LIMPOPO

PROVINCIAL GOVERNMENT

REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF EDUCATION

VHEMBE WEST PRE-TRIAL EXAMINATION

GRADE 12

PHYSICAL SCIENCES: CHEMISTRY (P2)

26 AUGUST 2022

MARKING GUIDELINES

MARKS: 150

This marking guidelines consist of 9 pages.

QUESTION 1

1.1 A✓✓ (2)

1.2 C✓✓ (2)

1.3 C✓✓ (2)

1.4 D✓✓ (2)

1.5 B✓✓ (2)

1.6 C✓✓ (2)

1.7 B✓✓ (2)

1.8 A✓✓ (2)

1.9 A✓✓ (2)

1.10 B✓✓ (2)
[20]

QUESTION 2

2.1.1 S✓ (1)

2.1.2 W✓ (1)

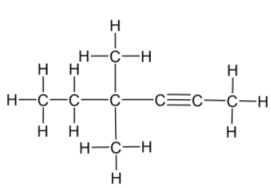
2.1.3 S✓ (1)

2.1.4 R✓ (1)

2.1.5 V✓ (1)

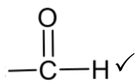
2.2.1 5-bromo-2,2-dimethylhexane✓✓✓ (3)

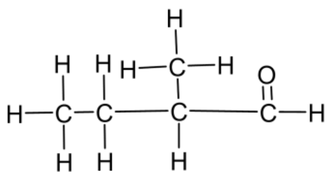
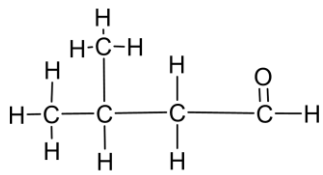
2.2.2



✓✓✓ (3)

2.3.1 Aldehydes✓ (1)

2.3.2  (1)

2.3.3  ✓✓ **OR:**  ✓✓ (2)

2.4.1 C_nH_{2n+2}✓ (1)

2.4.2 $2C_6H_{14} + 19O_2$ ✓→ $12CO_2 + 14H_2O$✓ bal✓ (3)

[19]

QUESTION 3

3.1 The temperature at which the vapour pressure of a substance equals the atmospheric pressure. ✓✓ (2)

3.2 Boiling point✓ (1)

3.3 Yes✓
Compounds have the same molecular mass/only one dependent variable and one independent variable.✓ (2)

3.4.1 Esters.✓ (1)

3.4.2 $C_nH_{2n+2}O$ or $C_nH_{2n+1}OH$✓ (1)

3.4.3 Carboxyl group. ✓ (1)

3.5 Both compounds are intermolecularly hydrogen bonded.
BUT: Each molecule of compound **Y** has only one site for hydrogen bonding. ✓
: Each molecule of compound **Z** has two sites for hydrogen bonding. ✓

- Therefore the hydrogen bonding in **Z** is stronger than the hydrogen bonding in **Y**. ✓
OR: therefore the hydrogen bonding in **Y** is weaker than the hydrogen bonding in **Z**.
- More thermal energy is needed/required to overcome/break the intermolecular forces in compound **Z** than in compound **Y**. ✓
OR: less thermal energy is needed/required to overcome/break the intermolecular forces in compound **Y** than in compound **Z**. (4)

[12]

QUESTION 4

4.1 In **A**: KOH is dilute✓

In **B**: KOH is concentrated✓ (2)

4.2.1 $CH_3CH_2CH_2CH_2OH$
$CH_3\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}OH$
OR:
$CH_3\text{-}(CH_2)_2\text{-}CH_2\text{-}OH$✓✓
Butan-1-ol✓ (3)

4.2.2 Hydrolysis✓ (1)

4.3.1 $CH_3CH_2CHCH_2$ **OR:** $CH_3\text{-}CH_2\text{-}CH\text{=}CH_2$✓✓
But-1-ene✓ (3)

4.3.2 Dehydrohalogenation **/** Dehydrobromination✓ (1)

4.4.1 Hydration✓ (1)

4.4.2 H_2SO_4 **/** H_3PO_4✓ (1)

4.4.3 Butan-2-ol✓✓ (2)

4.5 Alcohol **Z**: dilute HBr(aq) needed✓

Alkene **Y**: Dry HBr(g) needed✓ (2)

[17]

QUESTION 5

5.1.1 The minimum energy needed for a reaction to take place. ✓✓ (2)

5.1.2 Endothermic✓ (1)

5.1.3 Activated complex✓ (1)

5.1.4
$1250 - E_P(C) = 800$✓
$E_P(C) = 1250 - 800$
$= 450$ KJ✓
(2)

5.1.5
$EP(B) = 1250 - 520$
$= 730$ KJ✓

$\therefore \Delta H = E_P(P) - E_P(R)$
$= 730 - 450$
$= 280$ KJ✓
(2)

5.2.1 Time✓ (1)

5.2.2 X✓ (1)

5.2.3
- Granules →smaller surface area/Larger particle size✓
- Less particles have correct orientation
- Less effective collisions per unit time/Lower frequency of effective collisions✓
- Decreased reaction rate/smaller gradient✓

(3)

5.2.4
$N = \frac{V}{V_m}$
$= \frac{0,1}{24,04}$✓
$= 0,00415973$ mol

But: $n(Zn) : n(H_2) = 1:1$
$n(Zn)=n(H_2) = 0,00415973$ mol

$m(Zn) = nM$✓
$= (0,00415973)(65)$ ✓
$= 0,27038$ g✓
(4)
[17]

QUESTION 6

6.1 2,5 ($mol\cdot dm^{-3}$) ✓ (1)

6.2 A system which is isolated from its surroundings. ✓✓ (2)

6.3 Reversible reaction in equilibrium state. ✓ (1)

6.4.1 Decreases✓
Concentration of NH_3 remains constant. ✓ (2)

6.4.2 Stays the same✓
Concentration of NH_3 remains constant✓ (2)

6.5 Hydrogen gas✓ (1)

6.6
- From **t_1** to **t_2**, the reaction is in dynamic equilibrium. ✓
- Therefore the rate at which ammonia (NH_3) decomposes (forward reaction) into nitrogen (N_2) and hydrogen (H_2) ✓ equals the rate at which N_2 and H_2 re-combine to form NH_3 (reverse reaction). ✓

(3)

6.7 <u>**NUMBER OF MOLES TABLE:**</u>

Equation	$2NH_3(g) \rightleftharpoons$	$N_2(g)$	$+3H_2(g)$
Ratio	2	1	3
Initial amount (mol)	5	0	0
Change in amount (mol)	-3	1,5	+4,5✓
Equilibrium amount (mol)	2	1,5	4,5✓
$C = \frac{n}{v}$ ($mol\cdot dm^{-3}$)	1	0,75	2.25✓

$$Kc = \frac{[N_2][H_2]^3}{[NH_3]^2} \checkmark$$
$$= \frac{(0,75)(2,25)^3}{(1)^2} \checkmark$$
$$= 8,543 \checkmark$$

(6)

OR:

CONCENTRATION TABLE:

Equation	$2NH_3(g)$ ⇌	$N_2(g)$	$+3H_2(g)$
Ratio	2	1	3
Initial amount (mol·dm^{-3})	2,5	0	0✓
Change in concentration (mol·dm^{-3})	-1,5	+0,75	+2,25✓
Equilibrium concentration (mol·dm^{-3})	1	0,75	2,25✓

$$Kc = \frac{[N_2][H_2]^3}{[NH_3]^2} ✓$$

$$= \frac{(0,75)(2,25)^3}{(1)^2} ✓$$

$$= 8,543 ✓$$

(6)

6.8 Increase the temperature/heat the container. ✓ (1)

[19]

QUESTION 7

7.1 An acid that ionises incompletely in water to form a low concentration of H_3O^+ ions. ✓✓ (2)

7.2 Lower✓ (1)

7.3 Weak acid✓ (1)

7.4 Basic/alkaline✓ (1)

7.5 The point during a titration where the indicator changes colour. ✓✓ (2)

7.6

For NaOH	**But:** $n((COOH)_2) : n(NaOH) = 1:2$
$(c{\cdot}V)_{dilute} = (c{\cdot}V)_{concentrated}$	$n((COOH)_2) = 2xn(NaOH)$
$c_{dil} = \frac{(c{\cdot}V)_{Conc.}}{V_{dil}}$	$= \frac{1}{2}(0,0033)$ ✓
$= \frac{(1,63)(0,05)}{(1)}$ ✓	$=0,00165$ mol✓
$= 0,0825\ mol{\cdot}dm^{-3}$	$m(C_2H_2O_4) = nM$
	$= (0,00165)(90)$ ✓
$n(NaOH) = cV$	$= 0,1485$ g✓
$= (0,0825)(0,04)$ ✓	% purity $= \frac{m(C_2H_2O_4)_{pure}}{m(C_2H_2O_4)_{impure}} \times 100$
$= 0,0033$ mol✓	$= \frac{0,1485}{0,25} \times 100$✓
	$= 59,40$ %✓

(9)
[16]

QUESTION 8

8.1 A cell in which chemical energy is converted to electrical energy. ✓✓ (2)

8.2 $Cd(s) + Ni^{2+}(aq)$ ✓ → $Cd^{2+} + Ni(s)$ ✓ bal. ✓ (3)

8.3 $Cd(s) \mid$ ✓$Cd^{2+}(aq) \parallel$ ✓$Ni^{2+}(aq) \mid$ ✓$Ni(s)$ (3)

8.4 Negative✓ (1)

8.5

$E^{\theta}_{cell} = E^{\theta}_{cathode} - E^{\theta}_{anode}$ ✓
$= -0,27$ ✓ $- (-0,40)$ ✓
$= -0,27 + 0,40$
$= +0,13$ V✓

(4)
[13]

QUESTION 9

9.1.1 A substance of which the aqueous solution contains ions. OR: a substance that dissolves in water to give a solution that conducts electricity. ✓✓ (2)

9.1.2 Cathode ✓ (1)

9.1.3 $Cu^{2+} + 2e^{-} \rightarrow Cu$ ✓✓ (2)

9.2 Positive✓ (1)

9.3.1 It will sink to the bottom of the cell. ✓ (1)

9.3.2 It will be oxidised/it will go into solution. ✓ (1)

9.4 Cu^{2+} Is a stronger oxidising agent than Zn^{2+} ✓and therefore the Zn^{2+} will not be reduced (will stay in solution). ✓ (2)

9.5

$$m(Cu) = nM$$
$$= (3,75 \times 10^{-2})(63,5) \checkmark$$
$$= 2,38\ g \checkmark$$

$$\%Cu = \frac{m(Cu)_{pure}}{m(Cu)_{impure}} \times 100$$
$$= \frac{2,38}{4} \times 100 \checkmark$$
$$= 59,53\% \checkmark$$

(4)

9.6 Gan bubbles✓ (1)

9.7 It will change from “bright blue” to pale blue/colourless. ✓✓ (2)

[17]