol (3)

9.3 $c = \frac{n}{v}$ ✓

$= \frac{0,0128}{0,01}$ ✓✓

= 1,28 $mol.dm^{-3}$✓

OR

$\frac{C_aV_a}{C_bV_b} = \frac{n_a}{n_b}$ ✓

$\frac{(0,4)(0,016)}{C_b(0,01)}$ ✓ $= \frac{1}{2}$ ✓

C_b = 1,28 $mol.dm^{-3}$✓ (4)

9.4 n(OH-) in mixture Y = cv✓

= (1,28)(0,25)✓ (1 for equation once)

= 0,32 mol✓

n(OH-) in KOH = cv = (1)(0,25)✓ = 0,25 mol✓

n(OH-) in NaOH = 0,32 – 0,25 = 0,07 mol✓

mass of X = nM = 0,07(40) = 2,8g✓ (7)

[16]

QUESTION 10

10.1 Cobalt electrode (1)

10.2 Cobalt is a stronger reducing agent than silver. (2)

10.3 $Co + 2Ag^{+}_{(aq)} \rightarrow Co^{2+}_{(aq)} + 2Ag$

Reactants✓ Products✓ Balancing✓ (3)

10.4
- When the cell delivers a current the concentration of $Co^{2+}_{(aq)}$ increases in the cobalt half-cell.
- $NO_3^{-}{}_{(aq)}$ ions migrate from the salt bridge into the cobalt half-cell to neutralise the excess positive charge. (2)

10.5

$n = \frac{m}{M}$ ✓

$= \frac{1,77}{59}$ ✓

$= 0,03$ mol✓

$Co \rightarrow Co^{2+} + 2e^{-}$

1 mol Co produces 2 mol of electrons.
0,03 mol Co produces × mol electrons.

X = (2)(0,03) = 0,06 mol✓ (4)

[12]

QUESTION 11

11.1 Sulphur dioxide/Sulphur-1V-oxide
11.2 Vanadium pentoxide
11.3 $H_2S_2O_7$
11.4 Contact process
11.5 Haber process
11.6 Atmosphere
11.7 $(NH_4)_2SO_4$

(7 × 1) **[7]**

QUESTION 12

12.1 It is a nuclear reaction in which large nuclei are split into smaller nuclei with the simultaneous emission of energy. (2)

12.2
- Fear of radiation leakage/nuclear meltdown
- Storage of spent nuclear fuel which is still radioactive
- Very expensive (Any 1 × 2) (2)

12.3 A = 1✓ and X = hydrogen✓ (2)

12.4 12.4.1 Decays 50% in 8,1 days – remainder is ½ original
Decays 50% in 8,1 days – remainder is ¼ original
Time taken is 16,2 days (2)

12.4.2 Gamma radiation (2)

12.4.3 Cannot be stopped by human tissue, but can be stopped by high-density metal such as lead. (2)

12.4.4 Beta-decay will occur where a neutron is converted into a proton and electron and an antiparticle/neutrino is ejected. (2)

[14]

TOTAL SECTION B: 115
GRAND TOTAL: 150