Revision of Chapter Three

Chapter Three

Nonpolar

1. Which of the following compounds should be soluble in CCl_4 ?

a) NaCl	b) H_2O	c) NaOH	d) C_8H_{18}	e) None of these
ionic	*polar*	*ionic*	*Nonpolar*	

Chapter Three

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2. Which of the following gives the molarity of a 17% by mass solution of sodium acetate, CH_3COONa (molar mass= 82 g/mol) in water? The density of the solution is 1.09 g/ml.

a) 2.26×10^{-6} M	b) 0.207 M	c) 2.07 M	d) 2.26 M	e) 2.72 M

$$M = \frac{\% \; x \; d \; x \; 10}{MM}$$

$$= \frac{17 \; x \; 1.09 \; x \; 10}{82}$$

$$= 2.26 \; M$$

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3. What is the percent $CdSO_4$ by mass in a 1.0 molal aqueous $CdSO_4$ solution?

a) 0.001 %	b) 0.10 %	c) 17.2 %	d) 20.8 %	e) 24.4 %

$$\% = \frac{m \; x \; MM \; x \; 100}{(m \; x \; MM) + 1000}$$

Molar mass of $CdSO_4$ = 112 + 32 + 4x16 =208

$$= \frac{1 \; x \; 208 \; x \; 100}{(1 \; x \; 208) + 1000}$$

$$= 17.2 \; \%$$

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4. Calculate the percent by mass of potassium nitrate in a solution made from 45g of $KNO_3$and 295ml of water. The density of water is 0.997 g/ml?

a) 1.51 %	b) 7.57 %	c) 13.3 %	d) 15.2 %	e) None of these

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$$\%(\mathrm{KN}O_3) = \frac{mass\ of\ KNO_3}{mass\ of\ solution\ (KNO_3 + H_2O)} x100$$

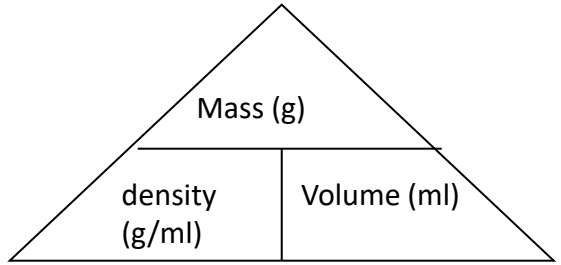
KNO_3=45g

H_2O =295 ml

Mass of H_2O =d x V

= 0.997 x 295

= 294.115 g



$$\%(\mathrm{KN}O_3) = \frac{45}{(45 + 294.115)} x100$$

$$= 13.3\ \%$$

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Chapter Three

5. Calculate the molality of a solution containing 14.3g of NaCl in 42.2g of water ?

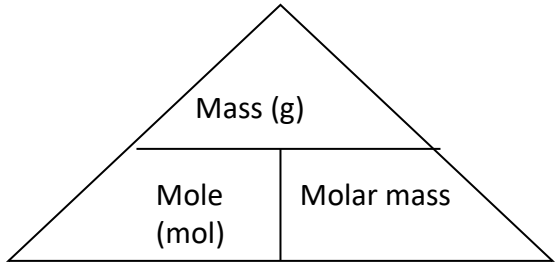
a) 2.45×10^{-4} m	b) 5.80×10^{-4} m	c) 2.45×10^{-1} m	d) 103 m	e) 5.80 m

$$m = \frac{mole\ of\ solut}{mass\ of\ solvent\ (kg)}$$

Solute (NaCl)= 14.3g

mole of NaCl = $\frac{mass}{molar\ mass} = \frac{14.3}{58.5}$ = 0.24 mol

solvent (H_2O)= 42.2 g = 42.2 $\times 10^{-3}$ kg



Molar mass of NaCl = 23 + 35.5 =58.5

$$m = \frac{0.24}{42.2x10^{-3}}$$

$$= 5.8\ m$$

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a) $2.45x10^{-4}$ m	b) $5.80x10^{-4}$ m	c) $2.45x10^{-1}$ m	d) 103 m	e) 5.80 m

6. The solubility of gases in water usually decreases with

a) Increasing pressure	b) Increasing temperature	d) Decreasing temperature

7. The solubility of nitrogen gas at 25 °C and nitrogen pressure of 522 mmHg is $4.7x10^{-4}$ mol/L. what is the value of Henry's Law in mol/L.atm ?

a) $6.8x10^{-4}$ M/atm	b) $4.7x10^{-4}$ M/atm	c) $3.2x10^{-4}$ M/atm	d) $9.0x10^{-7}$ M/atm	e) $1.5x10^{-3}$ M/atm

C = kP

P = 522 mmHg = 522/760 = 0.69 atm

$$k = \frac{C}{P}$$

$$= \frac{4.7x10^{-4}}{0.69} = 6.8x10^{-4} M/atm$$

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8. The solubility of CO_2 gas in water:

a) Increases with increasing temperature
b) Decreases with increasing temperature
c) Decreases with decreasing temperature
d) Is not dependent on temperature

Chapter Three

9. Consider a solution made from nonvolatiale solute and volatile solvent. Which

a) The vapor pressure of the solution is always grater than the vapor pressure of the pure solvent

b) The boiling point of the solution is always grater than the boiling point of the pure solvent

c) The freezing point of the solution is always grater than the freezing point of the pure solvent

10. Dissolving a solute such as KOH in s solvent such as water result in:

a) An increase in the melting point of the liquid.

b) A decrease in the boiling point of the liquid.

c) A decrease in the vapor pressure of the liquid.

d) No change in the boiling point of the liquid.

11. Which of the following aqueous solution has the highest boiling point? K_b for water is 0.52 °C/m ?

a) 0.2m KCl	b) 0.2m Na_2SO_4
c) 0.2m $Ca(NO_3)_2$	d) 0.2m KCl and 0.2m Na_2SO_4
e) 0.2m Na_2SO_4 and 0.2 m $Ca(NO_3)_2$	

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$$\Delta T_b = i\,x k_b x m$$

KCl
KCl

2

$Ca(NO_3)_2$
$Ca(NO_3)_2$

3

Na_2SO_4 ana $Ca(NO_3)_2$
3 3

6

Na_2SO_4
Na_2SO_4

3

KCl and Na_2SO_4
2 3

5

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e) 0.2m Na_2SO_4 and 0.2 m $Ca(NO_3)_2$

Chapter Three

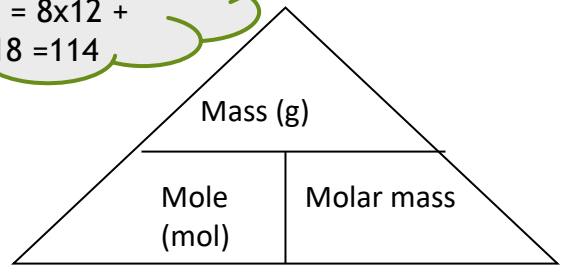
12. Calculate the freezing point od a solution made from 22g of octane (C_8H_{18}) dissolved in 148g of benzene. Benzene freezes at 5.5°C and its k_f value is 5.12°C/m ?

a) -1.16 °C	b) 0.98 °C	c) 6.66 °C	d) 12.2 °C	e) 5.49 °C

$$\Delta T_f = k_f x m$$

$$\mathrm{m} = \frac{mole\ of\ solut}{mass\ of\ solvent\ (kg)}$$

Molar mass of C_8H_{18} = 8x12 + 1x18 =114



Solute (C_8H_{18})= 22g

mole of C_8H_{18} = $\frac{mass}{molar\ mass}$ = $\frac{22}{114}$ = 0.19 mol

solvent (benzene)= 148 g = 148 x10^{-3} kg

$$\mathrm{m} = \frac{0.19}{148x10^{-3}} = 1.304\ m$$

$$\Delta T_f = 5.12x\ 1.304\ = 6.68\ °C$$

$$\Delta T_f = T_f^{\circ} - T_f$$

6.68 = 5.5- T_f

$$T_f = 5.5 - 6.68$$

$$= -1.16°C$$

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13. What is the molar mass of toluene if 0.85 g of toluene depresses the freezing point of 100 g of benzene by 0.47 °C? k_f of benzene is 5.12°C/m

a) 92.6 g/mol	b) 78.0 g/mol	c) 10.7 g/mol	d) 81.8 g/mol	e) 927 g/mol

$$\Delta T_f = k_f x m$$

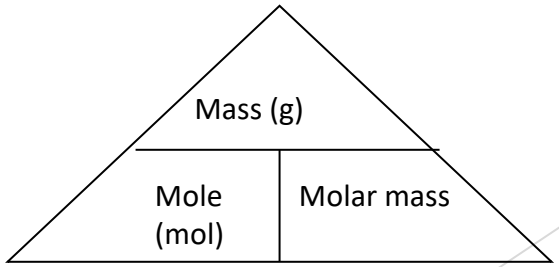
$$m = \frac{\Delta T_f}{k_f} = \frac{0.47}{5.12} = 0.092\ m$$

$$\mathrm{m} = \frac{mole\ of\ solut}{mass\ of\ solvent\ (kg)}$$

Mole of solute = m x mass of solvent (kg)

= 0.092 x 100 x 10^{-3} = 0.0092

$$\text{molar } mass = \frac{mass}{mole} = \frac{0.85}{0.0092} = 92.4\ g/mol$$



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14. 0.102 g of an unknown compound dissolved in 100 ml of water has an osmotic pressure of 281 mmHg at 20°C. calculate the molar mass of the compound?

a) 663 g/mol	b) 0.872 g/mol	c) 1.15 g/mol	d) 727 g/mol	e) 1.10×10^2 g/mol

$$\pi = MRT \qquad \pi = 281\ mmHg = \frac{281}{760} = 0.037\ atm, \mathrm{T} = 20°C = 20 + 273 = 293K$$

$$M = \frac{\pi}{RT} = \frac{0.037}{0.0821x293} = 0.00154M$$

$$M = \frac{n}{V(l)}$$

$$\text{molar } mass = \frac{mass}{mole} = \frac{0.102}{0.000154} = 663\ g/mol$$

n=M XV = 0.00154 x 100 x 10^{-3} = 0.000154 mole

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15. The osmotic pressure of a 0.010 M $MgSO_4$ solution at 25°C is 0.318 atm. Calculate *i*, the van't Hoff factor, for this $MgSO_4$ solution?

a) 0.013	b) 1.3	c) 1.5	d) 2.0	e) 76.8

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$$\pi = iMRT$$

$$i = \frac{\pi}{MRT}$$

$$= \frac{0.318}{0.01\ x\ 0.0821\ x\ (25 + 273)}$$

$$= 1.3$$

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