

**Answers**

**PART 1. MULTIPLE CHOICE and FILL IN THE BLANK.** Circle the best answer or fill in the blank. **CAUTION:** Some questions may appear similar to homework questions but are probably not exactly the same.

**Given:** Active metals: potassium, sodium, calcium, magnesium, aluminum, zinc, iron, tin.

1. A substance that only partially ionizes in water is called a (1 pts)

- \*a) weak electrolyte
- b) nonelectrolyte
- c) semiconductor
- d) nonconductor
- e) strong electrolyte

2. In order to increase the solubility of a gas in a liquid, the temperature must be (2 pts)

- a) increased
- \*b) decreased
- c) will have no affect

3. In order to increase the solubility of a solid solute in a liquid, the temperature must be (2 pts)

- \*a) increased
- b) decreased
- c) will have no affect

4. Which of the following will dissolve in water? (2 pts)

- a)  $\text{CCl}_4$
- b) octane,  $\text{C}_8\text{H}_{18}$ , a compound in gasoline
- \*c)  $\text{KNO}_3$
- d) oil

5. The molarity (M) of a solution refers to (1 pts)

- \*a) moles of solute/L of solution
- b) moles of solute/L of solvent.
- c) moles of solute/100 mL of solution.
- d) grams of solute/100 mL of solution.
- e) grams of solute/L of solution.

6. The process that uses a membrane that allows small solute molecules and ions as well as solvent molecules to pass through is called \_\_\_\_\_. (1 pts)

- a) osmosis
- b) hemolysis
- c) crenation
- \*d) dialysis
- e) suspending

7. An example of an isotonic solution would be a \_\_\_\_\_. (2 pts)
- a) 6.0 % (m/v) glucose solution
  - b) 0.90% (m/v) glucose solution
  - c) 5.0% (m/v) NaCl solution
  - d) 1.1% (m/v) NaCl solution
  - \*e) 0.90% (m/v) NaCl solution**
8. If a red blood cell was placed in a 1.1% (m/v) NaCl solution, \_\_\_\_\_ would occur. (2 pts)
- a) nothing
  - \*b) crenation**
  - c) hemolysis
  - d) dialysis
  - e) suspension
9. A solution with less solute than an isotonic solution called a \_\_\_\_\_. (1 pts)
- a) colloid
  - b) suspension
  - \*c) hypotonic solution**
  - d) hypertonic solution
  - e) isotonic solution
10. The definition of an Arrhenius base is a compound that \_\_\_\_\_. (1 pts)
- a) accepts a proton
  - b) donates a proton
  - c) produces  $H^+$  ions in solution
  - \*d) produces hydroxide ions in solution**
  - e) has a sour taste
11. The definition of a Bronsted-Lowry acid is a compound that \_\_\_\_\_. (1 pts)
- a) accepts a proton
  - \*b) donates a proton**
  - c) produces  $H^+$  ions in solution
  - d) produces hydroxide ions in solution
  - e) has a sour taste
12. A solution with  $[H_3O^+] = 1.0 \times 10^{-9} M$ , is considered \_\_\_\_\_. (1 pts)
- a) acidic
  - \*b) basic**
  - c) neutral
13. A solution with  $[OH^-] = 1 \times 10^{-5} M$  is considered \_\_\_\_\_. (1 pts)
- a) acidic
  - \*b) basic**
  - c) neutral
14. A solution with a pH = 7 is considered \_\_\_\_\_. (1 pts)
- a) acidic
  - b) basic
  - \*c) neutral**

15. The function of a buffer is to (1 pts)
- change color at the end point of a titration.
  - act as a strong acid.
  - maintain a neutral pH.
  - \*d) maintain the pH of a solution.
  - be a strong base.
16. Which of the following represents a buffer system? (2 pts)
- NaOH and NaCl
  - \*b)  $\text{H}_2\text{CO}_3$  and  $\text{NaHCO}_3$
  - HF and NaOH
  - KCl and NaCl
  - HF and HCl
17. Alkalosis can occur if (2 pts)
- the  $\text{CO}_2$  levels in the blood are increased
  - \*b) the  $\text{CO}_2$  levels in the blood are decreased
  - the pH decreases
  - the  $\text{H}_2\text{CO}_3$  concentration increased
  - the  $[\text{H}^+]$  is increased
18. Which of the following molecules can form hydrogen bonds? (2 pts)
- $\text{CCl}_4$
  - $\text{SiH}_4$
  - $\text{BH}_3$
  - HCl
  - \*e. HF
19. When NaCl dissolves in water (1 pts)
- the  $\text{Cl}^-$  ions are attracted to dissolved  $\text{Na}^+$  ions.
  - the  $\text{Cl}^-$  ions are attracted to the partially negative oxygen atoms of the water molecule
  - the  $\text{Na}^+$  ions are attracted to  $\text{Cl}^-$  ions on the NaCl crystal.
  - \*d. the  $\text{Na}^+$  ions are attracted to the partially negative oxygen atoms of the water molecule.
  - the  $\text{Na}^+$  ions are attracted to the partially positive hydrogen atoms of the water molecule.
20. Heterogeneous mixtures that are trapped by filters and semipermeable membranes are called (1 pt)
- elements.
  - colloids.
  - \*c. suspensions.
  - solids.
  - hydrated.
21. In the process known as osmosis, \_\_\_\_\_ moves through a semipermeable membrane into an area of \_\_\_\_\_ concentration. (2 pts)
- solvent, lower solute
  - \*b) solvent, higher solute
  - solute, higher solute
  - solute, lower solute

22. The normal blood pH is about (1 pts)
- a) 7.6
  - \*b) 7.4**
  - c) 7.2
  - d) 7.0
  - e) 6.8
23. Which of the following is NOT a unit measuring radiation? (1 pts)
- a) Curie
  - b) Sievert
  - c) Becquerel
  - \*d) Nobel**
  - e) rem
  - f) rad
24. Choose the type of radiation that best matches the symbol  ${}^4_2\text{He}$ . (1 pts)
- a) proton
  - b) neutron
  - c) beta particle
  - \*d) alpha particle**
  - e) gamma ray
25. The symbol  ${}^0_{-1}e$  is a symbol used for a(n) (1 pts)
- a) proton
  - b) neutron
  - c) gamma ray
  - \*d) beta particle**
  - e) alpha particle
26. Which of the following types of radiation has the highest energy? (1 pts)
- a)  $\alpha$ -particles
  - b)  $\beta$ -particles
  - \*c)  $\gamma$ -rays**
  - d) visible light
  - e) All of these have the same energy.
27. A positron is a particle emitted from the nucleus and has the same mass as a(n) (1 pts)
- \*a) electron but has a positive charge.**
  - b) neutron but has a positive charge.
  - c) alpha particle.
  - d) proton but has a negative charge.
  - e) proton emitted from the nucleus.

28. The following reaction is classified as a \_\_\_\_\_. (1 pts)



- a) radioactive decay
- b) natural radioactivity
- c) nuclear fission
- \*d) nuclear fusion
- e) chain reaction

**PART 2. FILL IN THE BLANKS AND PROBLEMS. Show all units. Show all answers to correct significant figures. SHOW WORK for Partial Credit.**

29. A label on a 750 mL bottle of wine reads that the wine is 12% ethanol (alcohol) by volume. How many mL of ethanol is in this bottle? (5 pts)

$$(750 \text{ mL soln}) \left( \frac{12 \text{ mL ethanol}}{100 \text{ mL soln}} \right) = 90 \text{ mL ethanol}$$

30. How many grams of glucose are needed to prepare 500. mL of a 5.0%(m/v) glucose ( $\text{C}_6\text{H}_{12}\text{O}_6$ ) solution? (5 pts)

$$(500. \text{ mL soln}) \left( \frac{5.0 \text{ g glucose}}{100 \text{ mL soln}} \right) = 25 \text{ g glucose}$$

31. What is the molarity of a solution which contains 23.8 g of sodium chloride dissolved in 250 mL of solution? (5 pts)

$$23.8 \text{ g NaCl} \left( \frac{1 \text{ mole NaCl}}{58.44277 \text{ g}} \right) = 0.407 \text{ mole NaCl}$$

$$\left( \frac{0.407 \text{ mole NaCl}}{0.25 \text{ L}} \right) = 1.6 \text{ M NaCl}$$

32. What volume of a 6.00 M HCl solution is required to prepare 500. mL of a 0.300 M HCl solution? (5 pts)

$$V_1 C_1 = V_2 C_2$$

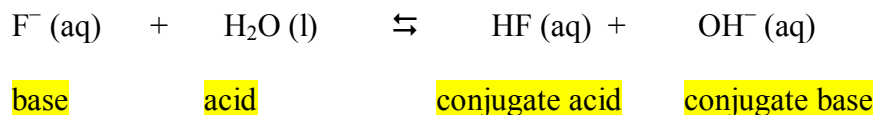
$$V_1 = \frac{V_2 C_2}{C_1} = \frac{(500. \text{ mL})(0.300 \text{ M})}{6.00 \text{ M}} = 25.0 \text{ mL}$$

33 – 35. Fill in the name or the chemical formula, whichever is missing. (2 pts. each)

	<u>Name</u>	<u>Chemical Formula</u>
33.	phosphoric acid	H <sub>3</sub> PO <sub>4</sub>
34.	sulfuric acid	H <sub>2</sub> SO <sub>4</sub>
35.	carbonic acid	H <sub>2</sub> CO <sub>3</sub>

36. For the following reaction, identify the acid and base, and their conjugate acid and conjugate base.

(3 pts)



37. Calculate the pH of a solution with  $[\text{H}^+] = 1.0 \times 10^{-8} \text{ M}$ . (3 pts)

$$\text{pH} = -\log[\text{H}^+] = -(1.0 \times 10^{-8}) = 8.00$$

38. Calculate the pH of a solution with  $[\text{OH}^-] = 2.3 \times 10^{-8} \text{ M}$ . (5 pts)

$$[\text{OH}^-][\text{H}^+] = 1.0 \times 10^{-14} = K_w$$

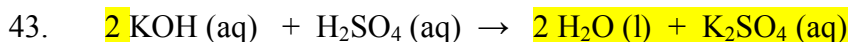
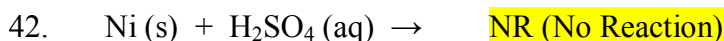
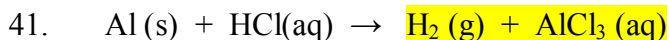
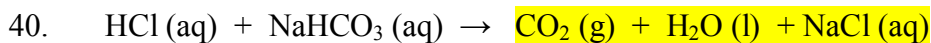
$$[\text{H}^+] = \frac{1.0 \times 10^{-14}}{[\text{OH}^-]} = 4.3 \times 10^{-7} \text{ M}$$

$$\text{pH} = -\log[\text{H}^+] = -\log(4.3 \times 10^{-7}) = 6.36$$

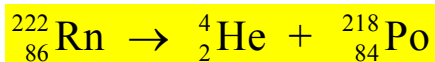
39. For a solution with a pH = 5.8, calculate the concentration of H<sup>+</sup> ions. (3 pts)

$$[\text{H}^+] = 10^{-5.8} = 1.6 \times 10^{-6} \text{ M}$$

40 – 43. Write the products of the following reactions, or if no reaction occurs, write NR for no reaction. (2 pts. each)



44. Write the products of the radioactive decay of the alpha emitter  $^{222}_{86}\text{Rn}$ . (4 pts)



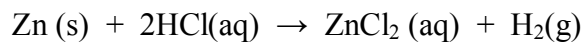
45. Iodine-131 is used in imaging and treating thyroid problems, and has a half-life of 8 days. How many grams of a 3.42 g sample would remain after 40 days? (5 pts)

1 half-life = 8 days

$$40 \text{ days} \left( \frac{1 \text{ half-life}}{8 \text{ days}} \right) = 5 \text{ half-lives}$$

$$3.42 \text{ g} \left( \frac{1}{2} \right) \left( \frac{1}{2} \right) \left( \frac{1}{2} \right) \left( \frac{1}{2} \right) \left( \frac{1}{2} \right) = 3.42 \text{ g} \left( \frac{1}{2^5} \right) = 0.107 \text{ g}$$

46. How many liters of a 1.50 M HCl solution is needed to completely react with 3.52 g of zinc? (6 pts)



3.52 g      1.50 M

$$3.52 \text{ g Zn} \left( \frac{1 \text{ mole Zn}}{65.39 \text{ g}} \right) \left( \frac{2 \text{ mole HCl}}{1 \text{ mole Zn}} \right) = 0.10766 \text{ mole HCl}$$

$$0.10766 \text{ mole HCl} \left( \frac{1 \text{ L}}{1.50 \text{ mole HCl}} \right) = 0.0718 \text{ L}$$

47. A typical concentration of  $\text{Ca}^{+2}$  ions in blood is 4 mEq/L. How many moles of calcium ions are in one pint (473 mL) of blood? (3 pts)

$$\left( \frac{4 \text{ mEq}}{\text{L}} \right) (0.473 \text{ L}) \left( \frac{1 \text{ Eq}}{1000 \text{ mEq}} \right) \left( \frac{1 \text{ mole Ca}^{+2}}{2 \text{ Eq}} \right) =$$

$$= 9 \times 10^{-4} \text{ moles Ca}^{+2} \text{ ions}$$