Physical Sciences P2 June 2016 MEMO

QUESTION 1

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

2.1 $R_{T(ext)} = R_s + R_p = R_s + \frac{R_1 \times R_2}{R_1 + R_2}$ ✓
$= 2 + \frac{9 \times (5+8)}{9 + (5+8)}$ ✓
$= 7,31\ldots\Omega$ ✓

$\varepsilon = I(R + r)$ ✓
$12 = I(7,31\ldots + 9\Omega)$ ✓ (OR $V = IR$)
$I = 1,60\ A\ (1,596\ A)$ ✓ (7)

2.2 V = IR = 1,60 x 7,31… ✓ = 11,71 V✓

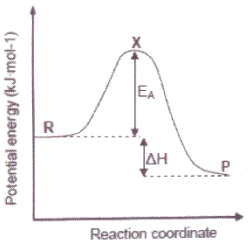
2.3 $I_{8\Omega} = I_{Tot} \times \frac{9}{9+5+8}$ ✓ $= 1,60 \times \frac{9}{32} = 0,45\ A$ ✓

2.4 Decrease✓✓

2.5 V decreases✓, since the Total Resistance <u>decreases</u> to 2Ω✓, thus I increases✓, and "Lost volt" (or internal Potential difference, Ir) increases.✓

3.1 The minimum energy needed for a reaction to take place. ✓✓

3.2



✓ Reactants & products labelled
✓ Activated complex
✓Correct shape and ΔH
✓ E_A

3.3.1 -241,8 kJ.mol^{-1} ✓
3.3.2 1611,8 kJ.mol^{-1}✓✓

4.1 electrolytic cell ✓
4.2 electrical energy → chemical energy ✓
4.3 The substance which gains electrons. ✓ ✓
4.4 Q ✓
4.5 $Cu^{2+}(aq) + 2e^- \rightarrow Cu\ (s)$ ✓✓
4.6 Good conductor of electricity ✓
Inert ✓
4.7 A ✓
Cl^{-1}-ions move to the positive electrode✓ where they are oxidised to Cl_2. ✓
4.8 anode ✓

5.1 chemical energy → electrical energy
5.2 $Ag^+ + ✓e^- \rightarrow Ag$✓

5.3 $Zn(s) / Zn^{2+}(aq)(25°C, 1\ mol.dm^{-3})$✓ // ✓$Ag^{+}(aq)(25°C, 1\ mol.dm^{-3}) / Ag(s)$✓
Correct conditions ✓

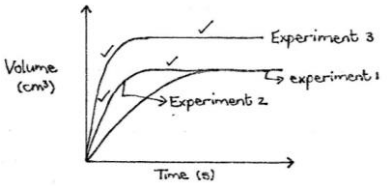
5.4 $E^{o}_{cell} = E^{o}_{oxidising\ agent} - E^{o}_{reducing\ agent}$ ✓
$= (0,80)$ ✓ $- (-0,76)$ ✓
$= 1,56\ V$ ✓

6.1.1 t_3 ✓

6.1.2 t_1 ✓

6.2 t_1 and t_2 ✓

6.3



6.4.1 increase ✓

6.4.2 Powder increases surface area.✓ Only collisions with molecules on surface, ✓ therefore more <u>effective collisions per second</u> ✓ ∴higher reaction rate.

6.5.1 $Mg(s) + 2HNO_3(aq) \rightarrow Mg(NO_3)_2(aq) + H_2(g)$

1,6 g — 100 cm³ 0,1 mol.dm⁻³

$n = \frac{m}{M}$ — 0,1 dm³ ✓

$= \frac{1,6}{24}$ — $n = cV$

$= \frac{1}{15}$ mol ✓ — $= 0,1 . 0,1$

$= 0,01$ mol ✓

$n_{HNO_3} : n_{Mg}$

$0,01 : 0,005 < \frac{1}{15}$

$\frac{1}{15} - 0,005 = 0,0617$ mol left ✓

$m = nM$

$= 0,0617(24)$

$= 1,48\ g$ ✓

6.5.2 smaller than ✓

7.1.1 dynamic equilibrium ✓

7.1.2 increase in pressure ✓

7.1.3 Neither,✓ Le Chatelier's Principle states that when pressure is increased the reaction that will decrease the pressure will be favoured ✓ ∴ the reaction producing the least amount of moles of gas, but both the forward and reverse reactions produce equal number of moles of gas.✓

7.1.4 Increase in temperature will favour reaction that absorbs heat (endothermic).✓ The forward reaction is endothermic. ✓ More products will be produced. ✓

7.1.5 stay the same ✓

7.1.6 Catalyst increases the rate of forward <u>and</u> reverse reaction equally∴ no change in yield. ✓

7.2.1 $n = \frac{m}{M}$ ✓

$= \frac{7}{28}$

$= 0,25$ mol ✓

$c = \frac{n}{V}$ ✓

$= \frac{0,25}{10}$

$= 0,025$ mol.dm^{-3} ✓

7.2.2 $2NaN_3(s) \rightleftharpoons 2Na(s) + 3N_2(g)$

Mole ratio	2	2	3
Initial mol	oc = 3,83 ✓		0,025 mol.dm ✓ 0,25 mol
Used / Formed mol	3,83 ($\frac{5,75}{3} \times 2$) ✓		✓ 5,75
Equilibrium mol			6 mol
[Equilibrium] mol.dm^{-3}			0,6

$K_c = [N_2]^3 = 0,216$ ✓

$[N_2] = 0,6$ mol.dm^{-3} ✓

3,83 mol ∴ $m = nM$

$= 3,83(23 + 3(14))$

$= 3,83(65)$ ✓

$= 249,17$ g ✓

7.2.3.1 decrease ✓

7.2.3.2 remain the same ✓

8.1.1 $n = \frac{m}{M}$ ✓ $C = \frac{n}{V}$ ✓

$= \frac{2,5}{98}$ ✓ $= \frac{0,025}{0,250}$ ✓

$= 0,025$ mol ✓ $= 0,1$ mol.dm^{-3}

8.1.2 $\frac{C_a V_a}{n_a} = \frac{C_b V_b}{n_b}$ ✓

$\frac{(0,1)(20)}{1}$ ✓ $= \frac{C_b(25)}{2}$ ✓

$C_b = 0,16$ mol.dm^{-3} ✓

8.1.3 $pH = -\log[H_3O^+]$ ✓

$[H_2SO_4] = 2[H_3O^+]$

$= 2[0,1]$

$pH = -\log[0,2]$

$= 0,70$ ✓

8.2.1 An acid that can donate only one H^+ ion ✓

Strong acid = complete ionisation ✓✓

Weak acid = partial ionisation ✓

8.2.3 $pH = 4$

$pH = -\log[H_3O^+]$ ✓

$4 = -\log[H_3O^+]$

$[H_3O^+] = 0,0001$ mol.dm^{-3} ✓

8.2.4 Weak acid ✓ – acid does not ionise completely ✓✓ ∴ weak acid.

8.3.1 ability of ions to react with water molecules, altering the pH ✓✓

8.3.2 $NH_4Cl + H_2O \rightarrow NH_3 + H_3O^+ + Cl^-$ ✓✓✓

8.3.3 Red/Orange ✓

9.1 a) London Forces ✓

b) Dipole-Dipole ✓

c) Hydrogen bond ✓

9.2

I_2	NaCl	Chloroform
Non Polar ✓	Ionic ✓	Non Polar ✓

* Like dissolves like ✓
* A non polar solute will dissolve in a non polar solvent
* ∴ I_2 will dissolve in Chloroform.

9.3

BF_3	NH_3
London Forces ✓	Hydrogen bond ✓

* Hydrogen bond stronger than L.F ✓
* More energy needed to break the bond (Hbond)
* ∴ NH_3 will have higher B.P. ✓