

Chemistry 1020 Sample 1 for Hour Exam #4 (11A, 11B, & 13) Revised by RI, 5/2003

.....**Each of the following questions is worth 7 points**.....

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1. When M and N react according to the equation $2 M + 3 N = 1 P + 2 Q$, it is found there are 4 moles of M, 10 moles of N, 12 moles of P, and 8 moles of Q in the container at equilibrium. If 19 moles of N were placed in the container originally, how many moles of P were in the container originally? (13-6)

A. 10 B. 9 C. 6 D. 15 E. 4

2. 56.4 grams of ammonium borate and 52.0 grams of water are mixed. What is the mole fraction of ammonium borate in the mixture? (11A-4)

A. 0.173 B. 0.853 C. 0.520 D. 0.951 E. 0.147

3. A semipermeable membrane is placed in a U-shaped tube. Then one side of the U-tube is filled with 0.1 m urea and the other side is filled with 0.3 m urea. Choose the correct statements from the following regarding the apparatus using *K-TYPE* answer format. (11B-4)

K-TYPE answer format:

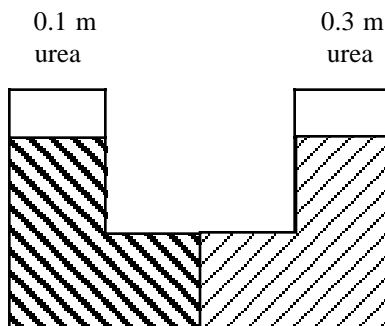
Mark *a* if A, B, C are correct;

b if A, C;

c if B, D;

d if D only;

e otherwise.



- A. Water flows from the right side of the U-tube to the left side as the system goes to equilibrium.
B. If the two sides of the U-type contain the same volumes of the two solutions at the beginning, there would be less volume in the left side than in the right when the system reaches equilibrium.
C. The concentration of the solution in the right cell would increase as the system goes to equilibrium.
D. The amount of urea on the left side would be the same at equilibrium as it was at the beginning of the experiment.

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4. At a certain temperature, the equilibrium constant for the reaction, $3A(g) + B(g) = C(g) + D(g)$, is 0.0021. If 2 moles of A, 4 moles of B, 0.1 moles of C, and 0.9 moles of D is placed in a 12 liter container, then **(13-5)**
- A. $Q = 0.0028$ and the system reaches equilibrium by decreasing the amount of D.
 - B. $Q = 0.40$ and the system reaches equilibrium by increasing the amount of D.
 - C. $Q = 0.0028$ and the system reaches equilibrium by increasing the amount of D.
 - D. $Q = 0.40$ and the system reaches equilibrium by decreasing the amount of D.
 - E. None of the above is correct.
5. At a certain temperature it is found that 2 moles of $H_2(g)$, 2 moles of $O_2(g)$, and 3 moles of $H_2O(g)$ are in equilibrium in a 45 liter container. What is the equilibrium constant for the reaction, $2H_2(g) + O_2(g) = 2H_2O(g)$? **(13-3)**
- A. 6.0×10^1 B. 1.3×10^0 C. 2.0×10^{-2} D. 1.1×10^0 E. 5.1×10^1
6. 1.60 grams of an unknown substance is dissolved in 50.0 grams of water to produce a solution which has a freezing point of $-0.720^\circ C$. What is the molecular weight of the unknown? The K_f of water is $1.86^\circ C/m$ and the K_b of water is $0.51^\circ C/m$. **(11B-10)**
- A. 22.7 g/mole B. 80.7 g/mole C. 42.9 g/mole D. 82.7 g/mole E. 121 g/mole
7. Choose the substances which are soluble in water using **K-TYPE** answer format:
Mark a if A,B,C are soluble; b if A, C; c if B, D; d if D only; e otherwise. **(11B-2)**
- A. zinc (II) sulfite
 - B. nickel (II) acetate
 - C. lead(II) sulfate
 - D. sodium nitrate

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8. **K-TYPE Answer Format:** Mark *a* if A,B,C are correct; *b* if A, C; *c* if B, D; *d* if D only; *e* otherwise.
- A. Potassium sulfite would probably be more soluble in hot water than in cold water. (11A-8)
 - B. A reaction with a large value of K might approach equilibrium very rapidly. (13-4)
 - C. Acetic acid would only break apart to a small extent if dissolved in water. (11A-1/2)
 - D. A small value of K indicates that the reaction under consideration could be used to produce high yields of product. (13-4)
9. What is the molarity of sodium hydroxide in a aqueous solution which is 15.2% sodium hydroxide by weight? The specific gravity of the solution is 1.12. (11A-7)
- A. 4.26 M B. 29.5 M C. 3.39 M D. 23.5 M E. 8.51 M
10. **K-TYPE answer format:** Mark *a* if A,B,C are correct; *b* if A,C; *c* if B,D; *d* if D only; *e* otherwise. (11B-5)
- A. A 0.1 m solution of urea would have the same freezing point as a 0.1 m solution of sugar.
 - B. A 0.1 m solution of NaCl would have a higher boiling point than a 0.1 m solution of sugar.
 - C. The vapor pressure of a 0.7 m solution of sugar would be lower than that of 0.5 m solution of sugar.
 - D. The osmotic pressure of a 0.2 m solution of urea would be higher than the osmotic pressure of 0.6 m urea.

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11. A rule often used to determine which substances mix together is "like dissolves like." Therefore when you mix water (a polar substance) with a substance such as CCl_4 which is nonpolar the two do not form a solution, but rather stay separate. If a nonpolar organic substance is now added to the mixture and shaken until equilibrium is reached, the substance A distributes itself between the two layers in a particular circumstance so that the equilibrium constant

$$K = \frac{A(\text{dissolved in water})}{A(\text{dissolved in } \text{CCl}_4)} \text{ is } 8.0.$$

If 10 grams of A are added to a container with 100 ml of water and 200 ml of CCl_4 , how much A (in grams) would be in the CCl_4 layer at equilibrium? **(13-Challenge)**

- A. 9.4 g B. 8.6 g C. 1.0 g D. 0.93 g E. 4.3 g
12. What is the concentration of a solution prepared by diluting 151 milliliters of 0.25 M sodium hydroxide to 453 milliliters? **(11B-1)**
- A. 12.0 M B. 0.75 M C. 0.083 M D. 1.33 M E. 0.052 M
13. Calculate the number of grams of lithium acetate in 200.0 milliliters of 0.50 M lithium acetate. **(11B-1)**
- A. 4.1×10^0 grams B. 8.2×10^0 grams C. 1.5×10^0 grams D. 6.6×10^0 grams E. 1.6×10^2 grams
14. If the solubility of a sodium chloride is 30 g per 100 grams of water, how many grams of the salt would dissolve in 125 mL of water? **(11A-1)**
- A. 15 g B. 38 g C. 60 g D. 24 g E. 40 g

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15. What is the expected boiling point of a solution prepared by adding 19.0 grams of sugar (gfw =180.0) to 175 mL of water ? The K_f of water is $1.86^\circ\text{C}/\text{m}$ and the K_b of water is $0.51^\circ\text{C}/\text{m}$. **(11B-7)**
- A. 100.16°C B. 100.31°C C. 103.25°C D. 101.12°C E. 98.88°C
-
16. Given the reaction $2 \text{H}_2 (\text{g}) + \text{O}_2 (\text{g}) = 2 \text{H}_2\text{O} (\text{g})$, what happens overall if H_2O is added to a system in which the reaction is at equilibrium? **(13-8/9)**
- A. The amount of H_2O increases, H_2 increases, O_2 decreases.
B. The amount of H_2O increases, H_2 and O_2 decrease.
C. The amounts of H_2O , H_2 and O_2 all increase.
D. The amount of H_2O increases, while the amount of H_2 and O_2 remain constant.
E. The amount of H_2O increases, H_2 decreases, O_2 increases.

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No. in Q-Bank	No. on Test	Correct Answer
8	5	1 B
3	5	2 E
15	5	3 C
11	5	4 D
9	5	5 E
7	5	6 D
13	5	7 C
5	5	8 A
16	5	9 A
14	5	10 A
12	5	11 A
1	5	12 C
2	5	13 D
4	5	14 B
6	5	15 B
10	5	16 C