HILLCREST HIGH SCHOOL

PHYSICAL SCIENCE

GRADE 11

PAPER 2- Chemistry

NOVEMBER 2025 MEMO

TIME: 2.5 HRS

Total 125

Section A

Question 1

1.1 D

1.2 B

1.3 D

1.4 B

1.5 A

1.6 B

1.7 C

1.8 B

[16]

Question 2

2.1 The reactant that is NOT used up completely ✓ and has some left over at the end of the reaction.

$CaCO_3$	2HCl	$CaCl_2$	CO_2
2.2 Given: 0,05 mol	n = c.V✓ = 0,2 (0,025) ✓ = 0,005 mol✓		
Needed: 0,005 mol÷ 2 x 1✓ = 0,0025 mol Thus $CaCO_3$ is in excess✓ (Given amount>needed amount)	0,05 mol ÷ 1 x 2 = 0,1 mol		
2.3			0,005 mol÷ 2 x 1✓ = 0,025 mol m = n.M = 0,025 (111) ✓ = 0,28 g✓
2.4		0,001 mol ÷ 1 x 1✓ = 0,001 mol %yield = $\frac{actual}{theoretical} x\ 100$ %yield = $\frac{0,001}{0,0025} x\ 100$✓ = 41,07%✓	Actual n = $\frac{V}{Vm}$ = $\frac{0,023}{22,4}$✓ = 0,001 mol

		Or m = n.M = 0,001 (111) = 0,111g %yield = $\frac{actual}{theoretical} x\ 100$ %yield = $\frac{0,111}{0,28} x\ 100$ = 39,64%	

Question 3

3.1 5 minutes ✓ (1)

3.2

Rate = - Δm/Δt = -(188,8–192,4) √ /(1-0) √
= 3,6 √ (grams per minute

Accept
Rate = Δm/Δt = (188,8–192,4) √ /(1-0) √
= -3,6 √ (grams per minute

(3)

3.3 Calcium carbonate √/$CaCO_3$ And CO_2/ carbon dioxide ✓ (2)

3.4

$m(CO_2) = 192,4 – 186,7 = 5,7$ g√

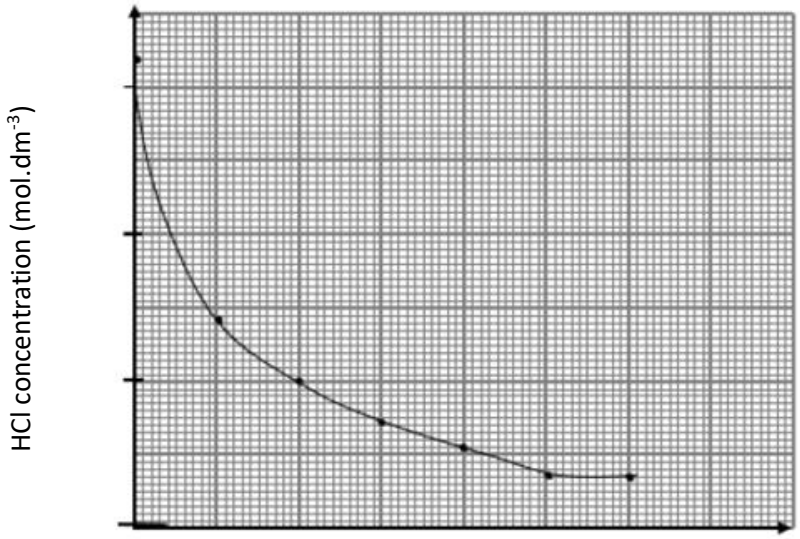
$n = m/M = 5,7 / 44$ √ $= 0,13$ mol (0,1295.. mol)

$n(CaCO_3) = n(CO_2) = 0,13$ mol√ (0,1295.. mol)

$m(CaCO_3) = n.M = 0,13 \times 100$ √ $= 13$ g (12,95 g) (5)

Accept Range 12,95 g to/*tot* 13 g

3.5



shape ✓

does not touch x-axis ✓

(2)

3.6 Crushing calcium carbonate (decreased particle size) means that there is <u>increased surface area</u> ✓ for the reaction to take place. This results in more collisions, therefore <u>more effective collisions per unit time</u>. ✓ So the reaction rate INCREASES. ✓ (3)

[17]

Question 4

4.1.1 An acid that donates ONLY one proton per molecule.✓✓ (2)

4.1.2 Strong acid ✓ (1)

4.1.3 (a) $[H_3O^+][OH^-] = k_w = 1 \times 10^{-14}$
$[H_3O^+](1 \times 10^{-11}) = 1 \times 10^{-14}$ ✓
$[H_3O^+] = 1 \times 10^{-3}$ mol·dm^{-3}

(b) $pH = - \log [H_3O^+]$ ✓
$pH = -\log (10^{-3})$ ✓
$pH = 3$✓ (4)

OR $pOH = - \log [OH-]$ ✓
$= - \log(1 \times 10^{-11})$ ✓
$= 11$

$pH = 14 - pOH$
$= 14 - 11$ ✓ **either one**
$= 3$ ✓ (4)

4.2.1 H_2O ✓ (1)

4.2.2 $c = \frac{n}{V}$ ✓
$0,15 = \frac{n}{0,7}$ ✓
$n = 0,11$ mol ✓

Marking criteria / Nasienriglyne
- Formula ✓
- Substitution ✓
- Answer ✓

(3)

4.2.3

① 80% of / *van* 7,5g

$\frac{80}{100}$ ✓ × 7,5

m = 6 g NaOH

② $n = \frac{m}{M}$ ✓

$n = \frac{6}{40}$ ✓

n = 0,15 mol NaOH

③ $n(H_2SO_4) = \frac{1}{2}(0,15) = 0,075$ mol ✓ (5·2·1)

$n(H_2SO_4)$ in excess = 0,105 - 0,075 ✓

$n(H_2SO_4)$ in excess = 0,03 mol

④ $c = \frac{n}{V}$

$c = \frac{0,03}{0,7}$ ✓

c = 0,043 mol·dm^{-3} H_2SO_4

⑤ $[H_3O^+] = 2(0,043) = 0,086$ mol·dm^{-3} ✓

$pH = -\log[H_3O^+]$

$= -\log(0,086)$ ✓

= 1,066 ✓

(9)

[20]

Question 5

5.1 The average distance between the nuclei of two bonded atoms in a molecule ✓✓ (2)

5.2 161 pm ✓ (1)

5.3 SHORTER THAN ✓ Cl is a smaller atom than I ✓ (2)

[5]

Question 6

6.1: Bonds are polar in both molecules√

Shape of NH 3 is trigonal pyramidal √

BF3 is trigonal planar √

NH3 has asymmetrical distribution of charge√

(4)

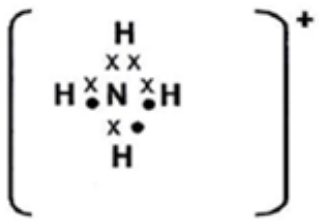
6.2 END = 3.5-2.5 = 1 ✓ Since the difference in electronegativity is greater than 0, the bond is polar ✓ (2)

6.3 CO_2 is a non-polar molecule and thus have van der waals London forces ✓ bewteen them. H_2S is a polar molecule and has Van der Waals, dipole-dipole. ✓

Van der Waals dipole-dipole forces are stronger than London forces, thus require more energy to weaken the Intermolecular forces. ✓ (4)

6.4.1 Dative / coordinate covalent bond ✓ (1)

6.4.2



✓✓ (2)

[13]

Question 7

7.1.1 Standard temperature and pressure ✓✓
Standaard temperatuur en druk✓✓ (2)

7.1.2 $n = \frac{V}{V_m}$ ✓

$V = 5{,}4(22{,}4)$ ✓

V = 120,96 dm^3 ✓ (3)

7.2.1 p1V1 = p2V2 ✓

120 x 100 = p2 x 40 ✓

p2 = 300 kPa ✓ (3)

7.2.2 Boyles Law✓ : The pressure of an enclosed gas is inversely proportional to the volume ✓it occupies at constant temperature. ✓ (3)

[11]

Question 8

6.1 Redox reactions are chemical reactions that involve the transfer of electrons✓✓ (2)

6.2 N = +5 ✓ (1)

6.3 $4H^+ + NO_3^- + 3e^-$ ✓ → $NO + 2H_2O$ ✓ (2)

(include phase symbols)

[5]

Question 9

9.1 chemical (potential) energy to electrical energy ✓ (1)

9.2 a solution/dissolved substance that conducts electricity through the movement of ions✓✓ (2)

9.3 B ✓ (1)

9.4 $Fe^{3+}(aq) + 3e \rightarrow Fe(s)$ ✓✓ (if double arrow only one mark)

-1 if no phases

9.5 $E^{\circ}_{cell} = E^{\circ}_{cathode} - E^{\circ}_{anode}$ ✓

(2)

= -0,06✓ – (-2,36) ✓

= 2,30V ✓ (4)

9.6 From B to A ✓ (1)

9.7 $Mg(s)|Mg^{2+}(aq)|| Fe^{3+}(aq)(1\ mol.dm^{-3})/Fe(s)$

(3)

[14]

Question 10

10.1 The chemical process in which electrical energy is converted to chemical energy. ✓✓
Die chemiese proses waarin elektriese energie omgeskakel word na chemiese energie.

OR/*OF*
The use of electrical energy to produce chemical change. ✓✓
Die gebruik van elektriese energie om chemiese verandering te weeg te bring. (2)

10.2

10.2.1 $Cr^{3+} + 3e^- \rightarrow Cr(s)$ ✓✓ (2)

10.2.2

Chromium(III) ions / *chroom(III)-ione* / Cr^{3+} ✓ (1)

10.3

$n = \frac{Q}{e^-}$

$= 2880 / 1,6 \times 10^{-19}$ ✓

$= 1,80 \times 10^{22}$ electrons

$n = No / N_A$

$= 1,80 \times 10^{22} / 6,02 \times 10^{23}$ ✓

$= 0,0299$ mol electrons

$n(Cr) = 0,0299 / 3$ ✓

$= 0,01$mol

$m = n \times M$

$= 0,01 \times 52$ ✓

$= 0,52g$ ✓ (5)

[10]

Total 125