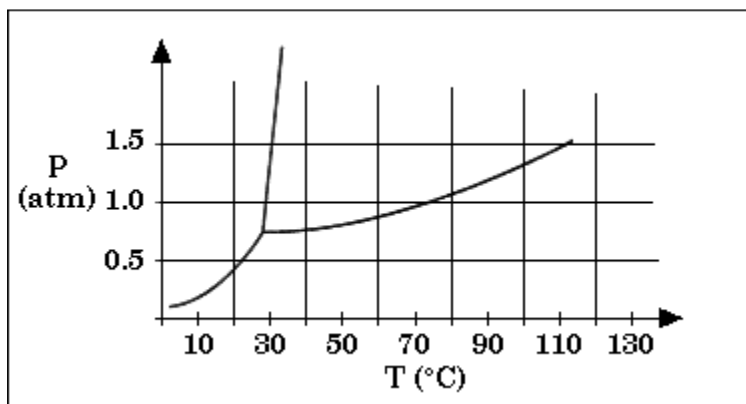


Basic Competency Quiz #6
Chemistry, 7th ed., Zumdahl & Zumdahl, sections 10.9-11.5

Unless otherwise specified, each question is worth 4 points.

1. Given the following phase diagram:



...estimate:

- a. normal boiling point **73°C**
 b. normal freezing point **29°C**
 c. triple point temperature **28°C**
 d. critical point temperature **114°C**

2. A solution of urea, $(\text{H}_2\text{N})_2\text{CO}$, is made by dissolving 34.30 g urea in 100.0 mL of water; the total volume of the solution was 125.5 mL. The density of water is 1.000 g/mL. Calculate

a. the mole fraction of urea in this solution

$$\text{mole fraction} = \text{moles of component} / \text{total moles}$$

$$\mathbf{0.09331}$$

b. the molality of urea in this solution

$$m = \text{mole solute} / \text{kg of solvent}$$

$$\mathbf{5.711 \text{ [}^{\text{mol}}/\text{kg}]}$$

Unless otherwise specified, each question is worth 4 points.

3. Which solvent, water or carbon tetrachloride, would you choose to dissolve each of the following? (*water is a polar compound, CCl₄ is non-polar, and "like dissolves like"*)
- a. SF₂ (*this is a polar compound*) **water**
 - b. CO₂ (*this is a NON-polar compound*)..... **CCl₄**
 - c. MgF₂ (*this is an ionic, or super-polar compound*)..... **water**
 - d. H₂CCH₂(*this is a hydrocarbon, which are always NON-polar compounds*)..... **CCl₄**
4. What is the concentration of nitrogen in a container of water that is open to the atmosphere at sea level and 20.0°C? The partial pressure of nitrogen is 0.78 atm at sea level. The Henry's Law constant for nitrogen in water at 20.0°C is 8.47×10^{-4} [mol/L·atm].

(Henry's Law =)

Concentration of gas in liquid = K (constant) x P (pressure of gas above liquid)

$$***C = K \times P***$$

$$***C = 8.47 \times 10^{-4} \text{ [mol/L·atm]} \times 0.78 \text{ atm} = \underline{0.00066 \text{ atm}}***$$

5. What is the freezing point of a solution made by dissolving 30.00 g of fructose, C₆H₁₂O₆, in 200.0 g of water?

$$***T_f = T_f^\circ (\text{pure solution}) - \Delta T_f***$$

$$***\Delta T_f = k_f \times \text{molality} = k_f \times \text{moles fructose} / \text{kg of solvent}***$$

$$***\Delta T_f = 1.55^\circ\text{C}***$$

$$***\underline{T_f = -1.55^\circ\text{C}}***$$

Unless otherwise specified, each question is worth 4 points.

Constants for Water:

$$K_b = 0.51 \text{ [}^\circ\text{C kg/mol]}$$

$$K_f = 1.86 \text{ [}^\circ\text{C kg/mol]}$$

normal freezing point = 0.00°C
normal boiling point = 100.00°C

Abbreviated Periodic Table of the Elements

1 1A 1 H 1.008	2 2A												13 3A	14 4A	15 5A	16 6A	17 7A	18 8A 2 He 4.00
3 Li 6.94	4 Be 9.01												5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31	3 3B	4 4B	5 5B	6 6B	7 7B	8 8B	9 8B	10 8B	11 1B	12 2B	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95	
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80	
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3	
55 Cs 132.9	56 Ba 137.3	57 La* 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)	
87 Fr (223)	88 Ra 226	89 Ac** (227)	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Uun	111 Uuu	112 Uub							