PRACTICE TEST: CHAPTER 15, SOLUTION CHEMISTRY

1. In soda pop, $CO_2(g)$ is a _____ and water is the _____.

   [A] solute; solution [B] solution; solute [C] solvent; solute

   [D] solvent; solution [E] solute; solvent

2. A mixture of sand and water is a(n) _____.

   [A] solvent [B] solution [C] solute [D] aqueous solution [E] none of these

3. Approximately 38 g of NaCl can be dissolved in 100 g of water at 25°C. A solution prepared by adding 35 g of NaCl to 100 g of water at 25°C is unsaturated.

   [A] True [B] False

4. When a solvent has dissolved all the solute it can at a particular temperature, it is said to be

   [A] unsaturated [B] supersaturated [C] diluted

   [D] saturated [E] none of these

5. A 1 molar solution of NaCl contains

   [A] 1 mol of solute per liter of solution

   [B] 1 liter of solute per mol of solution [C] 1 mol of solute per kilogram of solution

   [D] 1 mol of solute per mole of solution [E] 10.0 grams of solute per liter of solution

6. Which of the following aqueous solutions contains the greatest number of **ions**?

   [A] 200.0 mL of 0.10 *M* KBr [B] 400.0 mL of 0.10 *M* NaCl

   [C] 300.0 mL of 0.10 *M* $CaCl_2$ [D] 800.0 mL of 0.10 *M* sucrose

   [E] 200.0 mL of 0.10 *M* $FeCl_3$

7. What is the mass of H_2SO_4 in 1.00×10^2 mL of 0.200 *M* H_2SO_4 solution?

   [A] 20.0 g [B] 1.00×10^2 g [C] 19.6 g [D] 1.96 g [E] none of these

8. What number of moles of solute are present in 25.0 mL of 2.00 *M* HCl?

   [A] 50.0 mol [B] 0.0800 mol [C] 0.0500 mol [D] 2.00 mol [E] none of these

9. A chemist needs 225 mL of 2.4 *M* HCl. What volume of 12 *M* HCl must be dissolved in water to form this solution?

   [A] 6.8 mL [B] 3.4 mL [C] 7.2 mL [D] 21 mL [E] 45 mL

10. What volume of a 10.0 *M* HNO_3 solution is needed to completely neutralize 575 mL of a 4.10 *M* KOH solution?

$$HNO_3\ (aq) + KOH\ (aq) \rightarrow KNO_3\ (aq) + H_2O\ (l)$$

[A] 2.36 mL [B] 236 mL [C] 0.236 mL [D] 0.0236 mL [E] none of these

11. Adding a solute to a liquid will

[A] decrease the boiling point [B] increase the freezing point

[C] leave the boiling point unchanged [D] decrease the freezing point

[E] none of these

12. What is the solubility of each of these substances at 10°C? Use your graph of solubilities to determine the answers.
    a. Na_2SO_4
    b. NaCl
    c. SO_2
    d. NH_3
    e. KI
13. Consider a solution in which 90 g of $NaNO_3$ is dissolved in 100 g of water at 25 °C. Is it saturated, unsaturated, or supersaturated?
14. Consider a solution in which 90 g of $NaNO_3$ is dissolved in 200 g of water at 25 °C. Is it saturated, unsaturated, or supersaturated?
15. Consider a solution in which 90 g of $NaNO_3$ is dissolved in 50 g of water at 25 °C. Is it saturated, unsaturated, or supersaturated?
16. Balance the following chemical reaction. Identify the precipitate. Write the complete ionic equation. Identify the spectator ions. Then write the net ionic equation.
    a. $\_\_\_\mathbf{Na_3PO_4}_{\mathbf{(aq)}} + \_\_\_\mathbf{Ba(NO_3)_2}_{\mathbf{(aq)}} \rightarrow \_\_\_\mathbf{Ba_3(PO_4)_2}_{\mathbf{(s)}} + \_\_\_\mathbf{NaNO_3}_{\mathbf{(aq)}}$

    b. The precipitate is_____.

    c. Complete ionic equation:

    d. Spectator ions:

    e. Net ionic equation:

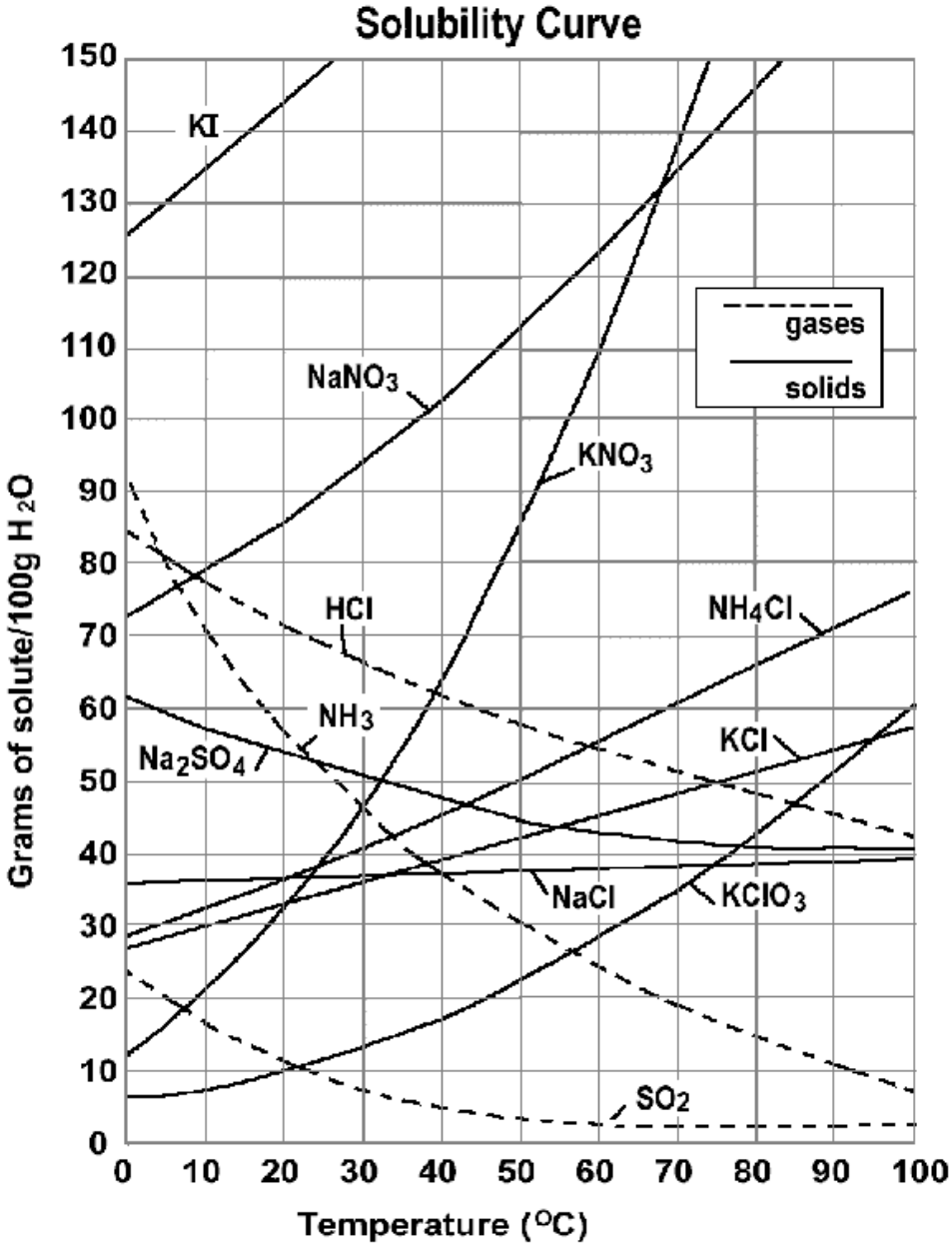
    f. Will oil dissolve in water? Why or why not?

17. Which of the following solutions is the most concentrated?
    a. 6.0 M $HCl_{(aq)}$
    b. 9.0 M $HCl_{(aq)}$
    c. 12.0 M $HCl_{(aq)}$
18. Which of the solutions from above is the most dilute?
19. What is meant by the “thermal pollution” of a lake?
20. What is “the bends”? What causes it? How could it be cured?

[1] [E]
[2] [E]
[3] [A]
[4] [D]

[5] [A]
[6] [C]
[7] [D]
[8] [C]

[9] [E]
[10] [B]
[11] [D]


Solubility Curve
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
KI
NaNO3
KNO3
HCl
NH4Cl
NH3
Na2SO4
KCl
NaCl
KClO3
SO2
gases
solids
0
10
20
30
40
50
60
70
80
90
100
Grams of solute/100g H2O
Temperature (°C)

ANSWERS - PRACTICE TEST
SOLUTION CHEMISTRY (CH. 15)

(6) First, find moles of solute. Then, find moles of ions

(a) $0.2000\ L\ KBr \times \frac{0.10\ mol}{L} = 0.020\ mol\ KBr \times \frac{2\ mol\ ions}{1\ mol\ KBr} = 0.040\ mol\ ions$

(b) $0.4000\ L\ NaCl \times \frac{0.10\ mol}{L} = 0.040\ mol\ NaCl \times \frac{2\ mol\ ions}{1\ mol\ NaCl} = 0.080\ mol\ ions$

(c) $0.3000\ L\ CaCl_2 \times \frac{0.10\ mol}{L} = 0.030\ mol\ CaCl_2 \times \frac{3\ mol\ ions}{1\ mol\ CaCl_2} = \boxed{0.090\ mol\ ions}$

(d) Sucrose is not an electrolyte. It dissolves, but it does not dissociate into ions. It forms zero (0) moles of ions.

(e) $0.2000\ L\ FeCl_3 \times \frac{0.10\ mol}{1\ L} = \underline{0.020}\ mol\ FeCl_3 \times \frac{4\ mol\ ions}{1\ mol\ FeCl_3} = 0.080\ mol\ ions$

(7) mass = ? Strategy: find moles of solute, then convert to grams

$M = \frac{n}{V} \Rightarrow VM = n \Rightarrow (0.100\ L)(0.200\ \frac{mol}{L}) = 0.0200\ mol\ H_2SO_4$

$0.0200\ mol\ H_2SO_4 \times \frac{98.1\ g\ H_2SO_4}{1\ mol\ H_2SO_4} = \underline{\boxed{1.96\ g\ H_2SO_4}}$

H 1.01
H 1.01
S 32.06
O 16.0
O 16.0
O 16.0
+ O 16.0
98.1 g / 1 mol

(8) $M = \frac{n}{V} \Rightarrow VM = n \Rightarrow (0.0250\ L)(2.00\ \frac{mol}{L}) = \boxed{0.0500\ mol}$

$25.0\ ml \times \frac{1\ L}{1000\ ml} = 0.0250\ L$

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(9) $M_1V_1 = M_2V_2$

$M_1 = 12\,M$
$V_1 = ?$
$M_2 = 2.4\,M$
$V_2 = 225\,ml$

$(12\,M)(V_1) = (2.4\,M)(225\,ml)$

$V_1 = \dfrac{(2.4\,M)(225\,ml)}{12\,M} = \boxed{45\,ml}$

(10) Solution Stoichiometry. Do not use $M_1V_1 = M_2V_2$, which is the dilution formula.

$1HNO_3 + 1KOH \rightarrow HOH + KNO_3$

10.0 M	M	4.10 M
ⓒ ?	V	575 ml
ⓑ	n	ⓐ 2.36 mol

ⓐ $M = \dfrac{n}{V}$

$n = MV = \left(\dfrac{4.10\,mol}{L}\right)(0.575\,L)$

$= 2.3575\,mol\,KOH$

ⓑ $2.36\,mol\,KOH \times \dfrac{1\,mol\,HNO_3}{1\,mol\,KOH} = \underline{2.36}\,mol\,HNO_3$

ⓒ $M = \dfrac{n}{V} \Rightarrow MV = n \Rightarrow V = \dfrac{n}{M} = \dfrac{2.36\,mol\,HNO_3}{10.0\,\frac{mol}{L}\,HNO_3}$

$= 0.236\,L$

$= \boxed{236\,ml}$

(12) ⓐ 58g (per 100g H_2O)
ⓑ 38g
ⓒ 18g
ⓓ 70g
ⓔ 135g

(13) saturated

(14) unsaturated

$\dfrac{90g\,NaNO_3}{200g\,H_2O} = \dfrac{xg}{100g\,H_2O}$

$x = 45g\,NaNO_3$

(15) supersaturated

$\dfrac{90g\,NaNO_3}{50g\,H_2O} = \dfrac{xg}{100g\,H_2O}$

$xg = 180g\,NaNO_3$

(16) $\underline{2}\,Na_3PO_{4(aq)} + \underline{3}\,Ba(NO_3)_{2(aq)} \rightarrow Ba_3(PO_4)_{2(s)} + 6NaNO_{3(aq)}$

(b) ppt is $Ba_3(PO_4)_2$ (s)

(c) $6Na^+_{(aq)} + 2PO_4^{3-}{}_{(aq)} + 3Ba^{2+}_{(aq)} + 6NO_3^-{}_{(aq)} \rightarrow Ba_3(PO_4)_{2(s)} + 6Na^+_{(aq)} + 6NO_3^-{}_{(aq)}$

(d) Na^+ and NO_3^- (e) $2PO_4^{3-}{}_{(aq)} + 3Ba^{2+}{}_{(aq)} \rightarrow Ba_3(PO_4)_{2(s)}$

(f) oil is nonpolar, water is polar, and generally speaking like dissolves like, oil does not dissolve in water.

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(17) 12.0 M $HCl_{(aq)}$ has the highest molarity and is therefore the most concentrated.

(18) a – 6.0 M is most dilute.

(19) The solubility of gases in water decreases with increasing temperature. By simply heating up a body of water such as a lake, the amount of a gas such as O_2 which can be dissolved decreases.

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20. The bends occurs from the depressurization of a scuba diver over too short a period of time. As pressure decreases, the solubility of air in the bloodstream decreases. The bubbles formed in the bloodstream from rapid depressurization are painful and deadly. Curing the bends requires the scuba diver to be placed temporarily under increased pressure (e.g., in a hyperbaric chamber) in order to re-dissolve the gas bubbles in the diver's bloodstream.