35 pts Chapter 15 test

Molarity Problems

Name: _____

Section: _____

C 1. Which solution contains the greatest number of moles of solute?
A) 0.5 L of 2 M $2M = \frac{x\,mol}{.5L} = 1\,mol$ B) 2 L of 0.5 M $.5M = \frac{x\,mol}{2L} = 1\,mol$
C) 2 L of 2 M $2M = \frac{x\,mol}{2L} = 4\,mol$ D) 0.5 L of 0.5 M $.5M = \frac{x\,mol}{.5L} = .25\,mol$

D 2. What is the total number of grams of solute in 500. milliliters of 1 M CH_3COOH (formula mass = 60.)?
A) 60. g .5L B) 90. g C) 120. g D) 30. g $1M = \frac{x\,mol}{.5L} = .5\,mol$

D 3. In the reaction $Al^{3+} + 6H_2O \longrightarrow Al(H_2O)_6^{3+}$, the Al^{3+} ion is undergoing the process called
A) neutralization B) hydrogenation
C) addition D) hydration
$.5\,mol\left(\frac{60g}{mol}\right) = 30g$

A 4. What is the molarity of a solution that contains 112 grams of KOH in 2.00 liters of solution? KOH = 56.1 g/mol $112g\left(\frac{1\,mol}{56g}\right) = 2\,Mol$
A) 1.00 M B) 4.00 M C) 2.00 M D) 3.00 M
$M = mol/L = 2mol/2L = 1M$

D 5. What is the total number of grams of KCl (formula mass = 74.6) in 1.00 liter of 0.200 molar solution? $.200M = \frac{x\,mol}{1L} = .200\,mol$
A) 7.46 g B) 29.8 g C) 22.4 g D) 14.9 g
$.200\,mol\left(\frac{74.6g}{mol}\right) = 14.92g$

C 6. What is the molarity of a solution of KNO_3 (molecular mass = 101) that contains 404 grams of KNO_3 in 2.00 liters of solution? $404g\left(\frac{1\,mol}{101g}\right) = 4\,mol$ $M = \frac{4\,mol}{2L} = 2M$
A) 0.500 B) 4.00 C) 2.00 D) 1.00

A 7. A solution in which an equilibrium exists between dissolved and undissolved solute must be
A) saturated B) concentrated
C) dilute D) unsaturated
definition of saturated solution

B 8. How many grams of ammonium chloride (gram formula mass = 53.5 g) are contained in 0.500 L of a 2.00 M solution? $2.00M = \frac{x\,mol}{.500L} = 1.00\,mol$
A) 107 g B) 53.5 g C) 26.5 g D) 10.0 g
$1\,mol\left(\frac{53g}{mol}\right) = 53.5g$

B 9. How many grams of KOH are needed to prepare 250. milliliters of a 2.00 M solution of KOH (formula mass = 56.0)? .250L
A) 2.00 B) 28.0 C) 112 D) 1.00 $2.00M = \frac{x\,mol}{.250L} = .500\,mol$
$.500\,mol\left(\frac{56g}{mol}\right) = 28.0g$

Molarity $M = \frac{mol}{L}$ → $M \cdot L = mol$ → $L = \frac{mol}{M}$

Name _____ Date _____ Class _____

15–2 Practice Problems

Molarity & Molality → $M = \frac{mol\ solute}{Kg\ solvent}$

1. What is the molarity of the solution produced when 145 g of sodium chloride (NaCl) is dissolved in sufficient water to prepare 2.75 L of solution?

$145\,g\ NaCl \left(\frac{mol}{58.5\,g}\right) = 2.48\,mol$

$M = \frac{2.48\,mol}{2.75\,L} = 0.901\,M$

2. How many grams of potassium chloride (KCl) are needed to prepare 0.750 L of a 1.50 *M* solution of potassium chloride in water?

KCl
39.1 + 35.5
74.6 g/mol

$mol = M \cdot L = 1.50\,M \cdot 0.750\,L = 1.13\,mol$

$1.13\,mol \left(\frac{74.6\,g}{mol}\right) = 83.9\,g\ KCl$

3. What is the molarity of the solution produced when 85.6 g of hydrochloric acid (HCl) is dissolved in sufficient water to prepare 0.385 L of solution?

$85.6\,g \left(\frac{mol}{36.5\,g}\right) = 2.35\,mol$

$M = \frac{2.35\,mol}{0.385\,L} = 6.09\,M$

4. To produce 3.00 L of a 1.90 *M* solution of sodium hydroxide (NaOH), how many grams of sodium hydroxide must be dissolved?

NaOH
23.0 + 16.0 + 1.00
40.0 g/mol

$1.90\,M \cdot 3.00\,L = 5.70\,mol$

$5.70\,mol \left(\frac{40.0\,g}{mol}\right) = 228\,g\ NaOH$

5. If 8.77 g of potassium iodide (KI) are dissolved in sufficient water to make 4.75 L of solution, what is the molarity of the solution?

KI
39.1 + 126.9
166.0 g/mol

$8.77\,g \left(\frac{mol}{166.0\,g}\right) = 0.0528\,mol$

$M = \frac{0.0528\,mol}{4.75\,L} = 0.0111\,M$

6. In order to prepare 2.00 L of a 3.00 *M* solution of ferric chloride ($FeCl_3$), how many grams of ferric chloride must be used?

3.00 M × 2.00 L
6.00 mol

Fe: 55.847
Cl: 3(35.453)
162.2069 g/mol

$6.00\,mol \left(\frac{162.2069\,g}{1\,mol}\right)$

$973\,g\ FeCl_3$

7. What is the molarity of the solution produced when 14.1 g of ammonia (NH_3) is dissolved in sufficient water to prepare 0.100 L of solution?

$14.1\,g\ NH_3 \left(\frac{mol}{17.0\,g}\right) = 0.829\,mol$

$M = 0.829\,mol / 0.1\,L = 8.29\,M$

8. To prepare 10.5 L of a 2.50 *M* solution of potassium hydroxide (KOH), how many grams of potassium hydroxide must be used?

$mol = 2.50\,M \cdot 10.5\,L = 26.25\,mol$

KOH
39.1 + 16.0 + 1.00
56.1 g/mol

$26.25\,mol \left(\frac{56.1\,g}{mol}\right) = 1472.6\,g$

$1.47 \times 10^3\,g\ KOH$

9. What is the molality of a solution containing 75.2 g of silver perchlorate ($AgClO_4$) dissolved in 885 g of benzene?

$AgClO_4$ 207.32 g/mol

$75.2\,g \left(\frac{mol}{207.32\,g}\right) = 0.363\,mol$ → $= 0.410\,m$

$885\,g \left(\frac{Kg}{1000\,g}\right) = 0.885\,Kg$

10. What is the molality of a solid solution containing 0.125 g of chromium and 81.3 g of iron?

0.0296 m

$0.125\,g\ Cr \left(\frac{mol}{51.996\,g}\right) = 2.40 \times 10^{-3}\,mol$ =

$81.3\,g \left(\frac{Kg}{1000\,g}\right) = 0.0813\,Kg$

11. If 18.6 g of methanol is used to dissolve 2.68 g of $Hg(CN)_2$, what is the molality of the solution?

$2.68\,g \left(\frac{mol}{252.6256\,g}\right) = 0.0106\,mol$ → $= 0.570\,m$

$18.6\,g \left(\frac{mol}{1000\,g}\right) = 0.0186\,Kg$

12. What is the molality of solid solder wire if it is made from 68.7 g of lead dissolved in 117 g of tin?

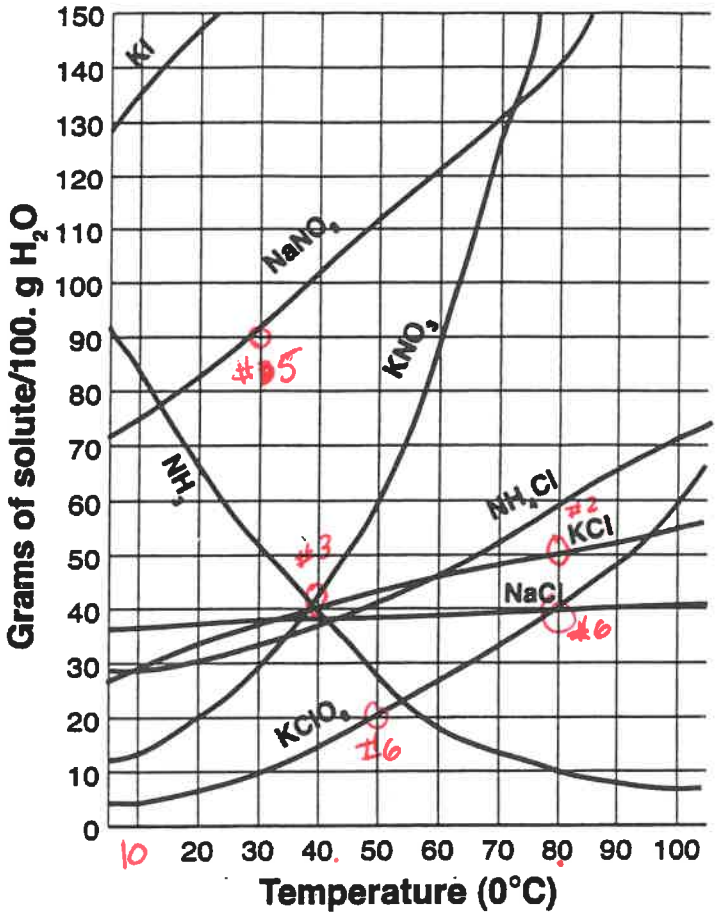
$68.7\,g\ Pb \left(\frac{mol}{207.2\,g}\right) = .332\,mol$ → $2.84\,m$

$117\,g \left(\frac{Kg}{1000\,g}\right) =$ 0.117 Kg

SOLUBILITY CURVES

Name _____

Answer the following questions based on the solubility curve below.



1. Which salt is least soluble in water at 20° C? $KClO_3$

2. How many grams of potassium chloride can be dissolved in 200 g (double) of water at 80° C?
   50g x 2 = 100g

3. At 40° C, how much potassium nitrate can be dissolved in 300 g (triple) of water? 42g x 3 = 126 g

4. Which salt shows the least change in solubility from 0° – 100° C?
   NaCl (slope closest to zero) (flattest line)

5. At 30° C, 90 g of sodium nitrate is dissolved in 100 g of water. Is this solution saturated, unsaturated or supersaturated?
   Unsaturated b/c its "under" the line

6. A saturated solution of potassium chlorate ($KClO_3$) is formed from one hundred grams of water. If the saturated solution is cooled from 80° C (40g) to 50° C (20g), how many grams of precipitate are formed? 20g

7. What compound shows a decrease in solubility from 0° to 100° C? NH_3 b/c it's a gas

8. Which salt is most soluble at 10° C? KI

9. Which salt is least soluble at 50° C? $KClO_3$

10. Which salt is least soluble at 90° C? NaCl (It's not NH_3 b/c it's a gas, not a salt)

B 10. In the reaction $Al^{3+} + 6H_2O \longrightarrow Al(H_2O)_6^{3+}$, the Al^{3+} ion is undergoing the process called

A) hydrogenation
B) addition
C) neutralization
D) hydration

Study the solubility curves in the figure, and then answer the questions that follow.

1. What relationship exists between solubility and temperature for most of the substances shown?

2. a. What is the exception?

b. What general principle accounts for this exception?

3. a. Approximately how many grams of $NaNO_3$ will dissolve in 100 g of water at 20°C?

b. How many grams will dissolve at 60°C?

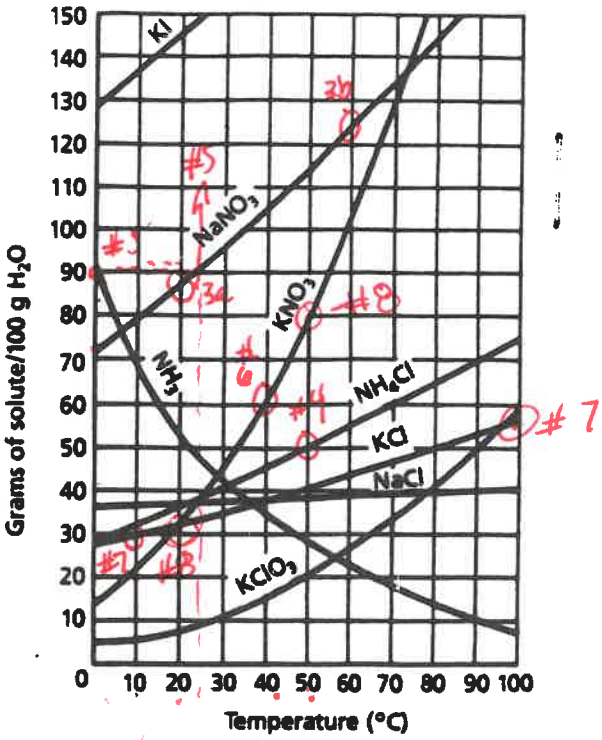
4. How many grams of NH_4Cl will dissolve in 1 Liter of H_2O at 50°C? 1 L = 1000 g H_2O ∴ x10

5. Ninety grams of $NaNO_3$ is added to 100 g of H_2O at 0°C. With constant stirring, to what temperature must the solution be raised to produce a saturated solution with no solid $NaNO_3$ remaining?

6. A saturated solution of $KClO_3$ was made with 300 g of H_2O at 40°C. How much $KClO_3$ could be recovered by evaporating the solution to dryness?

7. Five hundred grams of water is used to make a saturated solution of KCl at 10°C. How many more grams of KCl could be dissolved if the temperature were raised to 100°C?

8. A saturated solution of KNO_3 in 200 g of H_2O at 50°C is cooled to 20°C. How much KNO_3 will precipitate out of solution?



1. as Temp ↑ : Solubility ↑
2. a. NH_3
   b. It's a gas. for gases as Temp ↑ the Solubility ↓
3. a. 88g
   b. 124g
4. 50g x10 = 500g NH_4Cl
5. 24°C (+/- 1°C)
6. 60g x3 = 180g $KClO_3$
7. 130g KCl more can dissolve
8. 96g KNO_3 precipitates out

saturated

x3

x5

x2

#7 @10°C = 30g/100g H_2O → 26g/100g H_2O
@100°C = 56g/100g H_2O

#8 @50°C = 80g/100g H_2O → 48g/100g
@20°C = 32g/100g H_2O
x2
96g/200g H_2O

Precipitates
26
x 5
130g/500g H_2O

1. The freezing point of a 1.00-molal solution of $C_2H_4(OH)_2$ is closest to
(1) +1.86°C (2) -1.86°C (3) -3.72°C (4) +3.72°C

2. Why is salt (NaCl) put on icy roads and sidewalks in the winter?
(1) It is ionic and lowers the freezing point of water.
(2) It is ionic and raises the freezing point of water.
(3) It is covalent and lowers the freezing point of water.
(4) It is covalent and raises the freezing point of water.

3. How are the boiling and freezing points of a sample of water affected when salt is dissolved in the water?
(1) The boiling point decreases and the freezing point decreases.
(2) The boiling point decreases and the freezing point increases.
(3) The boiling point increases and the freezing point decreases.
(4) The boiling point increases and the freezing point increases.

4. Compared to the normal freezing point and boiling point of water, a 1-molal solution of sugar in water will have a
(1) higher freezing point and a lower boiling point
(2) higher freezing point and a higher boiling point
(3) lower freezing point and a lower boiling point
(4) lower freezing point and a higher boiling point

5. Which solution containing 1 mole of solute dissolved in 1,000 grams of water has the lowest freezing point?
(1) KOH(aq) (3) $C_2H_5OH(aq)$
(2) $C_6H_{12}O_6(aq)$ (4) $C_{12}H_{22}O_{11}(aq)$

20. Which solution is the most concentrated?
(1) 1 mole of solute dissolved in 1 liter of solution
(2) 2 moles of solute dissolved in 3 liters of solution
(3) 5 moles of solute dissolved in 4 liters of solution
(4) 4 moles of solute dissolved in 8 liters of solution

21. A solution in which the crystallizing rate of the solute equals the dissolving rate of the solute must be
(1) saturated (3) concentrated
(2) unsaturated (4) dilute

22. According to Reference Table G, approximately how many grams of $KClO_3$ are needed to saturate 100 grams of H_2O at 40°C?
(1) 6 (2) 16 (3) 38 (4) 47

23. According to Reference Table G, a temperature change from 60°C to 90°C has the *least* effect on the solubility of
(1) SO_2 (2) NH_3 (3) KCl (4) $KClO_3$

24. According to Reference Table G, which compound's solubility decreases most rapidly when the temperature increases from 50°C to 70°C?
(1) NH_3 (2) HCl (3) SO_2 (4) KNO_3

25. Based on Reference Table E, which of the following saturated solutions would be the *least* concentrated?
(1) sodium sulfate (3) copper (II) sulfate
(2) potassium sulfate (4) barium sulfate

26. What is the concentration of a solution of 10 moles of copper (II) nitrate in 5.0 liters of solution?
(1) 0.50 M (2) 2.0 M (3) 5.0 M (4) 10 M

27. What is the total number of moles of H_2SO_4 needed to prepare 5.0 liters of a 2.0 M solution of H_2SO_4?
(1) 2.5 (2) 5.0 (3) 10 (4) 20

28. What is the molarity of a KF(aq) solution containing 116 grams of KF in 1.00 liter of solution?
(1) 1.00 M (2) 2.00 M (3) 3.00 M (4) 4.00 M

1. When ethylene glycol (an antifreeze) is added to water, the boiling point of the water
(1) decreases, and the freezing point decreases
(2) decreases, and the freezing point increases
(3) increases, and the freezing point decreases
(4) increases, and the freezing point increases

2. How many moles of a nonvolatile, nonelectrolyte solute are required to lower the freezing point of 1,000 grams of water by 5.58°C?
(1) 1 (2) 2 (3) 3 (4) 4

3. A 0.100-molal aqueous solution of which compound has the *lowest* freezing point?
(1) $C_6H_{12}O_6$ (2) CH_3OH (3) $C_{12}H_{22}O_{11}$ (4) NaOH

* Table D is Now Table G *

7. A 1 kilogram sample of water will have the highest freezing point when it contains
(1) 1×10^{17} dissolved particles (2) 1×10^{19} dissolved particles
(3) 1×10^{21} dissolved particles (4) 1×10^{23} dissolved particles

8. Compared to the normal freezing point and boiling point of water, a 1-molal solution of sugar in water will have a
(1) higher freezing point and a lower boiling point
(2) higher freezing point and a higher boiling point
(3) lower freezing point and a lower boiling point
(4) lower freezing point and a higher boiling point

9. Which ratio of solute-to-solvent could be used to prepare a solution with the highest boiling point?
(1) 1 g of NaCl dissolved per 100 g of water
(2) 1 g of NaCl dissolved per 1000 g of water
(3) 1 g of $C_{12}H_{22}O_{11}$ dissolved per 100 g of water
(4) 1 g of $C_{12}H_{22}O_{11}$ dissolved per 1000 g of water

10. Which expression defines the molality (m) of a solution?
(1) $\frac{\text{grams of solute}}{\text{kg of solution}}$ (2) $\frac{\text{moles of solute}}{\text{kg of solution}}$
(3) $\frac{\text{grams of solute}}{\text{kg of solvent}}$ (4) $\frac{\text{moles of solute}}{\text{kg of solvent}}$

11. A student dissolves 1.0 mole of sucrose ($C_{12}H_{22}O_{11}$) in 1,00 grams of water at 1.0 atmosphere. Compared to the boiling poir of pure water, the boiling point of the resulting solution is
(1) 0.52 C° lower (2) 1.86 C° lower (3) 0.52 C° highe
(4) 1.86 C° higher

1. How many grams of ammonium chloride (gram formula mas 53.5 g) are contained in 0.500 L of a 2.00 M solution?
(1) 10.0 g (2) 26.5 g (3) 53.5 g (4) 107 g

2. What is the molarity of an H_2SO_4 solution if 0.25 liter of solution contains 0.75 mole of H_2SO_4?
(1) 0.33 M (2) 0.75 M (3) 3.0 M (4) 6.0 M

3. What is the total number of grams of NaOH (formula mass = needed to make 1.0 liter of a 0.20 M solution?
(1) 20. g (2) 2.0 g (3) 80. g (4) 8.0 g

4. As additional $KNO_3(s)$ is added to a saturated solution of KI at constant temperature, the concentration of the solution
(1) decreases (2) increases (3) remains the same

5. What is the total number of grams of KCl (formula mass = 7 in 1.00 liter of 0.200 molar solution?
(1) 7.46 g (2) 14.9 g (3) 22.4 g (4) 29.8 g

6. If 0.50 liter of a 12-molar solution is diluted to 1.0 liter molarity of the new solution is (1) 2.4 (2) 6.0 (3) 12 (4

* diluting doesn't change amount of solute

SOLUTIONS!

QUESTIONS

1. How many moles of H_2SO_4 are needed to prepare 5 L of a 2.0 M solution of H_2SO_4? (1) 2.5 moles (2) 5.0 moles (3) 10 moles (4) 20 moles

2. What is the mass of KCl in 1.0 L of 0.2 M solution? (1) 7.46 g (2) 14.9 g (3) 22.4 g (4) 29.8 g

3. What is the molarity of a solution that contains 20 g $CaBr_2$ in 0.50 L of solution? (1) 0.50 M (2) 2.0 M (3) 0.10 M (4) 0.20 M

4. What is the mass of solute in 500 mL of 1.0 M CH_3COOH? (1) 30 g (2) 60 g (3) 90 g (4) 120 g

5. What is the molarity of a solution that contains 10 g of NaOH in 500 mL of solution? (1) 1.0 M (2) 0.50 M (3) 0.25 M (4) 0.10 M

6. How many moles of $AgNO_3$ are found in 500 mL of a 5.0 M solution of $AgNO_3$? (1) 2.5 moles (2) 5.0 moles (3) 10 moles (4) 170 moles

7. What is the molarity of a solution that contains 80 g of NaOH in 4.0 liters of solution? (1) 0.50 M (2) 2.0 M (3) 8.0 M (4) 20.0 M

8. If 0.50 liter of a 12 M solution is diluted to 1.0 liter, what is the molarity of the new solution? (1) 2.4 M (2) 6.0 M (3) 12.0 M (4) 24.0 M

9. What is the molarity of a solution of KNO_3 (molecular mass = 101) that contains 404 grams of KNO_3 in 2.0 liters of solution? (1) 1.0 (2) 2.0 (3) 0.50 (4) 4.0

10. A 5% solution of potassium chloride contains 5 grams of solid dissolved in a quantity of water that is equal to (1) 100 grams (2) 100 moles (3) 95 grams (4) 95 moles

11. In 10 grams of a 5% salt solution, the mass of salt is (1) 0.5 gram (2) 0.2 gram (3) 95 grams (4) 9.5 grams

The Mathematics of Chemistry

#10 $5\% = \frac{5g}{Xg} \times 100 = .05 = \frac{5g}{Xg}$

$\frac{.05X}{.05} = \frac{5g}{.05}$

$X = 100g$

More on other side

#11. $5\% = \frac{Xg}{10g} \times 100$

$.05 = \frac{Xg}{10g}$

$X = .5g$

* QUESTIONS

1. Compared to pure water, a 1.0 m solution of NaCl will have a (1) higher boiling point and a higher freezing point (2) higher boiling point and a lower freezing point (3) lower boiling point and a higher freezing point (4) lower boiling point and a lower freezing point

2. Which 0.1 molal solution has the lowest freezing point? (1) $C_6H_{12}O_6$ (2) $(NH_4)_2SO_4$ (3) KBr (4) $CuSO_4$

3. Which 0.1 molal solution has the highest freezing point? (1) $C_6H_{12}O_6$ (2) $(NH_4)_2SO_4$ (3) KBr (4) $CuSO_4$

4. A 1-kilogram sample of water will have the highest freezing point when it contains (1) 1×10^{17} dissolved particles (2) 1×10^{19} dissolved particles (3) 1×10^{21} dissolved particles (4) 1×10^{23} dissolved particles

5. Which solution will freeze at the *lowest* temperature? (1) 1 mole of sugar in 500 g of water (2) 1 mole of sugar in 1,000 g of water (3) 2 moles of sugar in 500 g of water (4) 2 moles of sugar in 1,000 g of water

Choice 3 has largest concentration

QUESTIONS

1. How many grams of ammonium chloride (gram formula mass = 53.5 g) are contained in 0.500 L of a 2.00 M solution?

(1) 10.0 g (2) 26.5 g (3) 53.5 g (4) 107 g

2. What is the molarity of an H_2SO_4 solution if 0.25 liter of the solution contains 0.75 mole of H_2SO_4?

(1) 0.33 M (2) 0.75 M (3) 3.0 M (4) 6.0 M

3. What is the total number of grams of NaOH (formula mass = 40.) needed to make 1.0 liter of a 0.20 M solution?

(1) 20. g (2) 2.0 g (3) 80. g (4) 8.0 g

4. As additional $KNO_3(s)$ is added to a saturated solution of KNO_3 at constant temperature, the concentration of the solution

(1) decreases (2) increases (3) remains the same

5. What is the total number of grams of KCl (formula mass = 74.6) in 1.00 liter of 0.200 molar solution?

(1) 7.46 g (2) 14.9 g (3) 22.4 g (4) 29.8 g

6. If 0.50 liter of a 12-molar solution is diluted to 1.0 liter, the molarity of the new solution is (1) 2.4 (2) 6.0 (3) 12 (4) 24

#1-6 these questions are all explained on the sheet that says "Solutions" on the bottom!

22. How many grams of KOH are needed to prepare 250. milliliters of a 2.00 M solution of KOH (formula mass = 56.0)? (1) 1.00 (2) 2.00 (3) 28.0 (4) 112

23. What is the maximum number of grams of NH_4Cl that will dissolve in 200 grams of water at 70°C? (1) 60 (2) 70 (3) 100 (4) 120

24. A solution in which an equilibrium exists between dissolved and undissolved solute must be (1) saturated (2) unsaturated (3) dilute (4) concentrated

25. Which solution contains the greatest number of moles of solute? (1) 0.5 L of 0.5 M (2) 0.5 L of 2 M (3) 2 L of 0.5 M (4) 2 L of 2 M

26. Which quantity of salt will form a saturated solution in 100 grams of water at 45°C? (1) 30 g of KCl (2) 35 g of NH_4Cl (3) 60 g of KNO_3 (4) 110 g of $NaNO_3$

27. How many grams of ammonium chloride (gram formula mass = 53.5 g) are contained in 0.500 L of a 2.00 M solution? (1) 10.0 g (2) 26.5 g (3) 53.5 g (4) 107 g

Extended materials on the mole, formula from percent composition, gram molecular mass from gas density, colligative effects of solute on the solvent; which includes molality, boiling point elevation, freezing point depression, and abnormal behavior of electrolytes.

28. Which of the following gases has the greatest density at STP? (1) SO_2 (2) CO_2 (3) Cl_2 (4) N_2

29. What is the empirical formula of a compound whose composition by mass is 50.% sulfur and 50.% oxygen? (1) SO (2) SO_2 (3) SO_3 (4) S_2O_3

30. The density of a gas is 3.00 grams/Liter at STP. What is the gram molecular mass of the gas? (1) 7.47 g (2) 11.2 g (3) 22.4 g (4) 67.2 g

31. Which solution has the highest boiling point? (1) 1 mole of $NaNO_3$ in 250 g of water (2) 1 mole of $NaNO_3$ in 500 g of water (3) 1 mole of $NaNO_3$ in 750 g of water (4) 1 mole of $NaNO_3$ in 1000 g of water

1. How many grams of KNO_3 are needed to saturate 50.0 grams of water at 70°C? (1) 30. g (2) 65 g (3) 130. g (4) 160. g

2. How many grams of $NaNO_3$ per 100 grams of H_2O would produce a supersaturated solution? (1) 110. g at 40°C (2) 90. g at 30°C (3) 80. g at 20°C (4) 60. g at 10°C

3. As additional $KNO_3(s)$ is added to a saturated solution of KNO_3 at constant temperature, the concentration of the solution: (1) decreases (2) increases (3) remains the same

4. As additional solid KCl is added to a saturated solution of KCl, the conductivity of the solution: (1) decreases (2) increases (3) remains the same

5. Based on Reference Table D, which of the following substances is most soluble at 60°C? (1) NH_4Cl (2) KCl (3) NaCl (4) NH_3

* Table D is Now Table G *

9. When sodium chloride is dissolved in water, the resulting solution is classified as a (1) heterogeneous compound (2) homogeneous compound (3) heterogeneous mixture (4) homogeneous mixture

10. According to Reference Table G, which compound's solubility decreases most rapidly as the temperature changes from 10°C to 70°C? (1) NH_4Cl (2) NH_3 (3) HCl (4) KCl

11. Based on Reference Table E, which of the following saturated solutions would be the *least* concentrated? (1) sodium sulfate (2) potassium sulfate (3) copper (II) sulfate (4) barium sulfate

E-1. What is the name of the solid that forms when silver nitrate is mixed with sodium chloride? (1) silver nitrate (2) silver chloride (3) sodium chloride (4) sodium nitrate

E-2. According to Reference Table E, which of the following compounds would most likely have the smallest K_{sp}? (1) barium chloride (2) calcium sulfate (3) magnesium nitrate (4) silver acetate

E-3. Based on Reference Table E, which of the following compounds is the most soluble in water? (1) AgI (2) AgCl (3) $PbCl_2$ (4) $Pb(NO_3)_2$

1. What is the molarity of a solution that contains 4 grams of NaOH in 500 milliliters of solution? (Formula mass of NaOH = 40) (1) 0.1 M (2) 2 M (3) 0.2 M (4) 0.5 M

2. What is the molarity of a solution that contains 28 grams of KOH (formula mass = 56) in 2.0 liters of solution? (1) 1.0 M (2) 2.0 M (3) 0.25 M (4) 0.50 M

3. If 500 cubic centimeters of 2.0 M HCl is diluted with H_2O to a volume of 1 000 cubic centimeters, the molarity of the new solution will be (1) 1.0 M (2) 2.0 M (3) 0.25 M (4) 0.50 M

4. How many moles of KNO_3 are required to make 0.50 liter of a 2.0 M solution of KNO_3? (1) 1.0 (2) 2.0 (3) 0.50 (4) 4.0

1. What is the freezing point of a solution that contains 1.00 mole of a nonelectrolyte dissolved in 1 000 grams of water? (1) 0.00° C (2) 0.520° C (3) −1.86° C (4) −3.72° C

2. Which water solution will have the lowest freezing point? (1) 1 molal $CaCl_2$ (2) 1 molal NaCl (3) 1 molal $C_{12}H_{22}O_{11}$ (4) 2 molal $C_6H_{12}O_6$

3. Which 1 molal solution will have the highest boiling point? (1) KNO (2) $Mg(NO_3)_2$ (3) $Al(NO_3)_3$ (4) NH_4NO_3

4. NaOH is added to one beaker of distilled water, and C_2H_5OH is added to another beaker of distilled water. Both of the solutions that are formed will (1) be strong electrolytes (2) turn litmus paper blue (3) have a lower boiling point than pure water (4) have a lower freezing point than pure water

5. At standard pressure, a molal solution of sugar has a boiling point (1) greater than 100 °C and a freezing point greater than 0 °C (2) greater than 100 °C and a freezing point less than 0 °C (3) less than 100 °C and a freezing point greater than 0 °C (4) less than 100 °C and a freezing point less than 0 °C

6. According to Reference Table E, which 0.1 molal solution will have the lowest freezing point? (1) HF (2) HNO_2 (3) HNO_3 (4) CH_3COOH

D-1. A solution contains 90 grams of a salt dissolved in 100 grams of water at 40°C. The solution could be an unsaturated solution of (1) KCl (2) KNO_3 (3) NaCl (4) $NaNO_3$

D-2. Based on Reference Table G, which of the following substances is most soluble at 60° C? (1) NH_4Cl (2) KCl (3) NaCl (4) $NaNO_3$

D-3. A solution contains 52 grams of solute per 100 grams of water at 80°C. This solution could be a saturated solution of (1) NaCl (2) $NaNO_3$ (3) KCl (4) $KClO_3$

D-4. Which two salts are equally soluble in 100 mL of H_2O at 76°C? (1) NaCl and $KClO_3$ (2) NaCl and KCl (3) $NaNO_3$ and KCl (4) KCl and KNO_3

D-5. Given 100 mL of water at 10°C that contains 60 grams of NaNO. In order to form a saturated solution at 10°C, how many more grams of $NaNO_3$ must be added? (1) 19 (2) 38 (3) 60 (4) 120

12. Which solute, when added to 1,000 grams of water, will produce a solution with the highest boiling point? (1) 29 g of NaCl (2) 58 g of NaCl (3) 31 g of $C_2H_4O_2$ (4) 62 g of $C_2H_6O_2$

13. What occurs as a salt dissolves in water? (1) The number of ions in the solution decreases, and the F.P. point decreases. (2) The number of ions in the solution decreases, and the F.P. point increases. (3) The number of ions in the solution increases, and the F.P. point decreases. (4) The number of ions in the solution increases, and the F.P. point increases.

Freezing Pt. got cut off

7. A 1 kilogram sample of water will have the highest freezing point when it contains

(1) 1×10^{17} dissolved particles (2) 1×10^{19} dissolved particles

(3) 1×10^{21} dissolved particles (4) 1×10^{23} dissolved particles

8. Compared to the normal freezing point and boiling point of water, a 1-molal solution of sugar in water will have a

(1) higher freezing point and a lower boiling point
(2) higher freezing point and a higher boiling point
(3) lower freezing point and a lower boiling point
(4) lower freezing point and a higher boiling point

9. Which ratio of solute-to-solvent could be used to prepare a solution with the highest boiling point?

(1) 1 g of NaCl dissolved per 100 g of water
(2) 1 g of NaCl dissolved per 1000 g of water
(3) 1 g of $C_{12}H_{22}O_{11}$ dissolved per 100 g of water
(4) 1 g of $C_{12}H_{22}O_{11}$ dissolved per 1000 g of water

10. Which expression defines the molality (m) of a solution?

(1) $\frac{\text{grams of solute}}{\text{kg of solution}}$ (2) $\frac{\text{moles of solute}}{\text{kg of solution}}$

(3) $\frac{\text{grams of solute}}{\text{kg of solvent}}$ (4) $\frac{\text{moles of solute}}{\text{kg of solvent}}$

11. A student dissolves 1.0 mole of sucrose ($C_{12}H_{22}O_{11}$) in 1,000 grams of water at 1.0 atmosphere. Compared to the boiling point of pure water, the boiling point of the resulting solution is

(1) 0.52 C° lower (2) 1.86 C° lower (3) 0.52 C° higher
(4) 1.86 C° higher

These problems (# 7-11 are done on a previous sheet)

23 35.5
NaCl = 58.5 g/mol

12. Which solute, when added to 1,000 grams of water, will produce a solution with the highest boiling point?

(1) 29 g of NaCl .5 mol (2) 58 g of NaCl 1 mol
(3) 31 g of $C_2H_6O_2$ .5 mol (4) 62 g of $C_2H_6O_2$ 1 mol

$C_2H_6O_2$
$24 + 6 + 32 = 62$ g/mol

13. What occurs as a salt dissolves in water?

(1) The number of ions in the solution decreases, and the freezing point decreases.
(2) The number of ions in the solution decreases, and the freezing point increases.
(3) The number of ions in the solution increases, and the freezing point decreases.
(4) The number of ions in the solution increases, and the freezing point increases.

#12) New B.P. = 100°C + (molality × #particles × .512°C/m)

More on other Side

1) ¡3 eliminated b/c ↑[ ] will ↑ B.P.

2) NaCl → $Na^+ + Cl^-$ b/c it's ionic
2 particles

4) $C_2H_6O_2$ = covalent ∴ 1 particle

if Σ 7's are equal, # particles will determine B.P. elevation & F.P. depression