

# BETHANY HIGH SCHOOL NAALYA

## S.6 CHEMISTRY

### Paper 2

2 hrs 30 mins

#### INSTRUCTIONS

Attempt any 3 questions in Section A and 2 in Section B.

Neat work is a **MUST**

1. (a) (i) State Raoult's law. (1mk)  
(ii) State its limitation (1mk)
- (b) Heptane and hexane form a liquid mixture that obeys Raoult's law. The boiling points of heptanes and hexane are 98.1°C and 68.7°C respectively.
- (i) Explain why the mixture of hexane and heptanes. (3mks)  
(ii) Draw a labeled vapour pressure composition heptane. (3mks)  
(iii) Explain what would happen when a mixture containing 20% hexane is fractionally distilled. (5mks)
- (c) A liquid mixture containing 23g of hexane and 42.0g of heptanes was fractionally distilled. The vapour pressures of heptanes and hexane at the same temperature are 6018nm<sup>-2</sup> and 20180Nm<sup>-2</sup> respectively? Calculate the;
- (i) Partial pressure of each component in the vapour. (4mks)  
(ii) Percentage composition of the vapour above the liquid mixture.
2. The melting points and atomic numbers of magnesium, aluminium, phosphorus and chlorine members of period 3 of the periodic table are given in the table below.

Element	Mg	Al	P	Cl
Melting point /°C	649	661	44	-101
Atomic number	12	13	14	17

- (a) Explain the trend of melting points of the elements. (6mks)
- (b) Compare the reaction of the elements with;
- (i) Water (7mks)  
(ii) Sodium hydroxide. (7mks)
3. (a) (i) Explain what is meant by the term partition coefficient ? (2mks)  
(ii) State four conditions under which partition law is valid. (2mks)
- (b) (i) Describe an experiment to determine the partition coefficient of iodine

- between ether and water. (6mks)
- (ii) Give four reasons why ethoxyethane (ether) is most commonly used in solvent extraction of organic compounds from their aqueous solution. (2mks)
- (c) The partition coefficient of a substance Z between methylbenzene and water is 12. Calculate the mass of Z that will be extracted from 200cm<sup>3</sup> of an aqueous solution containing 8.0g of Z
- (i) Shaking 50cm<sup>3</sup> of methylbenzene.
- (ii) Shaking successively with two separate 25cm<sup>3</sup>- portions of methylbenzene. (4mks)
- (iii) Comment on your answers in (i) and (ii).
- (d) State two applications of partition law other than solvent extraction. (1mk)
4. (a) 2.8g of an alkene, C<sub>n</sub>H<sub>2n</sub> reacted completely with 8.0g of bromine.
- (i) Calculate the number of moles of bromine molecules that reacted with the alkene.
- (ii) Deduce the number of moles of the alkene that reacted (1 mole of bromine reacts with 1 mole of the alkene).
- (iii) Calculate the formula mass of the alkene. (3mks)
- (iv) Write the structural formula of the alkene. (1mk)
- (b) A gaseous hydrocarbon P consists of 85.7% carbon. If 0.14g of P occupies 112cm<sup>3</sup> at s.t.p.
- (i) Empirical formula of P. (3mks)
- (ii) Molecular mass of P and hence deduce the molecular formula of P (2mks)
- (c) State what will be observed and write an equation in each case when P was passed through,
- (i) Alkaline potassium manganate (2 ½ mks)
- (ii) Bromine water. (2 ½ mks)

**SECTION B:** *Attempt any two*

5. Complete the following equations and in each case, outline a mechanism for the reaction.
- (a)  $\text{CH}_3\text{CH}=\text{CH}_2 \xrightarrow{\text{HBr/ROOR}}$  (5mks)
- (b)  $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2 \xrightarrow{\text{Br}_2/\text{H}_2\text{O}}$  (3 ½ mks)
- (c)  $\text{CH}_4 + \text{Cl}_2 \xrightarrow{\text{U.V light}}$
- (d)  $\text{CH}_3\text{CH}=\text{CH}_2 \xrightarrow[\text{heat}]{\text{H}^+, \text{H}_2\text{O}}$  (4mks)
- (e)  $\text{CH}_3\text{CH}_2\text{OH} \xrightarrow{\text{H}_2\text{CO}_4}$  (3 ½ mks)
6. The boiling points and atomic radii of fluorine, chlorine, bromine and iodine are shown in the table below.

Element	F	Cl	Br	I
Boiling point (°C)	-188	-35	59	184
Atomic radii (nm)	0.072	0.099	0.114	0.133

- (a) Explain the trend in the;
- Atomic radius of the elements.
  - Boiling points of the element
- (b) Illustrating your answers with equations compare how chlorine and fluorine react with;
- (c) 10.0cm<sup>3</sup> of a sample of commercial bleach containing chlorine was diluted to 250cm<sup>3</sup> with water. 25.0cm<sup>3</sup> of this solution was transferred into a conical flask and potassium iodine solution added to liberate iodine. The iodine mixture required 23.2cm<sup>3</sup> of 0.1M sodium thiosulphate solution for complete reaction. Calculate the molar concentration of chlorine in the commercial bleach. Sodium thiosulphate reacts with iodine solution according to the following equation.
- $$2S_2O_3^{2-}(aq) + I_2(aq) \rightarrow 2I^-(aq) + S_4O_6^{2-}(aq) + I_2(aq)$$
- and chlorine reacts with iodide ions according to the following equation  $Cl_2(g) + 2I^-(aq) \rightarrow 2Cl^-(aq) + I_2(l)$  (3mks)

7. In the manufacture of ammonia nitrogen is catalytically hydrogenated to give ammonia according to the following equation.



- Name the catalyst used in the reaction. (1mk)
  - Write the expression for the equilibrium constant K<sub>p</sub> of the reaction (2mks)
- State and explain what would happen to the equilibrium position, rate of attainment if ;
  - Pressure was increased.
  - Temperature was increased.
- When 3 moles of hydrogen and 1 mole of nitrogen were mixed and allowed to attain equilibrium at 100 atmos and 400°C the equilibrium mixture contained 25% of ammonia by volume. Calculate;
  - The number of moles of nitrogen and hydrogen at equilibrium.(5mks)
  - The value of the equilibrium constant k<sub>p</sub>. (3mks)

**End**