

**Practice Final Exam**

Name: \_\_\_\_\_

Chemistry 151

**INSTRUCTIONS:** Complete each question and the answers to the questions are on the last part of the exam

1. How many protons, neutrons, and electrons are present in an atom of the element selenium with the isotopic symbol,  ${}_{34}^{79}\text{Se}^{4-}$  ?  
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2. How many protons, neutrons, and electrons are present in an atom of the element krypton with the isotopic symbol,  ${}_{36}^{84}\text{Kr}^{3+}$  ?  
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3. How many protons, neutrons, and electrons are present in an atom of the element rubidium with the isotopic symbol,  ${}_{38}^{86}\text{Rb}^{4+}$  ?  
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4. The element boron, obtained from borax deposits in Death Valley, consists of just 2 isotopes. They are  ${}^{10}\text{B}$  and  ${}^{11}\text{B}$ . Using the periodic chart, which isotope of boron is more abundant  ${}^{10}\text{B}$  or  ${}^{11}\text{B}$  ?  
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5. The element lithium, used to be in a soda called lithiated lemon-lime soda which became 7 UP in 1936. The element lithium consists of just 2 isotopes. They are  ${}^6\text{Li}$  and  ${}^7\text{Li}$ . Using the periodic table, which isotope of lithium is more abundant  ${}^6\text{Li}$  or  ${}^7\text{Li}$  ?  
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6. Recently the deep impact space probe slammed a projectile onto the comet temple 1 to investigate the composition of our early planetary system. The comet was thought to have a density of around  $5.0 \times 10^5 \frac{\text{g}}{\text{m}^3}$  and an overall  $1.3 \times 10^{14} \text{Kg}$ . Those 2 estimates, calculate the volume of temple 1 in cubic meters ( $\text{m}^3$ ) .  
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7. Give the formula for the following name: dinitrogen pentachloride

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8. Give the formula for the following name: ammonium carbonate

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9. Give the formula for the following name: vanadium(IV) sulfate Vanadium is atomic number 23.

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10. What is the formula for the simple compound formed by calcium and nitrate?

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11. What is the formula for the simple compound formed by magnesium and phosphate?

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12. What is the percent by mass composition of oxygen in  $NaNO_3$  ?

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13. What is the empirical formula for a compound consisting of 25.9 % N, 74.1 % O by mass?

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14. How many molecules are there in 25.54 g of  $CCl_2F_2$  ?

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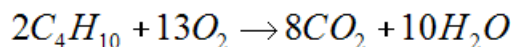
15. What is the mass in grams of 2.6 moles of  $CaSO_4$  ?

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16. What is the sum of all the coefficients in the following reaction when correctly balanced and don't forget the coefficients of 1?  $C_2H_6 + O_2 \rightarrow H_2O + CO_2$

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17. Given the following balanced equation, how many grams of carbon dioxide are produced from the reaction of 4.0 g of oxygen? (given an excess of  $C_4H_{10}$  )



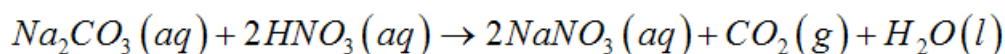
18. Tungsten (IV) oxide reacts with hydrogen gas according to the following reaction:  $WO_3 + 3H_2 \rightarrow W + 3H_2O$  What mass of water is formed from 2.5 g of  $H_2$  with 50.0 g  $WO_3$  ?
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19. What ions are present when sulfuric acid ( $H_2SO_4$ ) is dissolved in water?
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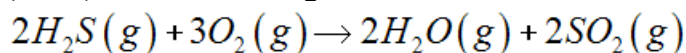
20. What volume of 2.2 M  $K_2CO_3$  is needed to prepare 400 mL of a 0.40 M  $K_2CO_3$  solution?
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21. In accordance with the solubility rules, what is the ionic and net ionic reactions, when  $CuSO_4(aq)$  and  $BaCl_2(aq)$  are mixed?
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22. What mass of  $Na_2CO_3$  in grams is required for complete reaction with 50.0 mL of 0.125 M  $HNO_3$  ?



23. Given the following table of standard heats of formation, calculate the enthalpy change (in KJ) for the following reaction:



$$\Delta H_f^\circ(H_2S) = -20.15 \frac{KJ}{mole} \quad \Delta H_f^\circ(H_2O) = -285.8 \frac{KJ}{mole}$$

$$\Delta H_f^\circ(SO_2) = -296.1 \frac{KJ}{mole} \quad \Delta H_f^\circ(O_2) = 0.00 \frac{KJ}{mole}$$

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24. Calculate the amount of heat required to raise the temperature of 37.4 g of silver from  $120.0^\circ C$  to  $9^\circ C$  .  $Sp.ht(Ag) = 0.235 \frac{J}{g^\circ C}$
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25. To increase the energy, does the wavelength ( $\lambda$ ) need to be long or short?
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26. To decrease the energy, does the frequency ( $\nu$ ) need to be long or short?
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27. What is the maximum total number of electrons that can occupy the energy level with principle quantum number 4?
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28. How many electrons would be in the  $n = 3$  level (shell) for a phosphorous (P) atom?
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29. What is the lowest shell that may contain p orbitals?
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30. Which shell contains a total of nine orbitals?
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31. What is the maximum number of electrons that a d subshell can contain?
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32. Which shell is the first to contain an f subshell?
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33. What is the ground state electronic configuration for  $Fe^{2+}$  (atomic number 26)?

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34. What is the ground state electronic configuration for  $Co^{2+}$  (atomic number 27)?

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35. Which atom below has the most unpaired electrons?

- a. N
- b. O
- c. P
- d. Mn
- e. Fe

36. Which of the following atoms make an isoelectronic pair:  $Cl^-$ ,  $O^{2-}$ ,  $F$ ,  $Ca^{2+}$ ,  $Fe^{3+}$

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37. Successive ionization energy's 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, etc...., provide evidence for the shell structure of an atom. For magnesium atoms, which ionization energy will show an exceptionally large increase over the preceding ionization energy values?

- a. 1<sup>st</sup>
- b. 2<sup>nd</sup>
- c. 3<sup>rd</sup>
- d. 4<sup>th</sup>
- e. 5<sup>th</sup>

38. Arrange the following ions in order of increasing size:  $K^+$ ,  $P^{3-}$ ,  $S^{2-}$ ,  $Cl^-$

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39. Draw the Lewis dot structure for the following molecules:

- a.  $SO_2$
- b.  $ClF_3$
- c.  $NH_3$
- d.  $XeF_4$

40. Determine whether or not the following molecules are polar:

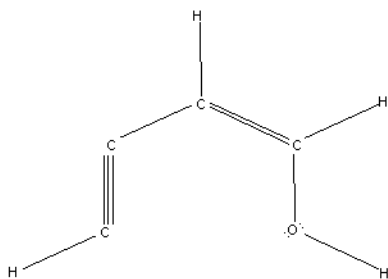
- a.  $SF_2$
- b.  $CO_2$
- c.  $SO_3$
- d.  $XeF_4$

41. Determine the molecular geometries for the following molecules:

- a.  $ClF_3$
- b.  $OF_4$
- c.  $IF_2^{1+}$
- d.  $XeF_4$

42. How many sigma and pi bonds are in the following molecule?

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43. Determine the hybrid orbitals of the following molecules:

- a.  $CO_2$
- b.  $SO_3$
- c.  $ClF_3$
- d.  $IF_2^{1+}$
- e.  $SF_6$

44. Which of the following molecules has the highest velocity (speed) at STP?

- a.  $O_2$
- b.  $CO_2$

- c.  $H_2$   
d.  $H_2O$   
e. None of the above
45. Calcium Carbonate,  $CaCO_3(s)$ , decomposes upon heating to give CaO (s) and carbon dioxide gas. A sample of  $CaCO_3(s)$  decomposes, and the carbon dioxide is collected in a 250 mL flask. After the decomposition is complete, the gas has a pressure of 1.3 atm at a temperature of  $31^\circ C$ . How many moles of carbon dioxide were generated?
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46. On combustion 15.0 L of a gaseous compound of hydrogen, carbon, and nitrogen gives 20.0 g of  $CO_2$ , 35.0 g of  $H_2O$ , and 5.0 g of nitrogen at STP. What is the molecular formula of the compound?
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47. A balloon holds 30 Kg of helium. What is the volume of the balloon if the final pressure is 1.20 atm and temperature is  $22^\circ C$ ?
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48. What types of intermolecular forces does each one of the following molecules contain?
- a.  $CO_2$   
b.  $NH_3$   
c.  $CHCl_3$   
d.  $Mg(NO_3)_2$
49. Rank the following atoms of molecules in order of increasing strength of intermolecular forces in the pure substance:  $Ne, CH_4, CO, CCl_4$
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50. Which of the following statements about physical properties of compounds is incorrect?
- a. An ionic compound is formed from a metal bonded to a non-metal.  
b. Metallic compounds can be easily deformed.  
c. Molecular compounds do not conduct electricity.

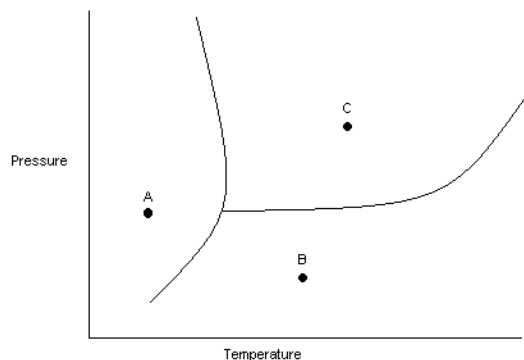
- d. Molecular compounds are formed from atoms with unlike charges
- e. None of these

51. Which statement is not correct?

- a. The total strength of the dispersion forces are larger in  $C_8H_{18}$  than  $C_3H_8$
- b. Hydrogen bonding always occurs in compounds which hydrogen is covalently bonded to a non-metal.
- c. Dispersion forces are present in all substances.
- d. Dipole-dipole forces exist in  $SO_2$  but not in  $SO_3$
- e. Dispersion forces are stronger in  $I_2$  than  $Cl_2$  because iodine atoms have more electrons than chlorine atoms

52. Choose the answer that lists one compound each of the following 3 pairs that has the higher boiling point of each pair: (1)  $KI$  and  $H_2O$  (2)  $HF$  and  $HCl$  (3)  $Br_2$  and  $Cl_2$

53. Consider the following phase diagram for a substance. Determine the following changes in the diagram below?



54. Which of the following substances dissolves in  $CH_4$  ?

- a.  $H_2O$
- b.  $NH_3$
- c.  $CCl_4$
- d.  $SO_3$





55. Which statement below is not true about pi bonds?

- a. They are formed by the “sideways” overlap of p orbitals.
- b. They cause rotation about the axis of a double bond to be very difficult.
- c. They concentrate electron density above and below a plane that passes through both nuclei
- d. They are present in double and triple bonds.
- e. Hybrid orbitals are used to form.

56. If you dissolve 102.5 g of splenda in 500.7 g of water, what is the mole ratio of the solute?  $MW(\text{splenda}) = 387.35 \frac{g}{mole}$

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57. How much heat (in joules) is required to convert 25 g of liquid water at  $20^\circ C$  to steam

$$Sp.ht(ice) = 2.06 \frac{J}{g^\circ C}$$

$$Sp.ht(liquid) = 4.184 \frac{J}{g^\circ C}$$

(gas) at  $126^\circ C$   $Sp.ht(gas) = 1.92 \frac{J}{g^\circ C}$

$$\Delta H_{fusion} = 333 \frac{J}{g}$$

$$\Delta H_{vaporization} = 2256 \frac{J}{g}$$

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58. Dissolving a solute such as KOH in a solvent such as water results in:

- a. An increase in the melting point of the liquid
- b. An decrease in the boiling point of the liquid
- c. An decrease in the vapor pressure of the liquid
- d. No change in the boiling point of the liquid.

59. If you dissolve 300.7 g of aspartame in 500.7 g water, what is the new boiling and freezing point of the solution? Assume normal boiling point of water to be  $93^\circ C$ .

$$MW(\text{aspartame}) = 294 \frac{\text{g}}{\text{mole}}$$

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