

KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

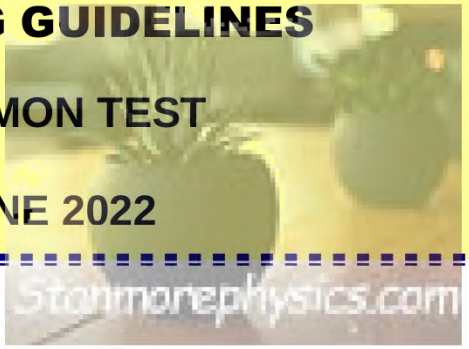
GRADE 12

PHYSICAL SCIENCES P2 (CHEMISTRY)

MARKING GUIDELINES

COMMON TEST

JUNE 2022



MARKS: 100

This marking guideline consists of 9 pages.

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QUESTION 1

1.1 A ✓✓ (2)

1.2 D ✓✓ (2)

1.3 B ✓✓ (2)

1.4 A ✓✓ (2)

1.5 D ✓✓ (2)

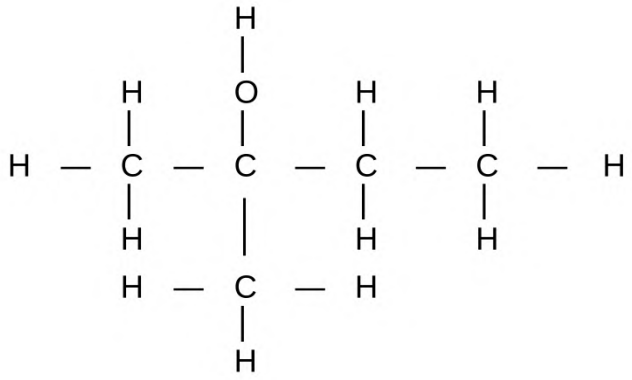
1.6 C ✓✓ (2)

[12]

QUESTION 2

2.1

2.1.1



(2)

Marking criteria:

- Tertiary carbon shown correctly with functional group: $\frac{1}{2}$
- Whole structure correct: $\frac{2}{2}$

2.1.2 The C atom to which the hydroxyl group is bonded to is bonded to 3 carbon atoms. ✓OR functional group C bonded to 3 other carbons✓ (1)

Stanmorephysics.com

2.2

2.2.1 2,2,3 – trimethylbutanoic acid

Marking criteria:

- Only parent name correct: Max:1/2✓
- All the substituents (3 methyl groups) correct and correctly numbered: ✓

(2)

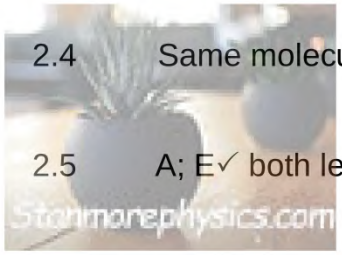
2.2.2 2,2,5-trimethylhex-3-ene

Marking criteria:

- Only parent name correct:✓
- Correct position of double bond: ✓
- All the substituents correct and correctly numbered: ✓

(3)

2.3 D✓✓ (2)



2.4 Same molecular formula✓, but different functional groups✓ (2)

2.5 A; E✓ both letters must be written (1)

[13]

QUESTION 3

3.1 The temperature at which the vapour pressure equals atmospheric (external) pressure. ✓✓ (2 or 0) (2)

3.2 Type of functional group/homologous series. ✓ (1)

3.3 LESS THAN✓ (1)

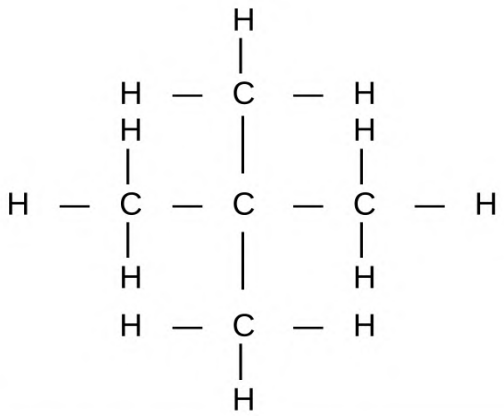
DO NOT APPLY NEGATIVE MARKING FROM 3.3

3.4 The intermolecular forces between molecules of propanoic acid are hydrogen bonding between molecules of ethyl methanoate, dipole-dipole forces. ✓
Intermolecular forces in propanoic acid are stronger than in ethyl methanoate✓
More energy required to overcome forces between molecules of propanoic acid/less energy to overcome forces between molecules of ethyl methanoate ✓ (3)

3.5 GREATER THAN✓ (1)

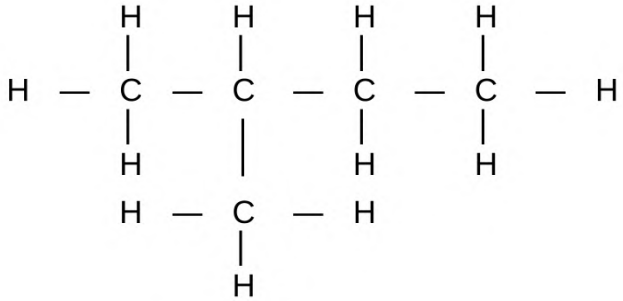


3.6



3 carbons longest chain✓ 2 methyl groups on second carbon✓ Whole structure correct✓

OR



4 carbons longest chain✓ 1 methyl group on second carbon✓ Whole structure correct✓

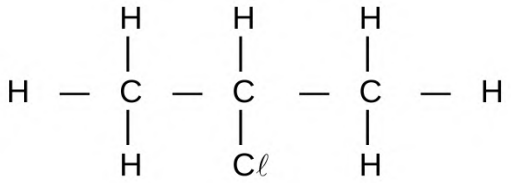
(3)

[11]

QUESTION 4

4.1 cracking✓ (1)

4.2.



3 carbons longest chain✓
halogen on second carbon✓

(2)

4.3 prop-1-ene/propene✓✓ (2)

4.4 ADDITION✓ (do not specify type of addition reaction) (1)

4.5 (mild) heat✓ (2)
Dilute Strong base (NaOH/KOH) (in ethanol)✓
Or $NaOH_{(aq)}$/ $KOH_{(aq)}$ (in ethanol)

Or (excess) water ✓ and (mild) heat ✓

4.6 C_8H_{18}✓✓ (2)

[10]

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QUESTION 5

5.1 *Note: Mark awarded for **per unit time** only if it is in the context of reaction rate*

- Change in concentration✓ of reactants/products per unit time. ✓ **OR**
- Change in amount/number of moles/volume/mass✓ of reactants or products per unit time✓ **OR**
- Amount/number of moles/volume/mass of products formed/reactants used up per unit time✓✓
- Rate of change in concentration/amount/number of moles/volume/ mass✓✓ **(2 or 0)**

(2)

5.2 60 ✓ (1)

5.3 $\text{average} = \frac{\Delta V}{\Delta t}$

$= \frac{(300 - 0)}{(20 - 0)}$ ✓ ✓

$= 15$ ✓ ($cm^3.s^{-1}$)

Accept $\frac{300}{20}$✓✓

(3)

5.4 GREATER THAN✓

Concentration of $HC\ell$ decreases or surface area of $CaCO_3$ decreases. ✓ (2)

OR: change in volume CO_2 between 0-20 s is greater than 20-40s/ over the same time interval



OR: accept $\text{average} = \frac{\Delta V}{\Delta t}$

$= \frac{460-300}{40-20}$

$= 8$

5.5

***Marking Criteria**:*

- *Formula:* $n = \frac{V}{V_m}$
- *Substitute* $= \frac{0,5}{25,70}$ ✓
-
- *Ratio:* $n(CaCO_3) = n(CO_2)$ ✓
- *Substitute 100* ✓*in* $m(CaCO_3) = nM$
- *Final answer = 1,95 g.* ✓

any formula✓

$n(CO_2) = \frac{V}{V_m}$

$= \frac{0,5}{25,70}$ ✓

= 0,0195 mols or 0,02 mol

$n(CaCO_3)_{initial} = n(CO_2)_{produced}$✓

$m(CaCO_3) = nM$

(5)

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= (0,0195)(100) ✓ 0r (0,02)(100)
= 1,95 g✓ = 2g

5.6.1 INCREASE✓ (1)

5.6.2 (Exposed) surface area increases✓
Number of reacting particles exposed/reacting with HCℓ increases ✓
Number of effective collisions per unit time increases/ frequency of effective collisions increases ✓ (3)

[17]



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QUESTION 6

6.1.1 ***Marking Criteria**:*

*If any one of the underlined phrases in the **correct context** is omitted, deduct 1 mark*
When the equilibrium in a closed system is disturbed, the system will re-instate a new equilibrium✓ by favouring the reaction that will oppose/cancel the disturbance. ✓ (2)

6.1.2 EXOTHERMIC✓ (1)

6.1.3 According to the graph a decrease in temperature at constant pressure results in the yield increasing. ✓
The forward reaction is favoured. ✓
According to Le Chatelier's Principle a decrease in temperature favours the exothermic reaction. ✓

- Or According to the graph an increase in temperature at constant pressure results in the yield decreasing✓
- The reverse reaction is favoured✓
- According to Le Chatelier's Principle an increase in temperature favours the endothermic reaction✓

(3)

6.1.4 As the pressure increases, the yield increases✓. (1)

6.1.5 According to Le Chatelier's Principle an increase in pressure favours the reaction that produces a fewer number of moles/ lower pressure. ✓
In this case the forward reaction produces a fewer number of moles/lower pressure. ✓ (2)

6.2 **Marking criteria:**

- *Calculating the initial number of moles of both reactants*✓
- *Calculating change in mols of I_2(2,5 -1,45)* ✓
- *Correct mol ratio*✓
- *Calculating the quantity(mol) at equilibrium of all H_2 and HI substances* ✓
- *Substitute V = 1,5 dm^3 to determine concentration at equilibrium of all the substances.*✓
- *K_c expression*✓
- *Substitution into K_c expression* ✓
- *Final answer 4,30* ✓



	H_2	I_2	HI	
Ratio	1	1	2	
Initial quantity (mol)	**1,75**	**2,5** ✓	0	
Change (mol)	1,05 *	1,05 ✓	2,10 *	*Using ratio ✓
Quantity at equilibrium (mol)	0,7	1,45	2,10 ✓	
Equilibrium concentration (mol·dm^{-3})	0,47	0,97	1,4	Divide by 1,5 ✓



$K_c = \frac{[HI]^2}{[H_2]\ [I_2]}$ ✓ substitution

$\therefore = \frac{[1,4]^2}{[0,47]\ [0,97]}$ ✓

$= 4,3$ ✓

No K_c expression, correct substitution. $\frac{6}{8}$

Wrong K_c expression $\frac{5}{8}$

(8)

[17]

QUESTION 7

7.1.1 Proton acceptor. ✓ (1)

7.1.2 Conjugate acid✓ (1)

7.1.3 Reaction of a salt with water✓✓ (2)

7.1.4 $NH_4^+ + H_2O \rightleftharpoons NH_3 + H_3O^+$ LHS✓ RHS✓ (2)

7.2.1 **Marking Criteria: OPTION ONE**

- *Formula: pH = - log $[H_3O^+]$* ✓
- *Substitution: 13,6*✓
- *$[H_3O^+]\ [OH^-]$ = 1 x 10^{-14}* ✓
- *Ratio: $Ba(OH)_2 : OH^-$* ✓
- *Final answer: 1*✓

pH = - log $[H_3O^+]$ ✓

13,6 ✓ = - log $[H_3O^+]$

$[H_3O^+]$ = 2,51189 x 10^{-14} mol.dm^{-3}

$[H_3O^+]\ [OH^-]$ = 1 x 10^{-14} ✓

$[OH^-]$ = 0,4 mol.dm^{-3}

$c(Ba(OH)_2)$ = ½ $c(OH^-)$ ✓

= ½ (0,4)

= 0,2 mol.dm^{-3}✓

(5)

OPTION 2

pOH = 14 - 13,6✓

= 0,4

poH = - log $[OH^-]$✓ = 0,4✓

$[OH^-]$ = 0,4 mol.dm^{-3}

$C(Ba(OH)_2)$ = ½ c (OH^-)✓

= ½(0,4)

= 0,2 mol.dm^{-3}✓

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7.2.2 **Marking criteria:** POSITIVE MARKING FROM 7.1.1

- *Substitute in the formula n = cV* ✓
- *Calculate initial number of mols of $Ba(OH)_2$.* ✓
- *Calculate initial number of mols of H_2SO_4.* ✓
- *Mol ratio: number of moles of $Ba(OH)_2$: number of moles of H_2SO_4.* ✓
- *Calculate number of mols of H_2SO_4 in excess - for subtracting* ✓
- *Formulae: Formulae: /n = cV/*
- *Substitute in the above formula.* ✓
- *Volume: 0,065* ✓
  Calculate c(H_2SO_4). ✓
- *Calculate c(H_3O^+)* ✓

$n(Ba(OH)_2)_{initial}$ = cV ✓
= 0,2 x 0,025 ✓
= 0,005 mols

$n(H_2SO_4)_{initial}$ = cV
= 0,15 x 0,04 ✓
= 0,006 mols

$n(H_2SO_4)_{reacted}$ = $n(Ba(OH)_2)$ ✓
= 0,005 mols

$n(H_2SO_4)_{excess}$ = 0,006 - 0,005 ✓
= 0,001 mols

OPTION 1

$c(H_2SO_4) = \frac{n}{V}$

$= \frac{0,001}{0,065}$ ✓✓

= 0,0154 mol.dm^{-3}. ✓

$[H_3O^+]$ = 2 $c(H_2SO_4)$
= 2(0,0154)
= 0,0308 mol.dm^{-3} ✓

OPTION 2

$n\ H_3O^+ = 2n(H_2SO_4)$

=2(0,001)

= 0,002 mol✓

$[H_3O^+] = \frac{0,002}{0,065}$ ✓

= 0,0308 mol.dm^{-3} ✓

(9)

[20]

TOTAL MARKS: 100



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