ST ANDREW'S SECONDARY SCHOOL

NAME | CLASS

CHEMISTRY **6092/01**

Paper 1 REVISION PACKAGE **+**

MULTIPLE CHOICE QUESTIONS

Solutions

1 B Since forward rxn represents exothermic, the reverse / backward rxn hence represent endothermic.
E_a is labelled for the energy difference between the reactants and the apex / peak of the graph.

2 D $NbCl_x + x\,Na \rightarrow Nb + x\,NaCl$

No. of moles of Nb produced = mass ÷ molar mass = 18.58 g ÷ 92.9 g mol^{-1} = 0.2 mol
Mass of Cl = 54.08 g – 18.58 g = 35.50 g
No. of moles of Cl lost = No. of moles of NaCl formed = 35.50 g ÷ 35.5 g mol^{-1} = 1.0 mol

Nb	:	NaCl
1	:	x
0.2	:	1.0
x = 5		

3 C $NaOH + HCl \rightarrow NaCl + H_2O$

No. of moles of NaOH added = vol × conc = 0.0125 dm^3 × 0.05 mol dm^{-3} = 0.000625 mol
No. of moles of HCl added = vol × conc = 0.025 dm^3 × 0.1 mol dm^{-3} = 0.0025 mol
∴ HCl is the ER.

No. of moles of HCl remain unreacted = 0.0025 mol – 0.000625 mol = 0.001875 mol
Combined volume of solution = 0.0125 dm^3 + 0.025 dm^3 = 0.0375 dm^3

Conc of remaining HCl = mol ÷ vol = 0.001875 mol ÷ 0.0375 dm^3 = 0.05 mol dm^{-3}

4 C Na_2O reacts with water to form NaOH (strong alkali)
NaCl dissolves in water to form its solution (neutral)
SO_2 reacts with water to form H_2SO_3 (sulfurous acid, strong acid)
$SiCl_4$ reacts with water to form HCl (strong acid): $SiCl_4 + 2\,H_2O \rightarrow SiO_2 + 4\,HCl$
[Hydrolysis = Breaking apart with water]

Even if you are unaware of the hydrolysis rxn, the other 3 pairs still does not give a pH of 7 each.

5 C Total no. of moles of gases in gaseous mixture = 0.12 dm^3 ÷ 24 dm^3 mol^{-1} = 0.005 mol

No. of moles of O_2 = 0.096 g ÷ 32 g mol^{-1} = 0.003 mol
No. of moles of N_2 = 0.056 g ÷ 28 g mol^{-1} = 0.002 mol

6 B No. of moles of ^{13}C = 0.13 g ÷ 13 g mol^{-1} = 0.01 mol

Each mole of ^{13}C contains L atoms, of which each ^{13}C atom contains 7 neutrons.

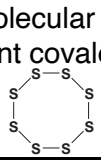
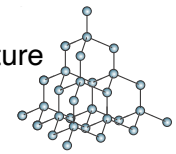
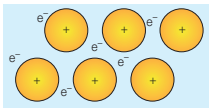
7 C Oxide of P = P_2O_5 (OS of P = +5)
Oxide of S = SO_2 (OS of S = +4)

$$P_4S_3 + 8\,O_2 \rightarrow 2\,P_2O_5 + 3\,SO_2$$

8 C No. of moles of H_2O formed = 3.6 g ÷ 18 g mol^{-1} = 0.2 mol
No. of moles of HCl required = No. of moles of NH_3 produced
= vol × conc = 0.1 dm^3 × 1.0 mol dm^{-3} = 0.1 mol
⇒ x = 1, y = 2

9 D

S (Group VI, forms a molecule S_8) : simple molecular structure
Si (Group IV, forms a lattice similar to C) : giant covalent structure
Al (Group III, metal) : giant metallic structure

10 A

Atomisation: Forms discreet atoms from molecules (e.g. X_2: X–X → 2 X) through bond breaking
= Endothermic rxn

bond breaking

Combustion = Burning with O_2 = Exothermic rxn
Hydration = Addition of water, e.g. water of crystallisation = Exothermic rxn
Neutralisation = Acid + Alkali = Exothermic rxn

11 D

No. of moles of $KMnO_4$ titrated = vol × conc = 0.0274 dm^3 × 0.02 mol dm^{-3} = 0.000548 mol

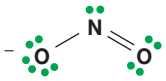
MnO_4^- : Fe^{2+}
1 : 5
0.000548 mol : 0.00274 mol

Conc of $FeSO_4$ reacted = mol ÷ vol = 0.00274 mol ÷ 0.025 dm^3 = 0.1096 mol dm^{-3}

12 B

Q contains NH_4^+ that accounts for the NH_3 evolved. At least 4 H in Q.
Molecular formula of Q = $2(NH_2O)$ = $N_2H_4O_2$ or NH_4NO_2 (ammonium nitrite)
Anion in Q = NO_2^- (additional 1 e^-)

Each N has 7 e^-; O has 8 e^-.
Total e^- present in NO_2^- = 7 + (2 × 8) + 1 = 24



13 B

Na_2CO_3 is thermally stable, it does not decompose upon heating.
However, when heated strongly, solid Na_2CO_3 melts to a liquid.

14 C

Catalyst provides the reaction with an alternative pathway with a lower E_a, thereby resulting in a larger proportion/frequency of successful collisions for the increased rate of reaction.

15 A

Endothermic energy profile diagram:
Enthalpy change = $Energy_{products}$ – $Energy_{reactants}$ = +ve

16 D

OS of Cr in $Cr_2O_7^{2-}$ = +6
OS of Cr in Cr_2O_3 = +3

OS of Cr decreases from +6 to +3, reduction.

17 A

Cl^- is the LR.
After precipitation, the residue (containing Cl^-) is removed from this mixture by filtration.

18 C

Al^{3+} and Pb^{2+} both form white ppt that dissolve in excess NaOH (aq).

19 C

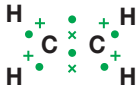
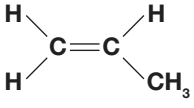
Oxidation: Fe (s) → Fe^{2+} (aq) + 2 e^-
Reduction: Fe^{3+} (aq) + e^- → Fe^{2+} (aq)
Overall: Fe (s) + 2 Fe^{3+} (aq) → 3 Fe^{2+} (aq)

As the final mixture contains equimolar amounts of Fe^{2+} (aq) and Fe^{3+} (aq), there is an excess of 3 mol Fe^{3+} (aq). Hence, the starting mixture should contain 2 + 3 = 5 mol Fe^{3+} (aq).

20 A

8 bonding e^- = 4 covalent bonds formed

CO_2 : 4 covalent bonds
C_2H_4 : 6 covalent bonds
C_3H_6 : 9 covalent bonds
NH_3 : 3 covalent bonds


21 A

No. of moles of Ag coated = 0.216 g ÷ 108 g mol^{-1} = 0.002 mol
No. of moles of Ag per cm^3 = 0.002 mol ÷ 150 cm^2 = 1.333 × 10^{-5} mol/cm^2

No. of Ag atoms per cm^3 = (1.333 × 10^{-5}) mol/cm^2 × (6 × 10^{23}) atoms/mol = 8.0 × 10^{18} atoms/cm^2

22 C

Cl in ClO^- = +1 x + (–2) = –1
ClO_3^- = +5 x + 3(–2) = –1
Cl^- = –1

23 B $CaCO_3 + 2\ HCl \rightarrow CaCl_2 + CO_2 + H_2O$

No. of moles of $CaCO_3$ = 4.0 g ÷ 100 g mol^{-1} = 0.04 mol [ER]
No. of moles of HCl = 0.1 dm^3 × 0.1 mol dm^{-3} = 0.01 mol [LR]

Generally, rate of reaction decreases over time as lesser reactants available for reaction.
LR gets reacted completely in the chemical rxn and controls the amount of product formed.

24 D Reaction of Group II metal oxides with water : increasing vigour down the Group.

MgO reacts very slowly to form $Mg(OH)_2$.
$Mg(OH)_2$ is sparingly soluble in water with partial ionisation, conc of OH^- ↓↓
⇒ weak alkaline sol^n [↑ pH]
BaO reacts readily to form $Ba(OH)_2$.
$Ba(OH)_2$ is soluble in water with complete ionisation, conc of OH^- ↑↑
⇒ strong alkaline sol^n [↑↑↑ pH]

$Ba(OH)_2$ is obtained as the filtrate, which produces the white ppt ($BaSO_4$).

25 C $MgCO_3$ undergoes thermal decomposition to form MgO and CO_2.

$MgCO_3$ reacts with HCl to form CO_2 (g).
MgO formed reacts with HCl to form H_2O (l).

26 B Most probable energy is the energy possessed by most of the reacting molecules.

When T increases, more reacting molecules will gain KE; a decrease in the reacting molecules initially with most probable energy.

27 C Reaction involves equimolar gaseous reactants and products. Hence, changes in pressure have no effect on the equilibrium.

Reaction absorbs energy from surroundings for reaction: ΔH = +ve (endothermic rxn)
Increasing T forms more products, the equilibrium then shifts to the right.

28 D Alternative pathway with a lower E_a.

29 C Ni in $NiO(OH)$: x + (–2) + (–1) = 0
x = +3
$Ni(OH)_2.H_2O$: x + 2(–1) + (0) = 0 [water of crystallisation= neutral molecule]
x = +2

Or… As Cd oxidises to $Cd(OH)_2$ (OS_{Cd} from 0 to +2), Ni gets reduced (OS_{Ni} from +3 to +2).

30 B Identify the noble gases (Group 0) from having the lowest mp.

A : Group VI oxygen
Group VII fluorine
Group 0 neon
B : Group I sodium
C : Group II magnesium
Group III aluminium
D : Group IV silicon (giant covalent structure)
Group V phosphorous
Group VI sulfur
Group VII chlorine
Group 0 argon

Compare (within the Group)
Group VI : S > O
Group VII : Cl > F
Group 0 : Ar > Ne
Mp increases down the Group

Compare (between non-metals)
P < S
P forms molecule P_4 (44 °C)
S forms molecule S_8 (115 °C)
Larger M_r, stronger IMF, greater amount of heat required, higher mp

Compare (between metals)
(98 °C) Na < Mg (650 °C)
No. of valence e^- increases, stronger metallic bond due to larger charge in ESF, greater amount of heat required, higher mp
[invalid for Group I metals]