



HILLCREST HIGH SCHOOL
PHYSICAL SCIENCE
GRADE 11
PAPER 2- Chemistry



JUNE 2022 MEMO

Total: 100

Question 1

- 1.1 D
- 1.2 C
- 1.3 C
- 1.4 A
- 1.5 A
- 1.6 B
- 1.7 D
- 1.8 C
- 1.9 C
- 1.10 B

Question 2

2.1 The substance that is used up completely in a reaction ✓✓ (2)

2.2

No of moles	C ₂₃ H ₄₈	O ₂	CO ₂	H ₂ O
Ratio	1	35	23	24
Start	0,08✓	3	0	0
Change	0,08✓	2,80✓	1,84	1,92
End	0	0,20	1,84	1,92

Candle wax is the limiting reagent. ✓

OR

Candlewax:

$$\begin{aligned}n &= N/N_A \\ &= 4,816 \times 10^{22} / 6,022 \times 10^{23} \checkmark \\ &= 0,08\text{mol}\end{aligned}$$

C₂₃H₄₈ : O₂

1: 35 ✓

n o₂ needed is 2,80mol ✓

Limiting reagent is candlewax ✓

(4)

2.3 POSITIVE MARKING

From table: $n_{\text{H}_2\text{O}}$ formed = 1,92 mol ✓✓

$$n = m/M$$

$$1,92 = m/18 ✓$$

$$m = 34,56\text{g} ✓$$

OR

$\text{C}_{23}\text{H}_{48} : \text{H}_2\text{O}$

1: 24 ✓

$$n_{\text{H}_2\text{O}} = 0,08 \times 24 = 1,92\text{mol} ✓$$

$$n = m/M$$

$$1,92 = m/18 ✓$$

$$m = 34,56\text{g} ✓$$

(4)

2.4.1

POSITIVE MARKING

n_{CO_2} formed = 1,84 mol ✓

$$V_{\text{CO}_2} = n \times V_m$$

$$= 1,84 \times 23,2 ✓$$

$$= 42,688 \text{ dm}^3$$

Actual Volume = $90/100 \times 42,688 ✓$

$$= 38,42 \text{ dm}^3 ✓$$

(4)

2.5

	C	H	O	
Mass in 100g	58.065g	7.527g	34.408g	
$n = m/M$	$\frac{58.065}{12}$	$\frac{7.527}{1}$	$\frac{34.408}{16}$	✓
	=4.839mol	=7.527mol	=2.151mol	
Divide by smallest	$\frac{4.839}{2.151}$	$\frac{7.527}{2.151}$	$\frac{2.151}{2.151}$	✓
	= 2.25	= 3.5	= 1	X4
Ratio	9	14	4	
Empirical Formula is $C_9H_{14}O_4$ ✓				

$$n = \frac{\text{Molecular Formula Mass}}{\text{Empirical Formula Mass}}$$

$$= \frac{372}{186} \quad \checkmark$$

$$= 2$$

Molecular Formula is $C_{18}H_{28}O_8$ ✓

(5)

Question 3

3.1 Exothermic ✓ (1)

3.2 Minimum energy needed for a reaction to take place. ✓✓ OR (2)

Amount of energy required to convert the reactants to the activated complex.

3.3 1580kJ.mol⁻¹ ✓ (1)

3.4 1580 + 197 ✓ = 1 777 kJ.mol⁻¹ ✓ (2)

3.5 1340 + 197 ✓ = 1537 kJ.mol⁻¹ ✓ (2)

3.6 Remains the same ✓ (1)

Question 4

4.1 The rate of a reaction is the change in concentration of reactant/product per unit time.✓✓ (2)

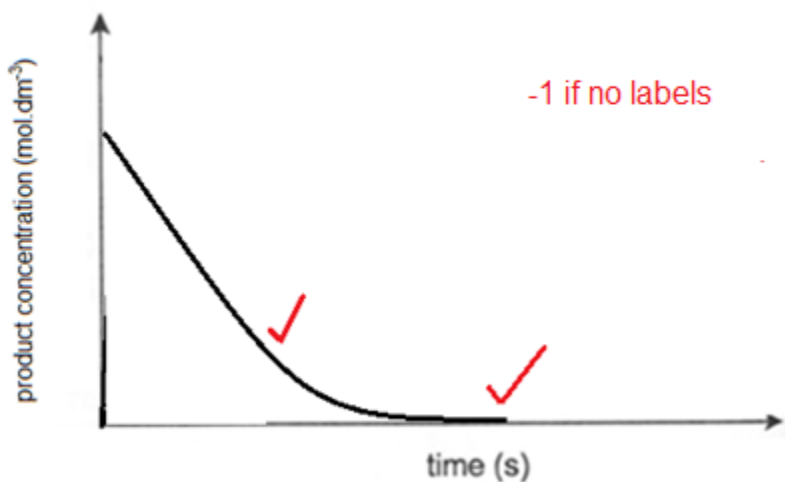
4.2.1 Concentration of sodium thiosulphate ✓ (1)

4.2.2 ANY ONE✓
Concentration of hydrochloric acid
Temperature (1)

4.3 S (sulphur/swawel)✓ (1)

4.4 Trial 1✓/Eksperiment 1 (1)

4.5



4.6 The rate of reaction increases as the concentration (of $\text{Na}_2\text{S}_2\text{O}_3$) increases✓✓ (2)

4.7 Increase the temperature of the reaction mixture✓
Use a catalyst✓ (2)

[12]

Question 5

5.1 Amount of solute per litre of solution. ✓ ✓ (2)

$$5.2 \quad n = m/M$$

$$= 4.14/69 \quad \checkmark$$

$$= 0.06 \text{ mol} \quad \checkmark$$

(2)

5.3 **Positive marking from 5.2**

$$c = n/V \quad \checkmark$$

$$\underline{0.05 = 0.06/V} \quad \checkmark$$

$$V = 1,20 \text{ dm}^3 \quad \checkmark$$

(3)

5.4

Positive marking from 5.3

$$c_1 V_1 = c_2 V_2 \quad \checkmark$$

$$\underline{0.05 \times 1.20} \quad \checkmark = \underline{c_2 \times 1.45} \quad \checkmark$$

$$C_2 = 0.04 \text{ mol.dm}^{-3} \quad \checkmark$$

Positive marking from 8.2. and 8.3

$$c = n/V \quad \checkmark$$

$$= 0.06 \quad \checkmark / 1.45 \quad \checkmark$$

$$c = 0.04 \text{ mol.dm}^{-3} \quad \checkmark$$

(4)

Question 6

6.1 A base forms hydroxide ions (OH^-) in water/aqueous solution/ $\text{OH}^-(\text{aq})$. ✓✓ (2)

6.2 $n(\text{KOH}) = cV$
 $= 0,1 \times 0,4$ ✓
 $= 0,04 \text{ mol}$
 $n(\text{OH}^-) = n(\text{KOH}) = 0,04 \text{ mol}$ ✓ (2)

6.3.1 Step 1 – calculate the total concentration of the hydronium ions from the pH

$\text{pH} = -\log [\text{H}_3\text{O}^+]$ ✓ *learners must be careful to write the formulae exactly as they are on the data sheet (including all exponents and full subscripts)

$13 = -\log [\text{H}_3\text{O}^+]$ ✓
 $[\text{H}_3\text{O}^+] = 1 \times 10^{-13} \text{ mol.dm}^{-3}$

Step 2 – Calculate the total $[\text{OH}^-]$, since you are ultimately looking for the concentration of the $\text{Ba}(\text{OH})_2$

$[\text{H}_3\text{O}^+][\text{OH}^-] = 1 \times 10^{-14}$
 $(1 \times 10^{-13})[\text{OH}^-] = 1 \times 10^{-14}$ ✓
 $[\text{OH}^-] = 0,1 \text{ or } 1 \times 10^{-1} \text{ mol.dm}^{-3}$

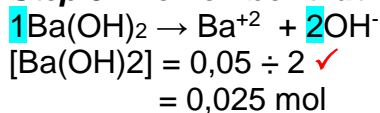
Step 3 – calculate the total number of moles of the OH^- ions

$n(\text{OH}^-) = c.V$
 $= 0,1 (0,9)$ ✓
 $= 0,09 \text{ mol}$

Step 4 – subtract the number of moles of OH^- (in the KOH) from the total to get the number of moles of OH^- in the $\text{Ba}(\text{OH})_2$

$n(\text{OH}^-) \text{ in } \text{Ba}(\text{OH})_2 = 0,09 - 0,04$ ✓ 0,04 mol from 6.2
 $= 0,05 \text{ mol}$

Step 5 – remember that $\text{Ba}(\text{OH})_2$ is dibasic, so you need to divide by 2 still



Step 6 – finally calculate the concentration of the $\text{Ba}(\text{OH})_2$

$c = \frac{n}{V}$
 $= \frac{0,025}{0,5}$ ✓
 $= 0,05 \text{ mol.dm}^{-3}$ ✓

6.3.2 weak ✓, the acid ionises partially in water to give a low [H₃O⁺] ✓

CH ₃ COOH	+ OH ⁻
<p>Step 2 0,0015 mol ÷ 1 x 1 ✓ = 0,0015 mol</p> <p>Step 3 $C = \frac{n}{V}$ $= \frac{0,015}{0,03}$ ✓ = 0,05 mol.dm⁻³ ✓</p>	<p>Step 1 n = c.V = 0,1 (0,015) ✓ *this 0,1 mol is from = 0,0015 mol</p>

OPTION 2/OPSIE 2

$$\frac{c_a \times V_a}{c_b \times V_b} = \frac{n_a}{n_b} \checkmark$$

$$\frac{c_a \times 30}{0,1 \times 15} \checkmark = \frac{1}{1} \checkmark$$

$$c_a = 0,05 \text{ mol} \cdot \text{dm}^{-3} \checkmark$$

Question 7

- 7.1 Substance whose oxidation number increases ✓ ✓ (2)
- 7.2 Mg / Magnesium ✓ (1)
- 7.3 I₂ ✓ (1)
- 7.4.1 $\text{Mg}_{(s)} \rightarrow \text{Mg}^{2+}_{(aq)} + 2e^{-}$ ✓ ✓ (2)
- 7.4.2 $\text{I}_{2(s)} + 2e^{-} \rightarrow 2\text{I}^{-}_{(aq)}$ ✓ ✓ (2)
- 7.4.3 $\text{Mg}_{(s)} + \text{I}_{2(s)} \rightarrow \text{Mg}^{2+}_{(aq)} + 2\text{I}^{-}_{(aq)}$ ✓ ✓ (2)
- [10]

Question 8

- 8.1 Galvanic/voltaic (cell) ✓ (1)
- 8.2 Incomplete circuit/No salt bridge. ✓ (1)
- 8.3 $2\text{H}^{+} + 2e^{-} \rightarrow \text{H}_2$ ✓ ✓ (2)
- 8.4.1 Phase boundary/interphase/phase separator ✓ (1)
- 8.4.2 Firstly – be careful of just using the 0,24 V as the voltage of the anode.
 $E^{\ominus}_{\text{cell}} = E^{\ominus}_{\text{Reduction}} - E^{\ominus}_{\text{oxidation}}$
 $0,24 = 0 - E_{\text{oxidation}}$
 $E_{\text{oxidation}} = - 0,24 \text{ V}$

$$E_{\text{cell/sel}}^{\theta} = E_{\text{cathode/katode}}^{\theta} - E_{\text{anode}}^{\theta} \checkmark$$
$$1,42 \checkmark = -0,24 \checkmark - E_{\text{J/J}^{2+}}^{\theta}$$
$$E_{\text{J/J}^{2+}}^{\theta} = -1,66 \text{ (V)} \checkmark$$

J = Aluminium/Al \checkmark

8.4.3 Exothermic/Eksotermies \checkmark (1)

8.5 Pressure/Druk: 1 atmosphere/atmosfeer (atm)/101,3 kPa/1,013 x 10⁵ Pa \checkmark
Temperature/Temperatuur: 25 °C / 298 K \checkmark
Concentration/Konsentrasie: 1 mol·dm⁻³ \checkmark (2)

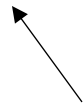
Any two

Question 10

10.1 liquid ✓ (1)

10.2 the temperature ✓ at which a compound changes state from a solid to a liquid. ✓ (2)

10.3 boiling point (1)



Careful here – even though the table has melting point on it (which will be linked to boiling point) the actual investigation says “to determine the relationship between boiling point and molar mass”

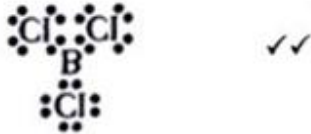
10.4 IMF (van der Waals, London) (1)

10.5 I₂ (1)

10.6 Melting point increases from F₂ to I₂. ✓ (1)

10.7 Halogens held together by weak van der Waals forces (London forces). ✓
Molar mass increases from F₂ to I₂ ✓ greater the molar mass the stronger the van der Waals forces ✓, more energy needed to break forces between molecules ✓ therefore the higher melting points. (4)

Question 11

- 11.1 Sharing of electrons between atoms to form a molecule. ✓✓ (2)
- 11.2.1 SCl_6 ✓ (1)
- 11.2.2 CO_2 ✓ (1)
- 11.3.1  ✓✓ (2)
- 11.3.2 Trigonal planar ✓ (1)
- 11.3.3 NH_3 has a lone pair of electrons ✓ and BCl_3 has an empty orbital. ✓ (2)
- 11.4 The electronegativity difference between carbon and fluorine is 1,5 which makes the bond polar covalent. ✓ The molecule is symmetrical ✓ with even distribution of charge/no net dipole moment. ✓ (3)

Question 12

$$p_1 \cdot V_1 = p_2 \cdot V_2 \quad \checkmark$$

$$100(20) \quad \checkmark = 120 \cdot V_2 \quad \checkmark$$

$$V_2 = 16,67 \text{ dm}^3 \quad \checkmark$$

(4)