

Chem 1110

Final

180 points

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Name _____

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Instructions:

This is a closed book, closed notebook test. You may not discuss this exam with anyone, either during or after the exam, until it has been graded and the scores are posted on the class web site. You may not use any outside materials - including Periodic Tables - on this exam, except two 3" x 5" index cards and an English-foreign language dictionary if necessary. You may use a calculator to help you compute the correct answer but may not retrieve or view any reference materials that may be stored in your calculator.

Each question is worth 6 points. All questions are of equal value.

Useful information:

1 mole = 6.02×10^{23}	$PV = nRT$	$R = 0.0821 \text{ (L}\cdot\text{atm/mol}\cdot\text{K)}$	
$(P_1V_1/n_1T_1) = (P_2V_2/n_2T_2)$		$PV = gRT/mw$	$^{\circ}\text{C} + 273 = \text{K}$
1 atm = 760 mm Hg = 760 T = 101,325 Pa		$P_{\text{tot}} = P_1 + P_2 + P_3 + \dots$	
$D = iMRT$	$D = igRT/(V\cdot mw)$	$M_1V_1 = M_2V_2$	$M = \text{mol/L}$
$w/w \% = [\text{solute (g)} / \text{solution (g)}] \times 100$		$\text{pH} = \text{pK}_a + \log [A^-] / [HA]$	
$w/v \% = [\text{solute (g)} / \text{solution (mL, L)}] \times 100$		$\text{pH} = -\log [H^+]$	$\text{pK}_a = -\log K_a$
$v/v \% = [\text{solute (mL, L)} / \text{solution (mL, L)}] \times 100$			

1. Which of the following formulas represents an acetate ion?
- A. OH^-
 - B. CN^-
 - C. HCO_3^-
 - D. $\text{C}_2\text{H}_3\text{O}_2^-$
 - E. None of the above
2. If the compound S_3O_7 exists its name will be: _____.
3. The number of lone pairs (i.e., non-bonding pairs) of electrons in the Lewis structure for water is:
- A. 0
 - B. 1
 - C. 2
 - D. 3
 - E. 4
4. Which of the following elements has the lowest electronegativity?
- A. N
 - B. C
 - C. F
 - D. Br
 - E. Pb
5. How many moles are there in 112 g of the anesthetic ethyl chloride ($\text{C}_2\text{H}_5\text{Cl}$)?
- A. 1.74
 - B. 0.578
 - C. 2.14
 - D. 1.12
 - E. 6.3×10^{-3}
6. How many grams of ibuprofen ($\text{C}_{13}\text{H}_{18}\text{O}_2$) are present in a bottle that contains 4.97×10^{19} molecules of the compound?
- _____

7. How many grams of silver (I) sulfide are needed to produce 10.5 grams of silver metal?
- A. 15.8 g
 - B. 13.2 g
 - C. 12.1 g
 - D. 11.8 g
 - E. None of the above
8. When the following reaction $\text{Sb}_2\text{S}_3 + \text{HCl} \rightarrow \text{H}_3\text{SbCl}_6 + \text{H}_2\text{S}$ is correctly balanced, which of the following is incorrect?
- A. Sb_2S_3
 - B. $2 \text{H}_3\text{SbCl}_6$
 - C. 10 HCl
 - D. $3 \text{H}_2\text{S}$
 - E. None of the above
9. A sample of nitrogen has a volume of 505 mL at a pressure of 705 T. What volume would a sample of carbon dioxide occupy at the same temperature but at 755 T?
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10. A steel cylinder has a bursting point of 680 atm. The cylinder is filled with gas at a pressure of 175 atm and at a temperature of 20.0 °C. If the cylinder sits in the sun and the gas reaches a temperature of 97.0 °C, what will the pressure inside the cylinder be? Will the cylinder burst?
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11. A 10.0 L cylinder contains oxygen 10.0 atm and 300 K. What mass of oxygen does the cylinder contain?
- A. 145 g
 - B. 130 g
 - C. 87.5 g
 - D. 76.9 g
 - E. None of the above

12. When 7.00 moles of oxygen and 3.00 moles of carbon dioxide are combined, the total pressure exerted by the mixture is 762 mm Hg. What is the partial pressure exerted by the oxygen?
- A. 760 mm Hg
 - B. 533 mm Hg
 - C. 228 mm Hg
 - D. 76.2 mm Hg
 - E. None of the above
13. Which of the following accounts for the ability of krypton to exist as a solid?
- A. London (dispersion) forces
 - B. Dipole-dipole interactions
 - C. Ionic bonds
 - D. Covalent bonds
 - E. All of the above
14. Molecules with large dipole moments are likely to
- A. Have lower melting points than molecules with no dipole moments
 - B. Have higher boiling points than molecules with no dipole moments
 - C. Behave no differently than molecules with no dipole moments
 - D. Exist as gases
 - E. Undergo large effects from London forces
15. Which of the following will have the highest boiling point?
- A. HF
 - B. H₂O
 - C. C₄H₁₀
 - D. NH₃
 - E. CH₂OHCH₂OH
16. A diamond is
- A. A covalent crystalline solid
 - B. An amorphous crystalline solid
 - C. An ionic crystalline solid
 - D. A molecular crystalline solid
 - E. None of the above

17. Calculate the % w/w of a solution made up of 135 grams of iron (II) nitrate dissolved in 105 mL of water. Assume the density of water is 1.00 g/mL.
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18. A 25% (w/v) solution of sodium hydroxide can be produced by dissolving 1.20 moles of sodium hydroxide in how many milliliters of solution?
- A. 176 mL
 - B. 214 mL
 - C. 293 mL
 - D. 337 mL
 - E. None of the above
19. How many grams of hydrochloric acid are there in 500 mL of a 5.000 M solution?
- A. 36.50 g
 - B. 54.75 g
 - C. 73.01 g
 - D. 91.25 g
 - E. None of the above
20. Which of the following is the most concentrated?
- A. 1 mole of solute dissolved in 1 liter of solution
 - B. 2 moles of solute dissolved in 3 liters of solution
 - C. 6 moles of solute dissolved in 4 liters of solution
 - D. 8 moles of solute dissolved in 7 liters of solution
 - E. All of the above
21. Calculate the volume of a 2.00 M NaCl solution needed to prepare 0.250 L of a 0.100 M sodium chloride solution.
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22. Chemical reactions in a state of equilibrium are characterized by
- A. Going to completion
 - B. Being nonspontaneous
 - C. The presence of both reactants and products in a definite proportion
 - D. An equilibrium constant of zero
 - E. All of the above
23. Given the equilibrium system $\text{PbCO}_3(s) \rightleftharpoons \text{Pb}^{2+}_{(aq)} + \text{CO}_3^{2-}_{(aq)}$, if lead (II) nitrate - which is soluble - is added to the system
- A. The amount of $\text{PbCO}_3(s)$ increases and the concentration of $\text{CO}_3^{2-}_{(aq)}$ decreases
 - B. The amount of $\text{PbCO}_3(s)$ increases and the concentration of $\text{CO}_3^{2-}_{(aq)}$ increases
 - C. The amount of $\text{PbCO}_3(s)$ decreases and the concentration of $\text{CO}_3^{2-}_{(aq)}$ decreases
 - D. The amount of $\text{PbCO}_3(s)$ decreases and the concentration of $\text{CO}_3^{2-}_{(aq)}$ increases
 - E. None of the above
24. Enzymes
- A. Must overcome extremely high activation energies to catalyze reactions
 - B. Possesses an active site that is structurally similar to the substance the enzyme acts upon
 - C. Can act on many more than one different substance (per enzyme)
 - D. Affect the outcome of only a few chemical reactions but these are biologically the most important reactions in the human body
 - E. All of the above
25. An exothermic reaction is at equilibrium. If the reaction is cooled what will happen?
- A. Nothing
 - B. The reaction will shift in the direction of the reactants
 - C. The reaction will shift in the direction of the products
 - D. The reaction solution will become slightly cloudy and then turn clear again
 - E. All of the above
26. In a solution in which the $\text{pH} = 5.53$
- A. $[\text{H}_3\text{O}^+] = [\text{OH}^-]$
 - B. $[\text{H}_3\text{O}^+] > [\text{OH}^-]$
 - C. $[\text{H}_3\text{O}^+] > [\text{OH}^-]$
 - D. $[\text{H}_3\text{O}^+] + [\text{OH}^-] = K_w$
 - E. None of the above

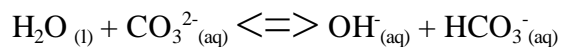
27. Which of the following compounds is not a weak acid?

- A. HBr
- B. HF
- C. HCN
- D. $\text{HC}_2\text{H}_3\text{O}_2$
- E. H_3PO_4

28. In the reaction $\text{H}_2\text{O}_{(l)} + \text{CO}_3^{2-}_{(aq)} \rightleftharpoons \text{OH}^-_{(aq)} + \text{HCO}_3^-_{(aq)}$ the Bronsted-Lowry acids are

- A. $\text{CO}_3^{2-}_{(aq)}$ and $\text{OH}^-_{(aq)}$
- B. $\text{CO}_3^{2-}_{(aq)}$ and $\text{HCO}_3^-_{(aq)}$
- C. $\text{H}_2\text{O}_{(l)}$ and $\text{OH}^-_{(aq)}$
- D. $\text{H}_2\text{O}_{(l)}$ and $\text{HCO}_3^-_{(aq)}$
- E. None of the above

29. Write the equilibrium expression for the reaction



30. If the pH of a 0.10 M solution is 11.00 then $[\text{H}_3\text{O}^+] =$

- A. $1.0 \times 10^{-1} \text{ M}$
- B. $1.0 \times 10^{-5} \text{ M}$
- C. $1.0 \times 10^{-11} \text{ M}$
- D. $1.0 \times 10^{-14} \text{ M}$
- E. None of the above