

Name: _____

Unit Review
Solution Chemistry

Date: _____

- Which compound is insoluble in water?
 - calcium bromide
 - potassium bromide
 - silver bromide
 - sodium bromide
- Which barium salt is *insoluble* in water?
 - BaCO_3
 - BaCl_2
 - $\text{Ba}(\text{ClO}_3)_2$
 - $\text{Ba}(\text{NO}_3)_2$
- Which compound is insoluble in water?
 - BaSO_4
 - CaCrO_4
 - KClO_3
 - Na_2S
- Which ion, when combined with chloride ions, Cl^- , forms an insoluble substance in water?
 - Fe^{2+}
 - Mg^{2+}
 - Pb^{2+}
 - Zn^{2+}
- Based on Reference Table F, which of these saturated solutions has the lowest concentration of dissolved ions?
 - $\text{NaCl}(\text{aq})$
 - $\text{MgCl}_2(\text{aq})$
 - $\text{NiCl}_2(\text{aq})$
 - $\text{AgCl}(\text{aq})$
- According to Reference Table F, which of these compounds is most soluble at 298 K and 1 atm?
 - AgNO_3
 - AgCl
 - PbCrO_4
 - PbCO_3
- According to Reference Table F, which substance is most soluble?
 - AgI
 - CaSO_4
 - PbCl_2
 - $(\text{NH}_4)_2\text{CO}_3$

- Based on Reference Table F, which of the following compounds is *least* soluble in water?
 - NaCl
 - Pb_2ClO_3
 - Na_2CrO_4
 - PbCrO_4
- Based on Reference Table F, which of these compounds is most soluble at 298 K and 1 atm?
 - BaCO_3
 - BaSO_4
 - ZnCO_3
 - ZnSO_4
- Which compound is most soluble in water?
 - silver acetate
 - silver nitrate
 - silver chloride
 - silver sulfate
- Which compound becomes *less* soluble in water as the temperature of the solution is increased?
 - HCl
 - KCl
 - NaCl
 - NH_4Cl
- Which compound is insoluble in water?
 - KOH
 - NH_4Cl
 - Na_3PO_4
 - PbSO_4
- According to Table F, which compound is soluble in water?
 - barium phosphate
 - calcium sulfate
 - silver iodide
 - sodium perchlorate

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- Which compound is *least* soluble in water at 60°C?
 - KClO_3
 - KNO_3
 - NaCl
 - NH_4Cl
- An unsaturated aqueous solution of NH_3 is at 90°C in 100. grams of water. According to Reference Table G, how many grams of NH_3 could this unsaturated solution contain?
 - 5 g
 10. g
 - 15 g
 20. g
- According to your Reference Tables, which substance forms an unsaturated solution when 80 grams of the substance is dissolved in 100 grams of H_2O at 10°C?
 - KI
 - KNO_3
 - NaNO_3
 - NaCl
- According to your Reference Tables, which of these compounds is the *least* soluble in water?
 - K_2CO_3
 - $\text{K}_2\text{H}_2\text{O}_7$
 - $\text{Ca}_3(\text{PO}_4)_2$
 - $\text{Ca}(\text{NO}_3)_2$
- The solubility of $\text{KClO}_3(\text{s})$ in water increases as the
 - temperature of the solution increases
 - temperature of the solution decreases
 - pressure on the solution increases
 - pressure on the solution decreases
- At STP, which of these substances is most soluble in H_2O ?
 - CCl_4
 - CO_2
 - HCl
 - N_2
- According to Table F, which of these salts is *least* soluble in water?
 - LiCl
 - RbCl
 - FeCl_2
 - PbCl_2
- Solubility data for four different salts in water at 60°C are shown in the table below.

Salt	Solubility in Water at 60°C
A	10 grams / 50 grams H_2O
B	20 grams / 60 grams H_2O
C	30 grams / 120 grams H_2O
D	40 grams/ 80 grams H_2O
- Which salt is most soluble at 60°C?
 - A
 - B
 - C
 - D
- Which of the following compounds is *least* soluble in water?
 - copper (II) chloride
 - aluminum acetate
 - iron (III) hydroxide
 - potassium sulfate
- According to Reference Table G, which of these substances is most soluble at 60°C?
 - NaCl
 - KCl
 - KClO_3
 - NH_4Cl
- According to Reference Table G, how many grams of KNO_3 would be needed to saturate 200 grams of water at 70°C?
 - 43 g
 - 86 g
 - 134 g
 - 268 g
- Based on Reference Table G, what is the maximum number of grams of $\text{KCl}(\text{s})$ that will dissolve in 200 grams of water at 50°C to produce a saturated solution?
 - 38 g
 - 42 g
 - 58 g
 - 84 g
- Which compound is *least* soluble in 100 grams of water at 40°C?
 - SO_2
 - NaCl
 - KClO_3
 - NH_4Cl

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31. A 2.00-liter sample of a gas has a mass of 1.80 grams at STP. What is the density, in grams per liter, of this gas at STP?

- (1) 0.900
- (2) 1.80
- (3) 11.2
- (4) 22.4

32. Based on Reference Table G, what change will cause the solubility of KNO_3 to increase?

- (1) decreasing the pressure
- (2) increasing the pressure
- (3) decreasing the temperature
- (4) increasing the temperature

33. According to Reference Table G, which of the following substances is *least* soluble in 100 grams of water at 50°C ?

- (1) NaCl
- (2) KCl
- (3) NH_4Cl
- (4) HCl

34. 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

35. According to Reference Table G, how does a decrease in temperature from 40°C to 20°C affect the solubility of NH_3 and KCl ?

- (1) The solubility of NH_3 decreases, and the solubility of KCl decreases.
- (2) The solubility of NH_3 decreases, and the solubility of KCl increases.
- (3) The solubility of NH_3 increases, and the solubility of KCl decreases.
- (4) The solubility of NH_3 increases, and the solubility of KCl increases.

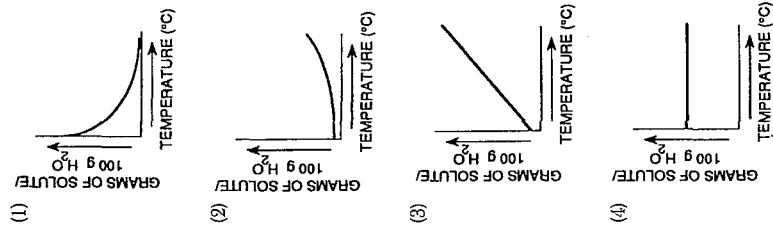
36. Which of the salts listed below is most soluble at 60°C ?

- (1) NaNO_3
- (2) KNO_3
- (3) NH_4Cl
- (4) KCl

37. A student obtained the following data in determining the solubility of a substance.

Temperature ($^\circ\text{C}$)	Grams of Solute/100 g H_2O
10	70
30	45
60	23
90	11

Which graph best represents the solubility curve drawn from the results obtained by the student?



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38. Based on Reference Table G, which of the following substances is most soluble at 50°C ?

- (1) KClO_3
- (2) NH_3
- (3) NaCl
- (4) NH_4Cl

39. Which compound decreases in solubility as the temperature of the solution is increased from 10°C to 50°C ?

- (1) NH_4Cl
- (2) NaCl
- (3) NH_3
- (4) NaNO_3

40. According to Reference Table G, what is the approximate difference between the amounts of KClO_3 and KNO_3 soluble in 100 grams of water at 40°C ?

- (1) 17 g
- (2) 22 g
- (3) 47 g
- (4) 64 g

41. A student tested the solubility of a salt at different temperatures and then used Reference Table G to identify the salt. The student's data table appears below.

Temperature ($^\circ\text{C}$)	g of salt per 10 g of water
30	1.2
50	2.2
62	3.0
76	4.0

What is the identity of the salt?

- (1) potassium nitrate
- (2) sodium chloride
- (3) potassium chlorate
- (4) ammonium chloride

42. As the temperature increases from 0°C to 25°C the amount of NH_3 that can be dissolved in 100 grams of water

- (1) decreases by 10 grams
- (2) decreases by 40 grams
- (3) increases by 10 grams
- (4) increases by 40 grams

43. According to Reference Table G, a temperature change from 10°C to 30°C would have the *least* effect on the solubility of

- (1) NaCl
- (2) KClO_3
- (3) NH_3
- (4) SO_2

44. A student obtained the following data in a chemistry laboratory.

Trial	Temperature ($^\circ\text{C}$)	Solubility (grams of KNO_3 /100 g of H_2O)
1	25	40
2	32	50
3	43	70
4	48	60

Based on Reference Table G, which of the trials seems to be in error?

- (1) 1
- (2) 2
- (3) 3
- (4) 4

45. Which salt has the greatest change in solubility between 30°C and 50°C ?

- (1) KNO_3
- (2) KCl
- (3) NaNO_3
- (4) NaCl

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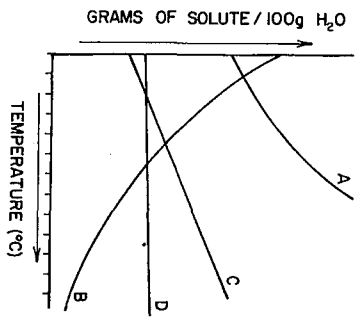
46. A student determined the mass, in grams, of compound X that would saturate 30. grams of water over a temperature range of 40.°C in 10-degree intervals. The results are tabulated below.

Grams of Dissolved Compound X	Temperature of 30. grams of H ₂ O
2.0 g	10.°C
4.0 g	20.°C
8.0 g	30.°C
16 g	40.°C
32 g	50.°C

If this solubility trend continues, what is the total number of grams of compound X that will dissolve in 30. grams of water at 60.°C?

(1) 16 (2) 32 (3) 48 (4) 64

47. The graph below represents four solubility curves. Which curve best represents the solubility of a gas in water?



- (1) A (2) B (3) C (4) D

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48. The solubility of KCl(s) in water depends on the

(1) pressure on the solution
 (2) rate of stirring
 (3) size of the KCl sample
 (4) temperature of the water

49. Under which conditions of temperature and pressure is a gas most soluble in water?

(1) high temperature and low pressure
 (2) high temperature and high pressure
 (3) low temperature and low pressure
 (4) low temperature and high pressure

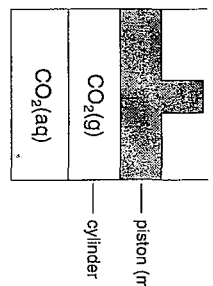
50. At room temperature, the solubility of which solute in water would be most affected by a change in pressure?

(1) methanol (2) carbon dioxide
 (3) sodium nitrate (4) sugar

51. As the pressure on a gas confined above a liquid increases, the solubility of the gas in the liquid

(1) decreases (2) increases
 (3) remains the same (4) increases

52. Given the diagram below that shows carbon dioxide in an equilibrium system at a temperature of 298 K and a pressure of 1 atm:



Which changes *must* increase the solubility of the carbon dioxide?

(1) increase pressure and decrease temperature
 (2) increase pressure and increase temperature
 (3) decrease pressure and decrease temperature
 (4) decrease pressure and increase temperature

53. Carbon dioxide gas is most soluble in water under conditions of

(1) high pressure and low temperature
 (2) high pressure and high temperature
 (3) low pressure and low temperature
 (4) low pressure and high temperature

54. At which temperature can water contain the most dissolved oxygen at a pressure of 1 atmosphere?

(1) 10.°C (2) 20.°C (3) 30.°C (4) 40.°C

55. The solubility of a salt in a given volume of water depends primarily on the

(1) surface area of the salt crystals
 (2) temperature of the water
 (3) rate at which the salt and water are stirred
 (4) pressure on the surface of the water

56. A change in pressure would have the greatest effect on the solubility of a

(1) solid in a liquid (2) liquid in a liquid
 (3) gas in a liquid (4) liquid in a solid

57. When PbI₂(s) is added to Na₂CO₃(aq), a white precipitate is formed. According to Reference Table F, the white precipitate most likely is

(1) KNO₃ (2) NaI (3) Na₂CO₃
 (4) PbCO₃

58. A student prepares four aqueous solutions, each with a different solute. The mass of each dissolved solute is shown in the table below.

Mass of Dissolved Solute for Four Aqueous Solutions		
Solution Number	Solute	Mass of Dissolved Solute (per 100. g of H ₂ O at 20.°C)
1	KI	120. g
2	NaNO ₃	88 g
3	KCl	25 g
4	KClO ₃	5 g

Which solution is saturated?

(1) 1 (2) 2 (3) 3 (4) 4

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59. A student adds solid KCl to water in a flask. The flask is sealed with a stopper and thoroughly shaken until no more solid KCl dissolves. Some solid KCl is still visible in the flask. The solution in the flask is
- saturated and is at equilibrium with the solid KCl
 - saturated and is not at equilibrium with the solid KCl
 - unsaturated and is at equilibrium with the solid KCl
 - unsaturated and is not at equilibrium with the solid KCl
60. A solute is added to water and a portion of the solute remains undissolved. When equilibrium between the dissolved and undissolved solute is reached, the solution must be
- dilute
 - saturated
 - unsaturated
 - supersaturated
61. When an equilibrium exists between the dissolved and the undissolved solute in a solution, the solution must be
- diluted
 - saturated
 - supersaturated
 - unsaturated
62. As additional $\text{KNO}_3(s)$ is added to a saturated solution of KNO_3 at constant temperature, the concentration of the solution
- decreases
 - increases
 - remains the same
 - decreases
63. What is the total mass of KNO_3 that must be dissolved in 50. grams of H_2O at 60°C to make a saturated solution?
- 32 g
 - 53 g
 - 64 g
 - 106 g
64. What is the mass of NH_4Cl that must dissolve in 200. grams of water at 50°C to make a saturated solution?
- 26 g
 - 42 g
 - 84 g
 - 104 g
65. When 5 grams of KCl are dissolved in 50. grams of water at 25°C , the resulting mixture can be described as
- heterogeneous and unsaturated
 - heterogeneous and supersaturated
 - homogeneous and unsaturated
 - homogeneous and supersaturated
66. An unsaturated solution is formed when 80. grams of a salt is dissolved in 100. grams of water at 40°C . This salt could be
- KCl
 - KNO_3
 - NaCl
 - NaNO_3
67. A saturated solution of NaNO_3 is prepared at 60°C using 100. grams of water. As this solution is cooled to 10°C , NaNO_3 precipitates (settles) out of the solution. The resulting solution is saturated. Approximately how many grams of NaNO_3 settled out of the original solution?
- 46 g
 - 61 g
 - 85 g
 - 126 g
68. The molarity of an aqueous solution of NaCl is defined as the
- grams of NaCl per liter of water
 - grams of NaCl per liter of solution
 - moles of NaCl per liter of water
 - moles of NaCl per liter of solution
69. What is the molarity of 1.5 liters of an aqueous solution that contains 52. grams of lithium fluoride, LiF , (gram-formula mass = 26 grams/mole)?
- 1.3 M
 - 2.0 M
 - 3.0 M
 - 0.75 M
70. The data collected from a laboratory titration is used to calculate the
- rate of a chemical reaction
 - heat of a chemical reaction
 - concentration of a solution
 - boiling point of a solution

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71. Which phrase describes the molarity of a solution?
- liters of solute per mole of solution
 - liters of solution per mole of solution
 - moles of solute per liter of solution
 - moles of solution per liter of solution
72. Molarity is defined as the
- moles of solute per kilogram of solvent
 - moles of solute per liter of solution
 - mass of a solution
 - volume of a solvent
73. A student wants to prepare a 1.0-liter solution of a specific molarity. The student determines that the mass of the solute needs to be 30. grams. What is the proper procedure to follow?
- Add 30. g of solute to 1.0 L of solvent.
 - Add 30. g of solute to 970. mL of solvent to make 1.0 L of solution.
 - Add 1000. g of solvent to 30. g of solute.
 - Add enough solvent to 30. g of solute to make 1.0 L of solution.
74. What is the total number of grams of NaI(s) needed to make 1.0 liter of a 0.010 M solution?
- 0.015
 - 0.15
 - 1.5
 - 15
75. Based on your reference tables, which compound could form a concentrated solution?
- AgBr
 - Ag_2CO_3
 - AgCl
 - AgNO_3
76. Which solution is the most concentrated?
- 1 mole of solute dissolved in 1 liter of solution
 - 2 moles of solute dissolved in 3 liters of solution
 - 6 moles of solute dissolved in 4 liters of solution
 - 4 moles of solute dissolved in 8 liters of solution
77. What is the total mass of solute in 1000. grams of a solution having a concentration of 5.0%?
- 0.05g
 - 0.5 g
 - 5g
 - 50 g
78. Which unit can be used to express the concentration of a solution?
- L/s
 - J/g
 - ppm
 - kPa
79. What is the total mass of solute in 1000. grams of a solution having a concentration of 5 parts per million?
- 0.005 g
 - 0.05g
 - 0.5 g
 - 5g
80. What is the concentration of $\text{O}_2(g)$, in parts per million, in a solution that contains 0.008 gram of $\text{O}_2(g)$ dissolved in 1000. grams of $\text{H}_2\text{O}(l)$?
- 0.8 ppm
 - 8 ppm
 - 80 ppm
 - 800 ppm
81. If 0.025 gram of $\text{Pb}(\text{NO}_3)_2$ is dissolved in 100. grams of H_2O , what is the concentration of the resulting solution, in parts per million?
- 2.5×10^{-4} ppm
 - 2.5 ppm
 - 250 ppm
 - 4.0×10^3 ppm
82. What is the concentration of a solution, in parts per million, if 0.02 gram of Na_3PO_4 is dissolved in 1000 grams of water?
- 20 ppm
 - 2 ppm
 - 0.2 ppm
 - 0.02 ppm
83. How many grams of NaCl are needed to be dissolved in water to make 1.0 gram of a 100.0 ppm solution?
- 1.0×10^{-4} g
 - 1.0×10^{-3} g
 - 1.0×10^{-2} g
 - 1.0×10^{-1} g
84. How many grams of $\text{C}_6\text{H}_{12}\text{O}_6$ are needed to be dissolved in water to make 100. grams of a 250. ppm solution?
- 4.00×10^2 g
 - 2.50×10^4 g
 - 4.00×10^1 g
 - 2.50×10^3 g

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85. How many grams of KNO_3 should be dissolved in water to make 500.0 grams of a 20.0 ppm solution?
 (1) 1.00×10^{-1} g (3) 1.00×10^{-3} g
 (2) 1.00×10^{-2} g (4) 1.00×10^{-4} g
86. How many grams of KOH should be dissolved in water to make 2000.0 grams of a 10.0 ppm solution?
 (1) 2.00 g (3) 2.0×10^2 g
 (2) 2.0×10^{-1} g (4) 2.0×10^{-3} g
87. What is the concentration expressed in parts per million of a solution containing 30.0 grams of NaNO_3 in 70.0 grams of H_2O ?
 (1) 2.38×10^6 ppm (3) 3.00×10^5 ppm
 (2) 4.29×10^6 ppm (4) 3.33×10^6 ppm
88. What is the concentration expressed in parts per million of a solution containing 5.0 grams of NH_4Cl in 95.0 grams of H_2O ?
 (1) 5.0×10^4 ppm (3) 5.3×10^4 ppm
 (2) 2.0×10^7 ppm (4) 1.9×10^7 ppm
89. What is the concentration expressed in parts per million of a solution containing 15.0 grams of KNO_3 in 65.0 grams of H_2O ?
 (1) 1.88×10^5 ppm (3) 2.31×10^5 ppm
 (2) 2.00×10^5 ppm (4) 5.33×10^6 ppm
90. What is the concentration expressed in parts per million of a solution containing 20.0 grams of $\text{C}_6\text{H}_{12}\text{O}_6$ in 80.0 grams of H_2O ?
 (1) 2.50×10^5 ppm (3) 4.00×10^6 ppm
 (2) 2.00×10^5 ppm (4) 5.00×10^6 ppm
91. Which solution has the highest boiling point at standard pressure?
 (1) 0.10 M KCl(aq)
 (2) 0.10 M $\text{K}_2\text{SO}_4(\text{aq})$
 (3) 0.10 M $\text{K}_3\text{PO}_4(\text{aq})$
 (4) 0.10 M $\text{KNO}_3(\text{aq})$
92. How do the boiling point and freezing point of a solution of water and calcium chloride at standard pressure compare to the boiling point and freezing point of water at standard pressure?
 (1) Both the freezing point and boiling point of the solution are higher.
 (2) Both the freezing point and boiling point of the solution are lower.
 (3) The freezing point of the solution is higher and the boiling point of the solution is lower.
 (4) The freezing point of the solution is lower and the boiling point of the solution is higher.
93. Compared to the freezing point and boiling point of water at 1 atmosphere, a solution of a salt and water at 1 atmosphere has a
 (1) lower freezing point and a lower boiling point
 (2) lower freezing point and a higher boiling point
 (3) higher freezing point and a lower boiling point
 (4) higher freezing point and a higher boiling point
94. Which aqueous solution of KI freezes at the lowest temperature?
 (1) 1 mol of KI in 500. g of water
 (2) 2 mol of KI in 500. g of water
 (3) 1 mol of KI in 1000. g of water
 (4) 2 mol of KI in 1000. g of water
95. Which solution has the lowest freezing point?
 (1) 10. g of KI dissolved in 100. g of water
 (2) 20. g of KI dissolved in 200. g of water
 (3) 30. g of KI dissolved in 100. g of water
 (4) 40. g of KI dissolved in 200. g of water
96. Compared to a 2.0 M aqueous solution of NaCl at 1 atmosphere, a 3.0 M aqueous solution of NaCl at 1 atmosphere has a
 (1) lower boiling point and a higher freezing point
 (2) lower boiling point and a lower freezing point
 (3) higher boiling point and a higher freezing point
 (4) higher boiling point and a lower freezing point

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97. Compared to the freezing point of 1.0 M KCl(aq) at standard pressure, the freezing point of 1.0 M $\text{CaCl}_2(\text{aq})$ at standard pressure is
 (1) lower (3) the same
 (2) higher
98. Compared to a 0.1 M aqueous solution of NaCl, a 0.8 M aqueous solution of NaCl has 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
99. Compared to pure water, an aqueous solution of calcium chloride has a
 (1) higher boiling point and higher freezing point
 (2) higher boiling point and lower freezing point
 (3) lower boiling point and higher freezing point
 (4) lower boiling point and lower freezing point
100. At standard pressure when NaCl is added to water, the solution will have a
 (1) higher freezing point and a lower boiling point than water
 (2) higher freezing point and a higher boiling point than water
 (3) lower freezing point and a higher boiling point than water
 (4) lower freezing point and a lower boiling point than water

