education

Department:
Education
PROVINCE OF KWAZULU-NATAL

PHYSICAL SCIENCES: CHEMISTRY (P2)

JUNE EXAMINATION

MARKING GUIDELINE

2020

NATIONAL
SENIOR CERTIFICATE

GRADE 12

Time: 3 hours

Marks: 150

NB. This marking guideline consists of 9 pages.

QUESTION 1

1.1 D✓✓ (2)

1.2 B ✓✓ (2)

1.3 C ✓✓ (2)

1.4 C✓✓ (2)

1.5 B✓✓ (2)

1.6 B✓✓ (2)

1.7 C ✓✓ (2)

1.8 A✓✓ (2)

1.9 D✓✓ (2)

1.10 C ✓✓ (2)

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QUESTION 2

2.1.1 E✓ (1)

2.1.2 B and F✓✓ (2)

2.1.3 G✓ (1)

2.1.4 F✓ (1)

✓ ✓

2.2.1 1-bromo-2,2-dichloroethane (2)

2.2.2 hexanal✓✓ (2)

2.2.3 2-propanol/propan-2-ol✓ (1)

2.2.4 Carboxyl group✓✓ (2)

2.2.5 C_nH_{2n}✓✓ (2)

2.3. C✓ (1)

2.4 Condensation polymerization. ✓
Molecules of two monomers with different functional groups undergo condensation reactions with the loss of small molecules, usually water. ✓✓ (3)

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QUESTION 3

3.1 The temperature at which the solid and liquid phases of a substance are at equilibrium. ✓✓ (2)

3.2.1 Compound A, ethane has only weak London forces between the molecules. ✓
Compound B, chloroethane has weak London forces and dipole-dipole forces between the molecules. ✓
Since compound B has stronger intermolecular forces than compound A, compound B has a higher boiling point. ✓ (3)

3.2.2 Compound C, ethanol, has strong hydrogen bonds in addition to dipole-dipole forces and weak London forces are between the molecules. ✓

Compound D, ethanoic acid has very strong hydrogen bonds (2 sites for hydrogen bonding) in addition to dipole-dipole forces and weak London forces (induced dipole forces) are between the molecules. ✓

Since compound D has stronger intermolecular forces than compound C, compound D has a higher melting point. ✓ (3)

3.3 The higher the boiling point, the lower the vapour pressure. ✓✓ (2)

[10]

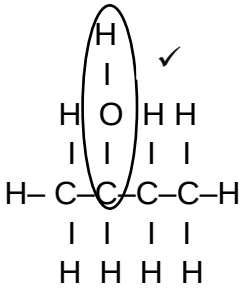
QUESTION 4

4.1 $2C_5H_{10} + 15O_2 \longrightarrow 10CO_2 + 10H_2O$ ✓ ✓ ✓bal (3)

4.2.1 Br_2 ✓
Heat/ UV light✓ (2)

4.2.2 Concentrated strong base(NaOH/KOH) in ethanol✓
Heat strongly under reflux✓ (2)

4.3.1



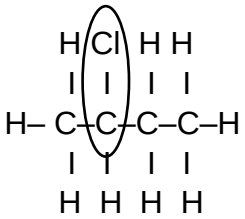
✓ ✓ 2-butanol/butan-2-ol✓ (3)

4.3.2 Alcohols✓ (1)

4.3.3 secondary✓
The OH group is joined to the carbon atom that is bonded to two other carbons✓ (2)

4.3.4 Addition/hydration✓ (1)

4.4

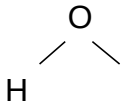


✓ ✓ (2)

4.5 Substitution✓ (1)

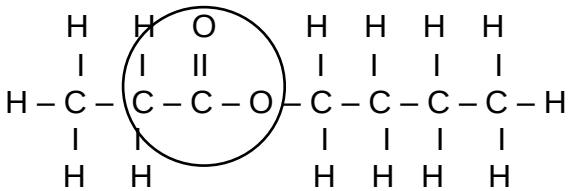
4.6 but-1-ene/1-butene✓✓ (2)

4.7



✓✓ (2)

4.8



✓ butyl propanoate✓ ✓whole structure (3)

4.9 Esterification✓ (1)

[25]

QUESTION 5

5.1 Change in concentration of reactants or products per unit time. ✓✓ (2)

5.2 Temperature✓
Concentration✓ (any 2) (2)
Catalyst

5.3 Sulphur✓ (1)

5.4 What is the relationship between concentration and reaction rate? ✓✓ (2)

5.5 A✓✓ (2)

5.6 In experiment B:

The concentration of $Na_2S_2O_3(aq)$ is higher. /More $Na_2S_2O_3$ particles per unit volume. ✓
More particles with correct orientation✓ (3)
More effective collisions per unit time / Higher frequency of effective collisions. ✓

5.7 Rate of Reaction = $\frac{\Delta V}{\Delta t}$

$= \frac{50 - 0}{125 - 0}$ ✓✓

$= 0,4\ cm^3 \cdot s^{-1}$ ✓ (3)

5.8 $C = \frac{m}{MV}$

$= \frac{100}{(158)(0,25)}$ ✓

$= 2.53 \text{ mol.dm}^{-3}$

$n (Na_2S_2O_3 \text{ in D}) = C \times V$ ✓
$= (2.53)(0,01)$ ✓
$= 0,025\text{mol}$

$n_s : n_{Na_2S_2O_3}$
$1 : 1$ ✓

$n_s = \frac{m}{M}$
✓ $0,025 = \frac{m}{32}$ ✓
$m = 0,8\text{g}$✓

(7)

[22]

QUESTION 6

6.1.1 Homogenous. ✓
The reactants and products are all in the same phase. ✓ (2)

6.1.2 $2CO(g) + 3H_2(g) \longrightarrow 2CH_2OH(g)$ ✓✓ (2)

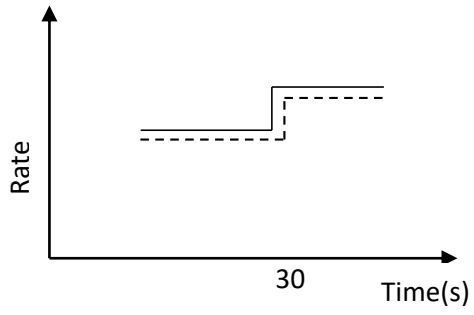
6.1.3 Reactants are being used up to form products. ✓ (1)

6.1.4 Exothermic✓An increase in temperature favoured the endothermic reaction. ✓✓ (3)

6.1.5 Equilibrium is reached.✓✓ / the rate of the forward reaction is equal to the rate of the reverse reaction. (2)

6.1.6 Increases. ✓ (1)

6.1.7



✓ shape
✓ two curves
✓axes
✓ 30

(4)

6.2.1 When the equilibrium in a closed system is disturbed, the system will reinstate a new equilibrium by favouring the reaction that will oppose the disturbance.✓✓ (2)

6.2.2.1 Decrease✓ (1)

6.2.2.2 Increase✓ (1)

6.2.3

	SO_2	O_2	SO_3	
Ratio	2	1	2	✓
Initial mole	0,3	x	0	
Change in mole	0,2	0,1	0,2	✓
Equilibrium Mole	0,1	x - 0,1	0,2	
Equilibrium concentration	0,01	$\frac{x - 0,1}{10}$	0,02	

$$K_c = \frac{[SO_3]^2}{[SO_2]^2[O_2]} \checkmark$$

$$15 \checkmark = \frac{(0,02)^2}{(0,01)^2 \left(\frac{X - 0,1}{10}\right)} \checkmark$$

$$x = 2,77 \text{ mol} \checkmark$$

$$n = \frac{m}{M}$$

$$2,77 = \frac{m}{32} \checkmark$$

$$m = 88,64 \text{ g} \checkmark$$ (8)

[27]

QUESTION 7

7.1 An acid is a substance that releases hydronium ions in solution. ✓✓ (2)

7.2

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

✓ $\frac{(0,5)(15)}{C_b(12,5)} = \frac{2}{1}$ ✓

$C_b = 0,3 \text{ mol.dm}^{-3}$

$C = \frac{m}{MV}$

$0,03 = \frac{0,795}{M(0,25)}$ ✓

$M = 106 \text{ g.mol}^{-1}$ ✓

$106 = 2M_x + 12 + 3(16)$ ✓

$M_x = 23 \text{ g.mol}^{-1}$ ✓

Therefore X is Na/Sodium✓

$n(HCl) = c \times V$ ✓

$= (0,5)(0,015)$ ✓

$= 0,0075\text{mol}$

$n_{HCl} : n_{X2CO3}$

2 : 1 ✓

$n_{X2CO3} = \frac{0,0075}{2}$

$= 0,00375$ mol ✓

$n_{X2CO3} = \frac{m}{M}$

$0,00375 = \frac{0,798}{M}$ ✓

$M = 106 \text{ g.mol}^{-1}$

$106 = 2M_x + 12 + 3(16)$ ✓

$M_x = 23 \text{ g.mol}^{-1}$ ✓

Therefore X is Na/Sodium ✓ (8)

7.3.1 $n(NaHCO_3) = \frac{m}{M}$

$= \frac{7}{84}$ ✓

$= 0,083\text{mol}$

$n(NaHCO_3) : n(HCl)$

1 : 2 ✓

$n(HCl) = 0,16\text{mol}$ ✓

$C = \frac{n}{V}$ ✓

$5 = \frac{0,16}{V}$ ✓

$V = 0,032 \text{ dm}^3$

$= 32 \text{ cm}^3$ ✓ (6)

7.3.2 $(C_aV_a)_{initial} = (C_aV_a)_{final}$
✓ $(5)V_a = (0,1)(1)$ ✓
$V_a = 0,02\ dm^3$ ✓

(3)

7.4.1 $M\ (NaHCO_3) = 23 + 1 + 12 + 3(16) = 84\ g.mol^{-1}$ ✓

$n = C \times V$
$= (0,052)\ (0,275)$ ✓
$= 0,0143\ mol$

$m = nM$
$= (0,0143)(84)$ ✓
$= 1,20g$✓

$\%\ Purity = \frac{1,20}{3,68} \times \frac{100}{1}$✓

$= 32,61\%$✓ (6)

7.4.2 $pH = -\log[H_3O^+]$✓
$= -\log(0,11)$ ✓
$= 0,96$✓ (3)

[28]

TOTAL: 150