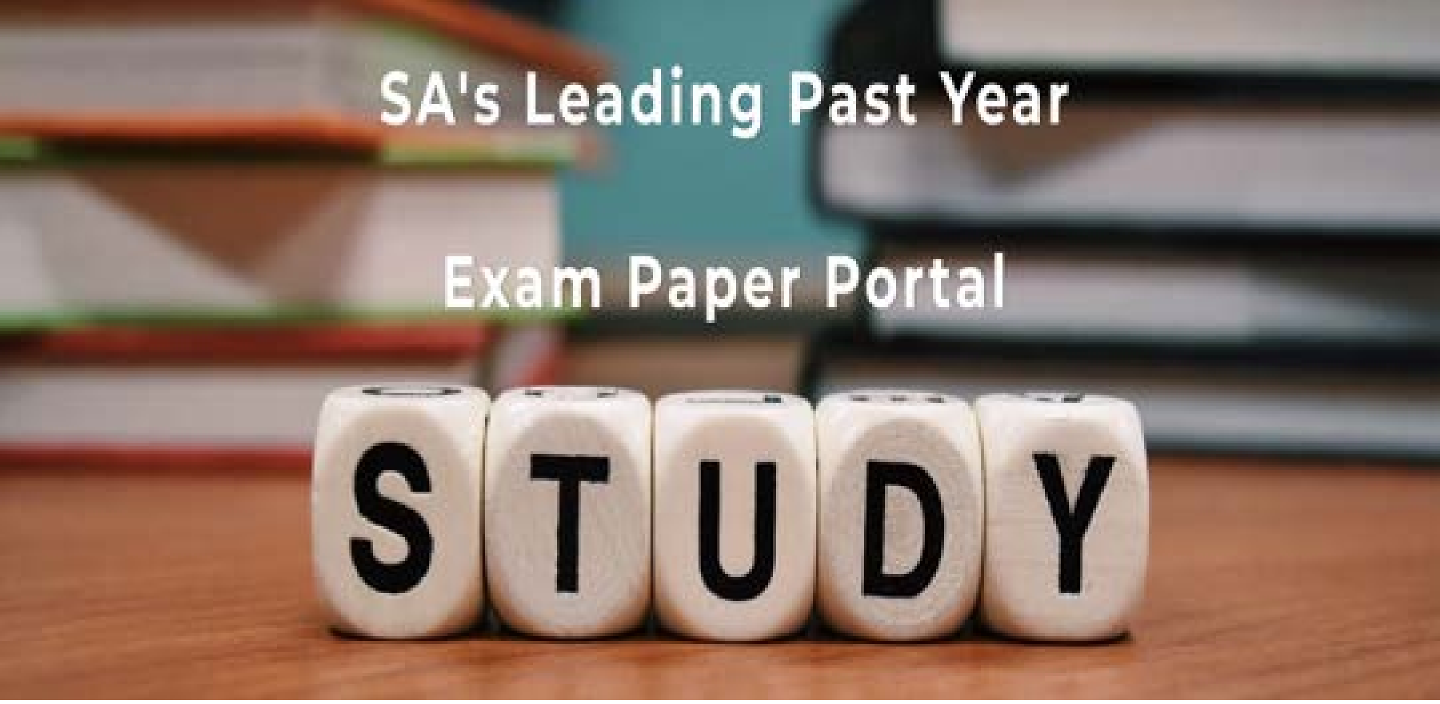
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PROVINCE OF KWAZULU-NATAL

NATIONAL
SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES: CHEMISTRY (P2)
PREPARATORY EXAMINATION
MARKING GUIDELINES
SEPTEMBER 2020

Time: 3 hours

Marks: 150

NB. This marking guideline consists of 10 pages.

QUESTION 1

1.1 D ✓✓ (2)

1.2 C ✓✓ (2)

1.3 D ✓✓ (2)

1.4 C✓✓ (2)

1.5 A✓✓ (2)

1.6 C✓✓ (2)

1.7 A✓✓ (2)

1.8 B✓✓ (2)

1.9 D✓✓ (2)

1.10 D✓✓ (2)

[20]

QUESTION 2

2.1 3,3-diethylhexane ✓ ✓ (2)

2.2 A and D ✓ (1)

2.3 B ✓ (1)

2.4

```
    H   Cl
    |  ✓ |
H — C = C — H
```

whole structure ✓ chloroethene ✓ (3)

2.5 formyl group ✓ (1)

2.6 C ✓ (1)

2.7 propan-2-ol✓/2-propanol (1)

[10]

QUESTION 3

3.1 Temperature at which the vapour pressure of a substance is equal to the atmospheric pressure. ✓ ✓ (2)

3.2 How does the type of functional group affect the boiling point of an organic compound? (2)

OR

What is the relationship between the functional groups of different organic compounds and their boiling points?

Dependent and independent variable correctly identified i.e. boiling point and functional group	✓
Relationship between dependent and independent variables given in the form of a question that cannot be answered by YES or NO.	✓

3.3 Molecular mass✓ (1)

3.4 Compound A has London/induced dipole forces ✓
whereas compound B has London forces and hydrogen bonds. ✓
Hydrogen bonds are stronger that London forces. ✓ (4)
Therefore more energy is required to overcome the intermolecular forces in compound B. ✓

3.5 Higher than. ✓
(-) The lower the boiling point, the higher the vapour pressure. ✓ (2)

3.6 Lower than. ✓
(-) Compound C has only one site for hydrogen bonding while compound B has two sites for hydrogen bonding. ✓therefore more energy required to separate molecules of B✓ (3)

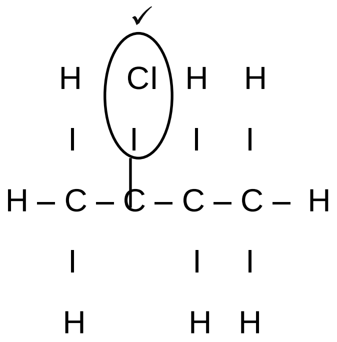
[14]

QUESTION 4

4.1 2-methylbut-1-ene ✓✓ (2)

4.2.1 hydrohalogenation ✓ (1)

4.2.2



✓ whole structure

2-chloro-2-methylbutane ✓✓ (4)

4.3.1 Pt / Pd /Ni /platinum/palladium/nickel ✓ (1)

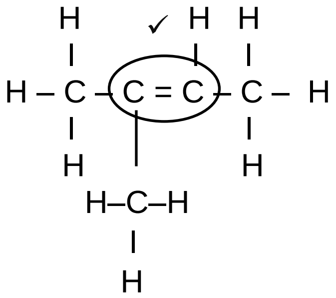
4.3.2 2-methylbutane ✓✓ (2)

4.4.1 <u>Dilute H_2SO_4</u> ✓✓ / <u>dilute H_3PO_4</u> ✓✓
Mild heat ✓ (2)
excess water✓
<u>H_2SO_4✓ OR H_3PO_4</u> ✓

4.4.2 Hydration ✓ (1)

4.4.3 Tertiary. ✓
The -OH/hydroxyl group is joined to the carbon that is joined to 3 other carbon atoms. ✓ (2)

4.4.4



✓ whole structure

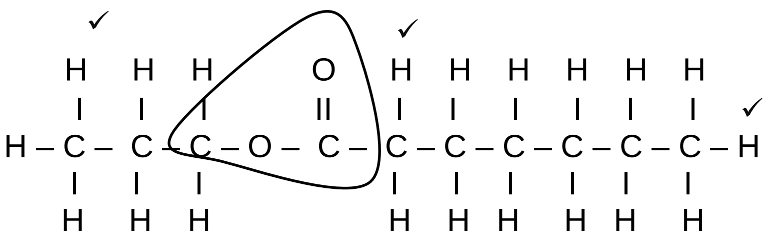
2-methylbut-2-ene✓✓ (4)

[19]

QUESTION 5

5.1.1 Heptanoic acid ✓✓ / hexanoic acid (2)

5.1.2



(3)

5.2.1 The breaking of organic molecules into smaller more useable units. ✓✓ (2)

5.2.2 thermal✓ (1)

5.2.3 pentene / pent-1-ene / pent-2-ene ✓✓ (2)

5.2.4 $2C_8H_{18} + 25O_2 \rightarrow 16CO_2 + 18H_2O$ ✓ ✓ ✓bal (3)

[13]

QUESTION 6

6.1 Change in concentration / mass / moles/ amount/ volume of reactants (or products) per unit time. ✓✓ (2)

6.2 $3,0\ dm^3$ ✓ (1)

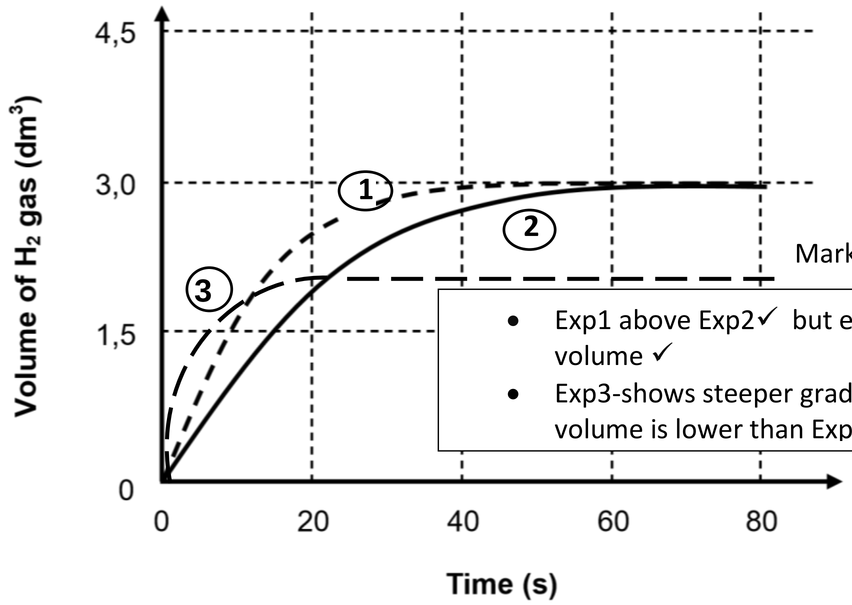
6.3 Rate of Reaction = $\frac{\Delta V}{\Delta t}$

$= \frac{3,0 - 0}{20 - 0}$ ✓✓

$= 0,15\ dm^3 \cdot s^{-1}$ ✓ (3)

6.4 Increases ✓
A higher concentration means that there is a greater number of particles per unit volume. ✓
This leads to an increase in the number of collisions per unit time✓.
This leads to an increase in the number of effective collisions per unit time. ✓ (4)

6.5



Marking guideline

- Exp1 above Exp2✓ but end at same point for volume ✓
- Exp3-shows steeper gradient✓ but end volume is lower than Exp 1 and 2 ✓

(4)

[14]

QUESTION 7

7.1 x axis- Kinetic Energy (of molecules)✓
y axis- % of molecules/no of particles✓ (2)

7.2 T_2✓ (1)

7.3 It indicates the percentage of molecules that have more energy than the activation energy at a specific temperature. / It is the percentage of molecules that are capable of effective collisions. ✓ (1)

7.4 The area under the curves remains the same. ✓
The number of molecules in the reaction mixture stays the same/does not change. ✓ (2)

7.5 There are no molecules/particles with ZERO energy. ✓ (1)

[7]

QUESTION 8

8.1 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)

8.2 Brown✓ (1)

8.3 Endothermic. ✓
An increase in temperature will favour the endothermic reaction in an equilibrium reaction. ✓
Since an increase in temperature resulted in an increase in the value of Kc, ✓
It can be concluded that the forward reaction is favoured✓ (4)

8.4 Add a catalyst✓
Increase the pressure. ✓
Increase concentration of reactant (any two) (2)

8.5

	N_2O_4	NO_2
Ratio	1	2
Initial mass	84,64g	0
Initial mole	$\frac{84,64}{92}$ ✓ = 0,92 mol	0
Change in mole	0,19✓	0,38
Moles at equilibrium	0,73mol	0,38mol
Equilibrium concentration ($mol.dm^{-3}$)	$\frac{0,73}{2}$ = 0,365	$\frac{0,38}{2}$ = 0,19✓

$$Kc = \frac{[NO_2]^2}{[N_2O_4]} \checkmark$$

$$= \frac{(0,19)^2}{0,365} \checkmark$$

$$= 0,1 \checkmark$$ (9)

Therefore the temperature is 300K✓

8.6 Remains the same. ✓
Only change in temperature affects Kc. ✓✓ (3)

[21]

QUESTION 9

9.1 A standard solution is one whose concentration is precisely known. ✓✓ (2)

9.2 $(C \times V)_{dilute} = (C \times V)_{conc}$

$C_{dilute} = \frac{(C \times V)_{conc}}{V_{dilute}}$

$= \frac{0,63 \times 0,05}{1 \checkmark} \checkmark$

$= 0,0315\ mol.dm^{-3}$✓ (3)

9.3 Positive marking from Q9.2

n_{NaOH} = C x V
= 0,0315 x 0,04 ✓
= 1,26 x 10^{-3}mol ✓

n_{NaOH}: $n_{C_2H_2O_4}$

2 : 1

$n_{C_2H_2O_4}$ = 6,3 x 10^{-4}mol ✓

$m_{C_2H_2O_4}$ = n x M ✓
= 6,3 x 10^{-4} x 90 ✓
= 0,0567g

% purity = $\frac{0,0567}{0,25}$ ✓ x $\frac{100}{1}$

= 22,68 % ✓ (7)

9.4

option 1

Kw = $[H_3O^+][OH^-]$ = 1x10^{-14} ✓
1x10^{-14} = $[H_3O^+]$ (0,20)
$[H_3O^+]$ = 5 x10^{-14} ✓

pH = -log $[H_3O^+]$ ✓
= -log (5 x10^{-14})
= 13,3 ✓

option 2

pOH = -log$[OH^-]$ ✓
= -log (0,2)
= 0,70 ✓

pH + pOH = 14 ✓
pH + 0,70 = 14
pH = 13,3 ✓

(4)

9.5 Is the point in a titration where the indicator changes colour. ✓✓ (2)

9.6 $\frac{C_aV_a}{C_bV_b} = \frac{n_a}{n_b}$

$\frac{C_a\,(15)}{(0,2)(30,25)}$ ✓ = $\frac{1}{1}$ ✓(ratio)

- Sub on LHS✓✓
- Sub no moles on RHS✓
- Answer with unit✓

C_a = 0,40 mol.dm^{-3} ✓ (4)

9.7 **Option 1** Positive marking from Q9.6

M (CH_3COOH) = 2(12) + 4(1) + 2(16)
= 60g.mol^{-1} ✓

n (CH_3COOH) $_{diluted}$ = C x V
= 0,40 x 0,25 ✓
= 0,1 mol

m (CH_3COOH) $_{dilute}$ = n x M
= 0,1 x 60
= 6,0g

% CH_3COOH in vinegar = $\frac{6,0}{25 ✓} \times \frac{100}{1}$ ✓

= 24,0% ✓

- Molar mass of CH_3COOH. ✓
- Substitution 0,24 x 0,25 ✓
- Mass of 25g in vinegar✓
- Substitution of percentage✓
- Final answer✓

Option 2 Positive marking from Q9.6

M (CH_3COOH) = 2(12) + 4(1) + 2(16)
= 60g.mol^{-1} ✓

m (CH_3COOH) $_{diluted}$ = C x V
= 0,40 x 60 x 0,25 ✓
= 6,0 g

% CH_3COOH in vinegar = $\frac{6,0}{25 ✓} \times \frac{100}{1}$ ✓

= 24,0% ✓

- Molar mass of CH_3COOH. ✓
- Substitution 0,4 x 60 ✓
- Mass of 25g in vinegar✓
- Substitution of percentage✓
- Final answer✓

(5)

9.8.1 reaction of a salt with water ✓✓ (2)

9.8.2 $CH_3COO^- + H_2O \leftrightarrows CH_3COOH + OH^-$ ✓(LHS) ✓ (RHS) (3)

pH will increase✓

[32]

TOTAL MARKS: 150