

General Instructions: Read each question carefully and express your answers in the expected format, using proper English grammar and punctuation. Show your work for all calculation problems and include units on answers where appropriate. To speed calculations, round all atomic weights to one decimal place. Draw a box around your final answer. If you need a calculator, pencil, etc., raise your hand.

Part A. Definitions (2 points each)

1. Solution -
2. \_\_\_\_\_ is energy from a molecule being in motion.
3. \_\_\_\_\_ is the term used to describe the amount of solute that will dissolve in solvent.
4. Solute -
5. \_\_\_\_\_ is a molecule that will conduct electricity in solution.
6. \_\_\_\_\_ are properties that depend on the number of moles of solute dissolved.
7. Colloid -
8. \_\_\_\_\_ is the part of a solution present in greater number of moles.
9. Percent solution (w/v) -
10. Potential energy -

Part B

11. Explain the following postulate of the kinetic molecular theory (KMT): As the temperature increases, the distance between particles increases. (5 points)
12. Describe a solid in terms of the KMT. (5 points)
13. List the three intermolecular forces and describe how they work, how strong they are, etc. (10 points)
14. List the three colligative properties and the effect of 1 mol solute on 1 kg water has on each of them. (5 points)
15. What is the molarity of a solution containing 257 g sucrose ( $C_{12}H_{22}O_{11}$ ) in 500.0 mL water? (5 points)
16. What is the normality of a solution composed of 527 g  $Mg(OH)_2$  dissolved in water to a final volume of 500.0 mL? (5 points)
17. How many calories does it take to convert 52.0 g ice at  $-10.0^\circ C$  to water at  $27.0^\circ C$ ? The heat of fusion is 79.6 cal/g and the specific heat is 1.00 cal/g $^\circ C$ . (5 points)

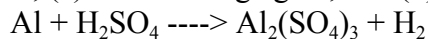
18. Complete the following table. (5 points)

| Molecule     | Soluble in Water | Electrolyte in Water |
|--------------|------------------|----------------------|
| NaCl         | _____            | _____                |
| $Ca(NO_3)_2$ | _____            | _____                |
| $Ca(OH)_2$   | _____            | _____                |
| $MgSO_4$     | _____            | _____                |
| $CH_4$       | _____            | _____                |

19. Identify the oxidation state of the underlined atom in the following molecules. (3 points)



20. In the following reaction, identify the (a) element that is reduced, (b) the element that is oxidized, (c) the reducing agent, and (d) the oxidizing agent. (8 points)



- (a) element that is reduced: \_\_\_\_\_
- (b) the element that is oxidized: \_\_\_\_\_
- (c) the reducing agent: \_\_\_\_\_
- (d) the oxidizing agent: \_\_\_\_\_

Part C. Multiple choice (2 points each)

21. The state of matter in which the intermolecular forces are weakest is  
a. solid b. liquid c. gas d. none of the above
22. The intermolecular forces between 2 molecules of ethyl alcohol,  $\text{CH}_3\text{CH}_2\text{OH}$  is(are)  
a. London forces b. hydrogen bonds c. Dipole-Dipole  
d. "a" and "b" e. "b" and "c" f. "a" and "b" and "c"
23. What is the state of ionic compounds at room temperature?  
a. solid b. liquid c. gas d. plasma
24. Which of the following transformations is condensation?  
a. Liquid  $\longrightarrow$  solid b. Solid  $\longrightarrow$  liquid  
c. Gas  $\longrightarrow$  liquid d. Solid  $\longrightarrow$  gas
25. Which of the following compounds exhibits hydrogen bonding?  
a. HCl b. NaF c. NaCl d. HF
26. Which of the following would have the highest boiling point?  
a.  $\text{CO}_2$  b.  $\text{I}_2$  c. He d.  $\text{F}_2$
27. The amount of energy it takes to change from a liquid to a solid is  
a. heat of vaporization b. heat of fusion c. specific heat d. none of the above
28. The element requiring the greatest amount of energy to melt is  
a.  $\text{I}_2$  b.  $\text{Cl}_2$  c.  $\text{Br}_2$  d.  $\text{F}_2$