

Name: Key

Date: sept 6

- 1 Calculate the mole fraction of methanol, CH₃OH, in a mixture of equal masses of methanol and water. The molar mass of methanol is 32.0 g/mol and that of water is 18.0 g/mol.

- A 0.500
- B 0.64
- C 1.00
- D 0.360

$$5g \text{ CH}_3\text{OH} \times \frac{1 \text{ mol}}{32g} = 0.156 \text{ mol}$$

$$5g \text{ H}_2\text{O} \times \frac{1 \text{ mol}}{18g} = 0.278 \text{ mol}$$

$$\frac{.156 \text{ mol}}{.156 \text{ mol} + .278 \text{ mol}} = \boxed{0.36}$$

- 2 Calculate the molality of ethyl alcohol in a bottle of wine that is 19.0% C₂H₅OH by mass. The molar mass of ethyl alcohol is 46.1 g/mol.

- A 0.412 m
- B 1.76 m
- C 5.09 m
- D 3.73 m

↓ assume
100g solution

$$19.0g \text{ solute} \times \frac{1 \text{ mol}}{46.1g} = 0.412 \text{ mol}$$

$$100g \text{ solution} - 19g \text{ solute} = 81g \text{ solvent}$$

$$\therefore \frac{0.412 \text{ mol}}{.081 \text{ Kg H}_2\text{O}} = \boxed{5.09 \text{ m}}$$

- 3 Concentrated aqueous ammonia is 14.8 M and has a density of 0.900 g·mL⁻¹. Calculate the molality of NH₃(aq) in this solution. The molar mass of ammonia is 17.0 g/mol.

- A 13.3 m
- B 22.8 m
- C 58.7 m
- D 16.4 m

1L x 14.8 mol/L = 14.8 mol

↑ assumed

↓ 1000 ml x 0.9 g solution / 1 ml solution = 900 g solution

$$m = \frac{14.8 \text{ mol}}{0.478 \text{ Kg}} = \boxed{22.8 \text{ m}}$$

$$\therefore 900g - 252g = 648g \text{ H}_2\text{O}$$

$$14.8 \text{ mol NH}_3 \times \frac{17g}{\text{mol}} = 252g$$

- 4 How much of a 3.5 M solution of NH₃ and how much water is needed to make 540 mL of a 0.5 M NH₃ solution?

- A 77 ml water and 463 mL of 3.5 M NH₃
- B 77 ml of 0.5 M NH₃ and 463 mL of water
- C 77 ml of 3.5 M NH₃ and 463 mL of water
- D 77 ml of 0.5 M NH₃ and 540 mL of water

$$M_1 V_1 = M_2 V_2$$

$$(3.5M)(V_1) = (0.5M)(540 \text{ ml})$$

$$V_1 = 77 \text{ ml of } 3.5M$$

in 463 ml H₂O