

Unless we change direction  
we will wind up where we  
are headed.--Confucius

## Unit 8 Sample Test

The test will be similar in format to previous tests with five multiple choice questions, two required problems, a choice of one out of two smaller problems, a choice of two out of four chemical reactions to write and one essay question. Beginning with this test *all* solubility rules will be given. Be sure to check the activity series as well as solubility rules before writing reactions.

*The following are representative of typical multiple choice questions but do not necessarily indicate topics to be addressed on your actual test.*

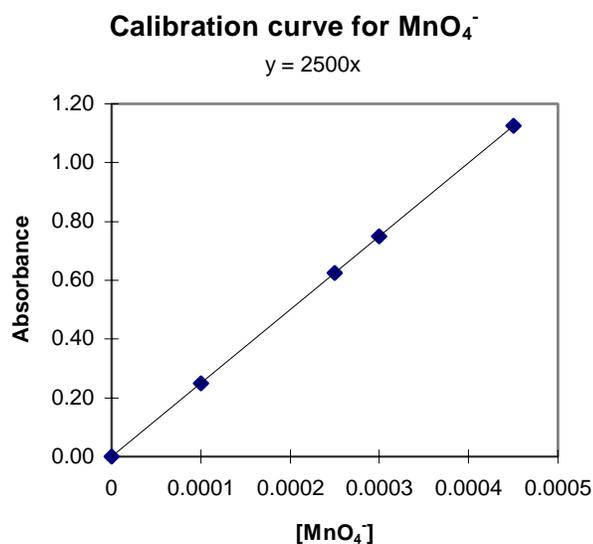
- \_\_\_\_\_1. In a solution which obeys Beer's Law, the concentration of the absorbing species and absorbance are
- inversely proportional
  - directly proportional
  - exponentially related
  - not related
- \_\_\_\_\_2. Which of the following liquids are *least* likely to be miscible?
- polar + polar
  - non-polar + polar
  - non-polar + non-polar
  - all of the above will be miscible
- \_\_\_\_\_3. Which method of expressing solution concentration is *temperature dependent*?
- mass %
  - mole fraction
  - molality
  - Molarity
- \_\_\_\_\_4. Which type of water-based solution would be likely to have the *lowest* freezing point?
- pure water
  - 1 M sucrose (non-electrolyte)
  - 1 M  $\text{Na}_3\text{PO}_4$  (electrolyte)
  - 1 M NaCl (electrolyte)
- \_\_\_\_\_5. Under what conditions will club soda be likely to retain its "fizz" longer? (i.e., under what conditions will the gas remain *in* the liquid longer?)
- low pressure and low temperature
  - high pressure and low temperature
  - low pressure and high temperature
  - high pressure and high temperature

The next section consists of representative problems which might be found in the required section.

6. The first preparation of *sulfanilamide* (one of the sulfa drugs) was published in 1908. According to the abstract, the mass composition of the compound is 41.84% C, 4.68% H, 16.27% N, 18.58% O and 18.62% S. A solution of 1.27 g sulfanilamide in 15.0 g of 1,4-dichlorobenzene (f.p. = 53.1°C,  $K_f = 7.10$ ) has a freezing point of 49.6°C. What are the molecular formula and molar mass for this compound?

7. A 0.1523 g sample of steel containing manganese was dissolved in acid and treated with a strong oxidizing agent to produce a stoichiometric amount of purple  $\text{MnO}_4^-$  (1 Mn = 1  $\text{MnO}_4^-$ ). Some of this solution is placed in a spectrophotometer. Its absorbance was 0.780. Using the calibration curve provided, determine:

- $[\text{MnO}_4^-]$  in the sample (in mol/L)
- the moles of  $\text{MnO}_4^-$  in the sample solution if the total volume was 100 mL
- the grams of Mn present in the 100 mL
- the % Mn in the steel (by mass)



The next section consists of representative problems such as might be found in the "options" section.

*Each student is expected to select one problem from this section to work on.*

8. One commercial "cold pack" contains 100 mL of water and 30.0 g of  $\text{NH}_4\text{NO}_3$ . When the inner water container is punctured, the solid dissolves. The heat of solution ( $\Delta H_{\text{soln}}$ ) for ammonium nitrate is +26.2 kJ/mol. Assuming that the specific heat of the resulting solution is 4.184 J/g $^\circ\text{C}$ , the density of the water is 1.0 g/mL and the starting temperature of the water is 20.0 $^\circ\text{C}$ , determine the final temperature reached by the mixture.

9. a. How would you prepare 25 mL of a solution containing 0.10 M  $\text{BaCl}_2$  starting with solid  $\text{BaCl}_2$ ?

b. Starting with the solution in (a), how would you prepare 100 mL of a solution with a  $\text{BaCl}_2$  concentration of 0.020 M?

*The next section consists of representative reactions to complete and write balanced net-ionic equations for. Note that some reactions do not occur in aqueous solution and thus molecular equations are all that would be needed. Each student is expected to choose two from this section. **Phase symbols ((s), (aq) etc.) are required for full credit.***

10. For each of the following, complete the word equation, write a balanced net-ionic reaction, and tell what type of reaction it is. (*all four reactions occur in aqueous solution*)

a. potassium metal + water  $\rightarrow$  \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

b. calcium chloride + sodium nitrate  $\rightarrow$  \_\_\_\_\_

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c. hydrochloric acid + lead(II) nitrate → \_\_\_\_\_

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d. aluminum metal reacts with permanganate ions in basic solution; solid  $\text{MnO}_2$  and  $\text{Al(OH)}_4^-$  are among the products

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*The final section of the test will consist of one essay question selected from the following topics:*

- types of solutions (unsaturated, etc.)
- connections between ionic bond strength and heat of solution for univalent electrolytes
- colligative behavior of electrolytes vs. non-electrolytes

[Answers](#)