## CH1011 Tutorial 4 Answers

1. Determine if there are any chiral centres in the following molecules and assign R or S absolute configurations to the chiral centres you find.



2. Assign E or Z configurations to the following substituted alkenes.



4. Explain the relationship between tertiary structure and function of a protein.

Tertiary structure of a protein is the sum of the various secondary structural components that results in the observed 3-D shape of the protein. General tertiary structures types are (i) globular proteins and (ii) fibrous proteins, the former have complex shapes which relate to their complex cellular functions (e.g. enzymes

such as chymotrpsin) whereas the fibrous proteins have simple sheet or helical structures which relate to their structural function in biological systems (eg. collagen found in tendons).

A gas cylinder of  $0.0500 \text{ m}^3$  internal volume contained 2.600 kg of acetylene (C<sub>2</sub>H<sub>2</sub>). If the 5. bursting disk in the cylinder was set to rupture at 100 atm. for safety reasons what is the maximum temperature (°C) that this cylinder may be used at? (assume ideal gas behaviour for acetylene).

$$\begin{array}{rcl} MC_2H_2 &= (2 \ x \ 12.0) + (2 \ x \ 1.0) &=& 26.0 \ g \ mol^{-1} \\ n \ C_2H_2 &= 2.600 \ x10^3 \ g \ / \ 26.0 \ g \ mol^{-1} &=& 100 \ mol \\ p &=& 100 \ atm = 100 \ x \ 1.01 \ x \ 10^5 \ Pa \\ &=& 101 \ x \ 10^5 \ Pa \\ T &=& pV \ / \ n \ R &=& 101 \ x \ 10^5 \ Pa \ x \ 0.0500 \ m^3 \ / \ 100 \ mol \ x \ 8.31 \ Pa \ m^3 \ K^{-1} \ mol^{-1} \\ &=& 607.7 \ K \\ T \ (^{\circ}C) &=& 607.7 \ - \ 273 &=& \textbf{335 } \ ^{\circ}C \end{array}$$

6. Nitrobenzene freezes at 5.70°C and has a molal freezing point constant of 7.00 K kg solvent / mol solute. Calculate the molecular weight of an unknown substance from the observation that a solution of 2.05 g of unknown dissolved in 40.0 g nitrobenzene freezes at 1.10°C.

$$\Delta T = K_F x m$$
  $m = \text{molality of solute (mol / kg solvent)}$ 

$$\therefore 5.7 - 1.1 = 7.00 \text{ x } m$$
  
$$\therefore m = \frac{4.6}{7.00}$$
  
$$= 0.657 \text{ mol} / \text{ kg solvent} \qquad \text{Take molar mass of unkn}$$

Take molar mass of unknown as  $M \text{ g mol}^{-1}$ 

: Solution as made up has

 $\frac{2.05 \times 1000}{M \times 40.0}$  mol/kg nitrobenzene

$$\therefore 0.657 = \frac{2.05 \times 1000}{M \times 40.0}$$
$$\therefore M = 78 \text{ g mol}^{-1}$$
$$\therefore \text{ Mol wt} = 78$$

7. Explain what you understand by the terms "osmosis", "osmotic pressure".

> **Osmosis** is the diffusion of a solvent through a semi-permeable membrane from a region of high solvent concentration to one of lower solvent concentration.

> **Osmotic Pressure** ( $\pi$ ) is the pressure associated with the process of osmosis  $\pi = [\text{solute}]RT$ . It can be defined as the magnitude of the pressure that must be applied to the system (on the side of the membrane containing the lowest solvent concentration) which just prevents osmosis from occurring.