



eduresourceza.com

PHYSICAL SCIENCES
P II
MEMORANDUM

GRADE 12

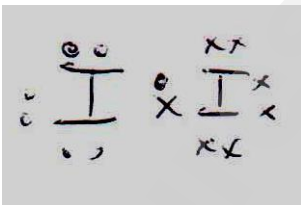
AUGUST 2017

QUESTION 1

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

[2 x 10 = 20]

QUESTION 2

- 2.1.1 Calcium ✓ nitrite ✓
- 2.1.2 ammonium ✓ dichromate ✓ (4)
- 2.2.1 Fe ✓ (MnO₄)₃ ✓
- 2.2.2 MnS₂ ✓ ✓ (4)
- 2.3.1 Covalent ✓ bonding
Sharing ✓ of a pair of electrons ✓ between non-metal atoms (3)
- 2.3.2 Iodine ✓ + Diamond ✓ (2)
- 2.3.3  1 shared pair of e^s ✓
each I with 3 lone pairs with 3 lone pairs ✓ (2)
- 2.3.4 I₂ - weak London forces as IMFs ✓
Diamond - strong covalent bonds ✓ ∴ more E required ✓ to change phase in diamond that iodine ∴ higher b.pt ✓ (4)
- 2.4.1 Positive ✓ + negative ✓ ions or K⁺ and I⁻ ions or cations and anions
Ionic bonding ✓ (3)
- 2.4.2 I₂ is non-polar molecule ✓ ∴ cannot form ion-dipole ✓
forces of attraction with polar water molecule.
KI has ionic bonding ✓ ∴ the cations can be attracted to the - dipole of H₂O and the anions to the + dipole of H₂O pulling the ions into solution ✓ (4)

[26]

QUESTION 3

- 3.1.1 On answer sheet (2)
- 3.1.2 C ✓ steepest ✓ gradient. (2)
- 3.1.3 ↑ concentration ✓ ∴ more moles ✓ per unit.
volume ∴ greater chance of effective collisions. ✓ (3)
- 3.1.4 44 ✓ cm³ ✓ (± 1cm³) (2)
- 3.1.5 Change in concentration per unit time of either reactant or product ✓✓ (2)
- 3.1.6 100 cm³ in 132s

$$n = \frac{V}{V_o} = \frac{100 \div 1000}{22,4} \checkmark = 0,0045 \text{ mol } \checkmark \text{ or } 4,46 \times 10^{-3} \text{ mol}$$

$$\text{rate} = \frac{\text{mol}}{\text{s}} = \frac{0,0045}{132} \checkmark = 0,000034 \text{ mol.s}^{-1} \checkmark$$
 Or 3,38 x 10⁻⁵ (4)
- 3.1.7 $n_{\text{mg}} = \frac{0,101}{24} \checkmark = 0,00042 \text{ mol } \checkmark$
 or 4,21 x 10⁻³ mol.
- $n_{\text{HCl}} = CV = (2) \left(\frac{20}{1000} \right) \checkmark = 0,04 \text{ mol}$
 Mg : HCl
 1 : 2 ✓
 0,0042 : x
 x = 0,0084 ✓ but have 0,04 ∴ in excess (5)
- 3.1.8 Mg is now not the limiting factor ✓ → will be in excess ✓
 Or HCl is not in excess ∴ limiting factor. (2)
- 3.1.9 Dec. ✓ temperature ✓ of solution / acid OR
 Use pieces of mg with a smaller ✓ surface area. i.e. pebbles. ✓ (2)
- [24]

QUESTION 4

- 4.1.1 When an external stress (change in pressure, temp / conc) is applied to a system in chemical equilibrium, the equilibrium point will change in such a way as to counteract the stress. (2)
- 4.1.2 No effect ✓ ↓ volume would increase pressure ✓ according to LCP this would favour reaction which relieves stress by producing less moles. ✓
 In this reaction neither reaction is favoured ✓ as equal moles ✓ (2) on both sides of equation. (5)
- 4.1.3 $K_c = \frac{[NO]^2 \checkmark}{[N_2][O_2] \checkmark}$ (2)
- 4.1.4 K_c increasing with increasing ✓ temp ✓

∴ forward reaction is being favoured ✓

According to LCP ↑ temp favour rxn which ↓ temp i.e. endothermic to absorb the heat ✓ ∴ forward reaction is endothermic ✓

(5)

4.2.1 Rate of forward reaction is equal ✓ to the rate of reverse rxn.

(2)

4.2.2 No ✓ change in the number of moles of gases after 25 s

(1)

4.2.3.1 }
4.2.3.2 } on answer sheet
4.2.3.3 }
4.2.3.4 }

(1)

(2)

(1)

(3)

4.2.4 1 ✓ x + 3 Y ✓ → 2 Z ✓

(3)

QUESTION 5

[28]

5.1.1 Proton ✓ donor ✓

(2)

5.1.2 Able to donate 1 proton ✓.

(1)

5.1.3 CH₃COO⁻ or ethanoate ion ✓

(1)

5.1.4 Weak ✓
K_a value is small ✓

(2)

5.2.1 n = CV
= (0,8)($\frac{100}{1000}$) ✓
= 0,08 mol ✓

(3)

5.2.2 7 ✓ Bromothymol blue ✓

(2)

5.2.3 n_{KOH} = CV
= (0,3)($\frac{35}{1000}$) ✓
= 0,0105 mol ✓

OR n_a/n_b = C_a/V_a

$\frac{1}{2} = (0,8)V_a / (0,3)(35)$

KOH : H₂SO₄
2 : 1

V_a = 6,56 cm³

0,0105 : x ✓

n_{H₂SO₄} = (0,8)(6,56/1000) = 5,25 × 10⁻³

2x = 0,0105

x = 0,00525 mol ✓ of H₂SO₄ neutralised

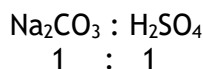
(4)

5.2.4 Moles H₂SO₄ reacted in

Reaction 1 = 0,08 - 0,00525
= 0,075 mol ✓

coe from Q5.2.1

coe from Q5.3.1



$$\therefore n\text{Na}_2\text{CO}_3 = 0,075 \text{ mol} \checkmark$$

$$m = n \times M_r$$

$$= 0,075 \times 106 \checkmark$$

$$= 7,95 \text{ g} \checkmark$$

$$M_r(\text{Na}_2\text{CO}_3) =$$

$$2(23) + 12 + 3(16)$$

$$= 46 + 12 + 48$$

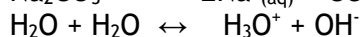
$$= 106 \text{ g.mol}^{-1}$$

(4)

5.2.5 Reaction with water where water itself is decomposed ✓✓

(2)

5.2.6 $\text{Na}_2\text{CO}_3 \leftrightarrow 2\text{Na}^+_{(\text{aq})} + \text{CO}_3^{2-}_{(\text{aq})}$ ✓ (for equations or dissociation)



When Na_2CO_3 is added to water the 2Na^+ ions and OH^- ions remain dissociated as NaOH is a strong base. (✓)

The $\text{H}_3\text{O}^+ + \text{CO}_3^{2-}$ - remain unionised (✓) forming HCO_3^- a weak acid $\therefore \downarrow [\text{H}_3\text{O}^+]$ leaving excess $[\text{OH}^-]$ ✓ $\therefore$ weakly basic ✓ Must have underlined section, equation and one of description with ticks in brackets

(4)

[25]

QUESTION 6

6.1 Electrode where reduction takes place ✓✓

(2)

6.2 Salt bridge ✓

Maintains ionic / electrical neutrality ✓

Completes the circuit. ✓

(3)

6.3 Copper ✓. It is a weaker ✓ reducing agent than Fe OR Cu^{2+} ions stronger oxidising agent than iron ions.

(2)

$$E^\circ_{\text{cell}} = E^\circ_{\text{cat}} - E^\circ_{\text{an}} (\text{coe})$$

$$= 0,34 - (-0,44) \checkmark$$

$$= \underline{0,78\text{V}} \checkmark$$

(2)

6.5 $\text{Fe} \mid \text{Fe}^{2+} \parallel \text{Cu}^{2+} \mid \text{Cu} \parallel \text{salt bridge}$ ✓ ✓ coe from 6.3

(3)

6.6 More conductive ✓ $\therefore$ (↓) internal resistance ↑ ability of cell to deliver current ✓

(2)

6.7.1 Increases ✓

6.7.2 No effect ✓

(2)

6.8 ↑ concentration of Cu^{2+} ✓ ions in cathode half-cell $\therefore$ ↑ EMF ✓ as more ions to accept electrons. ✓

(3)

6.9 No ✓ Ni is a weaker reducing agent than Fe $\therefore$ will not be able to oxidise Fe^{2+}

(2)

[21]

QUESTION 7

- 7.1.1 Substance that donates electrons ✓✓ (2)
- 7.1.2 P ✓✓ (2)
- 7.1.3 coe
 $\text{Cu}^{2+} + 2 \bar{e} \rightarrow \text{Cu}$ (-1 per error) (2)
- 7.1.4 A ✓ the Cl^- ions attracted to positive electrode ✓ and are oxidised ✓ by losing electrons (✓) to form Cl_2 gas. (3)
- 7.2.1 A - chlorine ✓
 B - hydrogen ✓ (2)
- 7.2.2 It is selective to cations (+). ✓ Won't allow anions (-) through ✓ (2)
- 7.2.3 $2\text{H}_2\text{O} + 2\bar{e} \rightarrow \text{H}_2 + 2\text{OH}^-$ OR $2\text{H}^+ + 2\text{e} \rightarrow \text{H}_2$ (-1 per error) (2)
- 7.2.4 Making PVC, HCl , insecticides, water purification (1)
- 7.2.5 This would affect % purity ✓ of NaOH ✓ (produced).
 OR $\text{Cl}_2 + \text{H}_2$ explosive mixture
 $\text{NaOH} + \text{Cl}_2 \rightarrow \text{NaOCl} \downarrow \text{NaOH}$ (2)
- 7.2.6 Cl_2 gas is toxic / poisonous. (1)

[19]

QUESTION 8

- 8.1.1
- ```

 H
 |
 H H-C - H
 | | |
 H - C - C - C - H ✓✓ (correct no. Cs and Hs)
 | | |
 H H H
 |
 H

```
- (2)

- 8.1.2 2,2 - dimethyl propane



(2) ✓

- 8.1.3 C - alkane  
 D - alkene

Add  $\text{Br}_2$  water / solution ✓ to C + D the one that decolourises ✓ rapidly is the alkene i.e. D. ✓

(3)

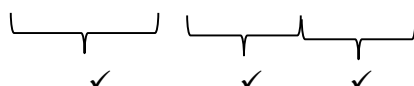
- 8.1.4.1 haloalkanes ✓

(1)

- 8.1.4.2 carboxyl group ✓

(1)

- 8.1.5.1 3 - methyl - 4 - bromoheptane



(3)

- 8.1.5.2 pentanol

(2)

8.1.5.3 methylmethanoate (2)

8.1.6.1  $\text{H}_2\text{SO}_4$  / sulphuric acid (1)

8.1.6.2  $\text{C}_3\text{H}_6\text{O}_2$  ✓✓ (- 1 per error). (2)

8.1.7 Carbon dioxide ✓ + water ✓ (2)

8.2.1.1 Substitution ✓ or halogenation or bromonation (1)

8.2.1.2 Elimination ✓ or dehydrohalogenation (1)

8.2.2  $\text{Br}_2$  or Bromine ✓ (1)

8.2.3

$$\begin{array}{ccccccc} & \text{H} & & \text{H} & \text{H} & & \text{H} \\ & | & & | & | & & | \\ \text{H} - & \text{C} = & \text{C} - & \text{C} - & \text{C} - & \text{H} \\ & & | & | & & & \\ & & \text{H} & \text{H} & & & \end{array}$$

✓ (correct no C's and H's)

OR

$$\begin{array}{ccccccc} & \text{H} & & \text{H} & & \text{H} & \text{H} \\ & | & & | & & | & | \\ \text{H} - & \text{C} - & \text{C} = & \text{C} - & \text{C} - & \text{H} \\ & | & & & | & & \\ & \text{H} & & & \text{H} & & \end{array}$$

✓ (double bond)

(2)

8.2.4

$$\begin{array}{ccccccc} & \text{H} & & \text{H} & & \text{H} & & \text{H} \\ & | & & | & & | & & | \\ \text{H} - & \text{C} - & \text{C} - & \text{C} - & \text{C} - & \text{OH} \\ & | & & | & & | & & | \\ & \text{H} & & \text{H} & & \text{H} & & \text{H} \end{array}$$

✓ (Correct C's and H's)

(2)

8.3.1 The greater number of carbon atoms ✓ the greater the boiling point ✓  
or  
boiling point is proportional to number of atoms (NOT directly - 1) (2)

8.3.2.1 P ✓ (1)

8.3.2.2 R ✓ (1)

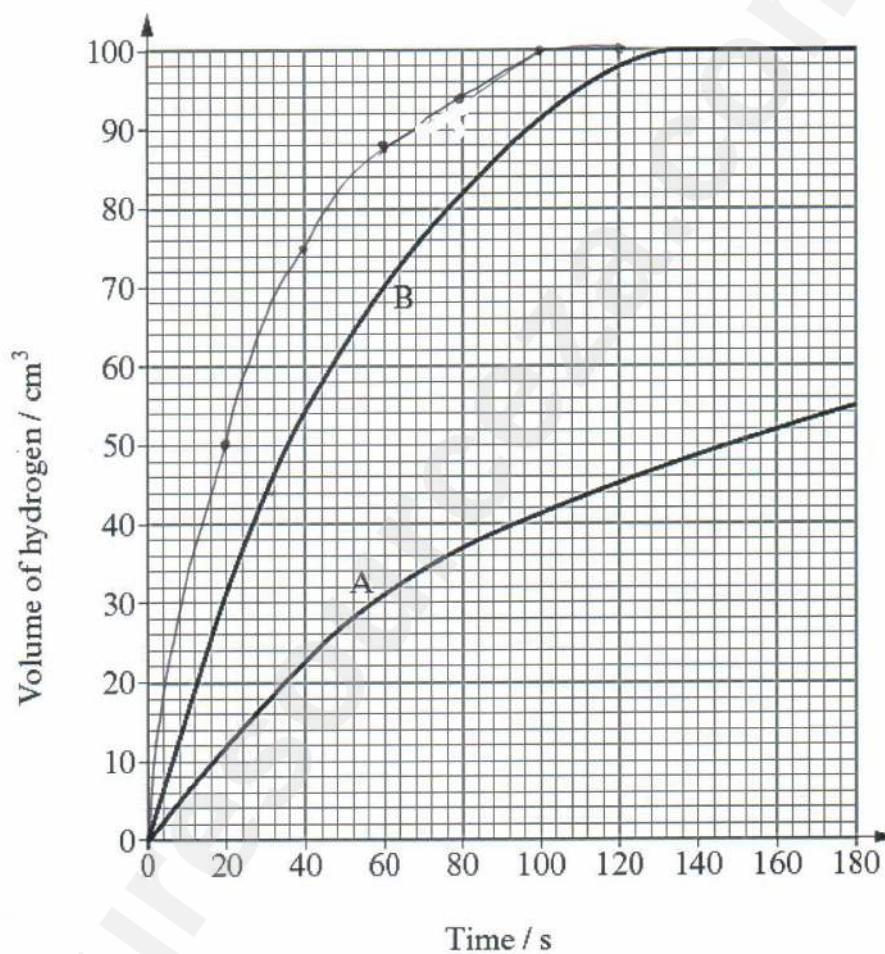
8.3.2.3 Alkane molecules → weak London forces between molecules ✓

Carboxylic acids has OH site for hydrogen bonding which are stronger ✓ than the London Forces of alkanes. Alcohols also have -OH for H<sub>2</sub> bonding ✓ but these are weaker ✓ than those of carboxylic acids (OR ✓)  
∴ carboxylic acids have stronger IMF ∴ more E required ✓ to break IMFs ∴ higher boiling point. (5)

[37]

QUESTION 3.1.1

HEADING: Graph showing the results from Experiments A and B



✓ correct plotting  
✓ correct shape

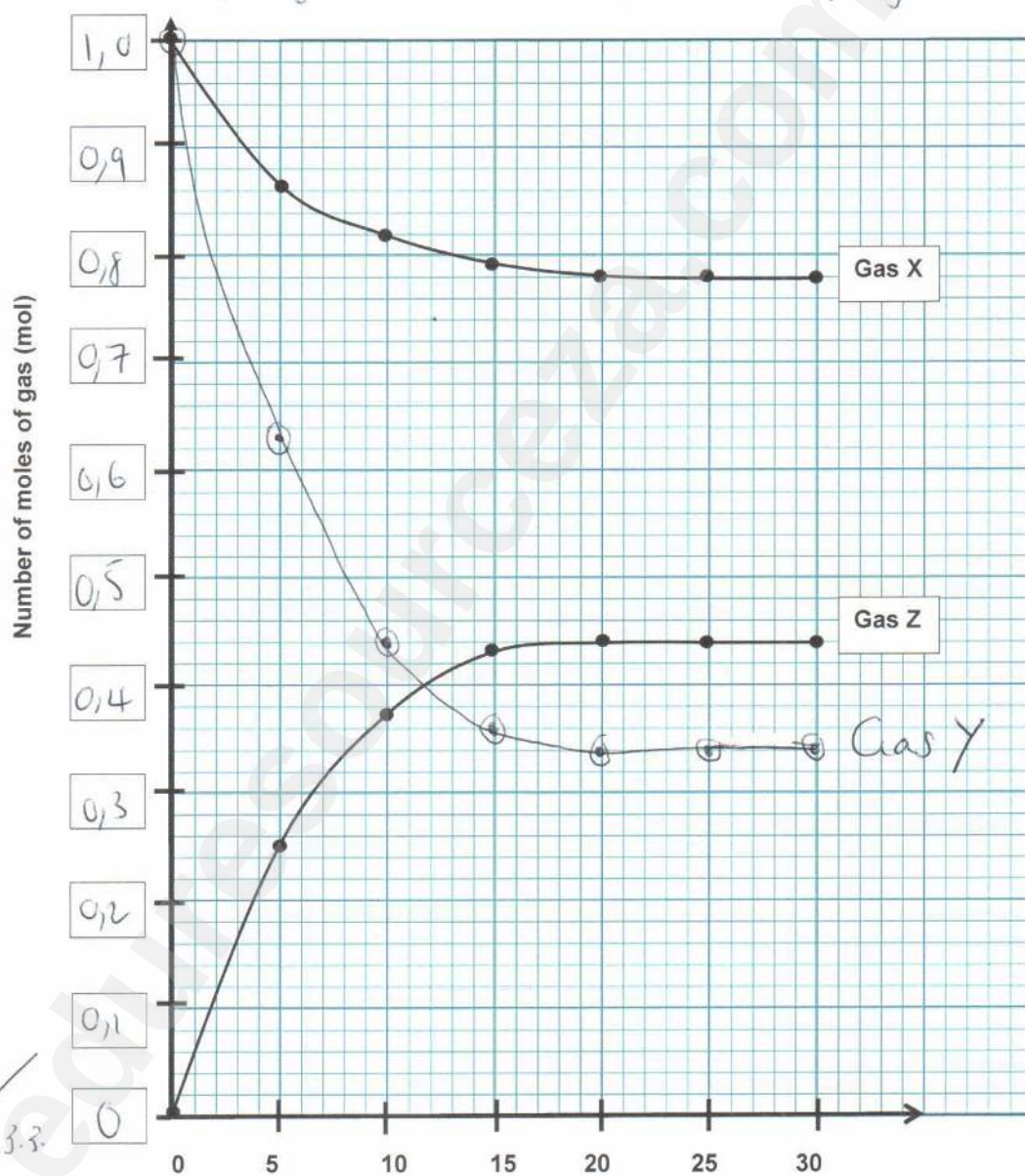
(2)

QUESTION 4.2.3

MEMO

HEADING:

Graph to show the number of moles of gas with time / moles of gas vs time



Q4.2.3.4  
✓ points  
✓ line

Q.4.2.3.3

Q4.2.3.2

Time (s)

(7)