

CHEM 1210 Exam #1 A12

1. Calculate and report with the correct number of significant figures

$$513.2352941$$

$$(4362.5/8.5) - 64.3$$

$$\begin{array}{r} 513.2352941 \\ - 64.3 \\ \hline 448.9352941 \\ 4.5 \times 10^2 \end{array}$$

- a) 5×10^2 (b) 4.5×10^2 c) 4.4×10^2 d) 448 e) 448.9

2. A carat is a mass which equals 200 mg. The density of diamond is 3.51 g/cm^3 . What is the volume of a 2.0 carat diamond?

- a) 0.11 cm^3 b) 0.24 cm^3 c) 0.39 cm^3 d) 0.53 cm^3 e) 0.68 cm^3

$$2.0 \text{ carat} \times \frac{200 \text{ mg}}{1 \text{ carat}} \times \frac{1 \text{ g}}{1000 \text{ mg}} \times \frac{\text{cm}^3}{3.51 \text{ g}} = 0.11396 \text{ cm}^3$$

3. Consider the data obtained for the mass of an object as measured by three students. The mass is known to be 25.8652 g. Which conclusion best summarizes the data?

Trial #	1	2	3	4	5	Ave
A	24.9	26.2	25.3	24.7	26.6	25.54
B	26.2	26.2	26.1	26.2	26.1	26.16
C	25.4	25.6	26.1	26.2	25.7	25.80 ← most accurate

most precise →

a) Student A has the most precise work.

b) Student C has the most precise work.

c) Student B probably has a determinate error.

d) Student A has the most accurate work.

e) Student B has the most accurate work.

Each data point for student B is very precise, but too high, which shows directional bias + is a det. error (pg 5 Lab Manual)

4. Which of following statements about atomic structure is FALSE?

a) The electrons occupy a large volume compared to the nucleus. T

b) Almost all of the mass of the atom is concentrated in the nucleus. T

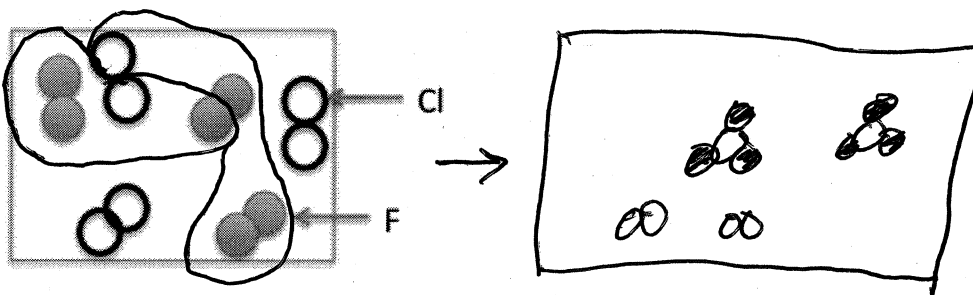
c) The protons and neutrons in the nucleus are tightly packed in a small volume. T

d) The number of protons and neutrons is always equal in a neutral atom. F

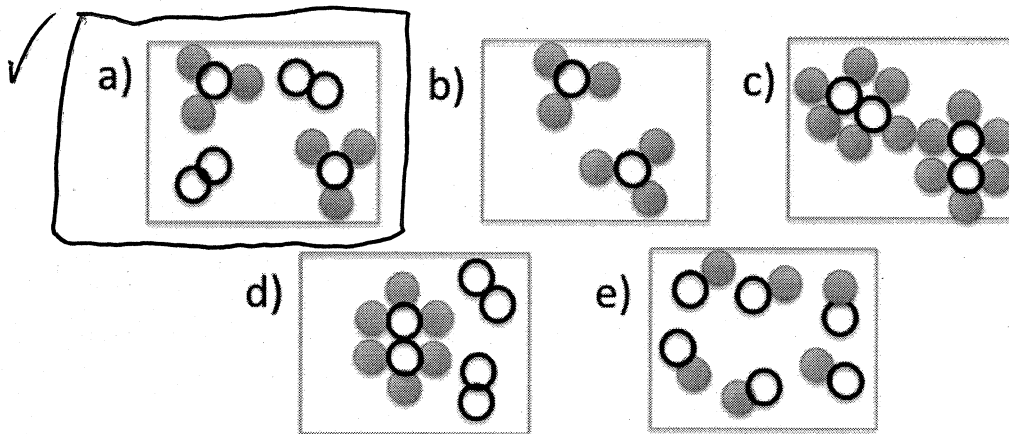
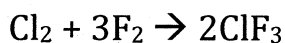
5. Which of the following pairs **DOES NOT** have the same number of electrons?

- a) $^{19}\text{F}^-$ and ^{20}Ne both have $10e^-$
- b) $^{24}\text{N}^{2+}$ and $^{23}\text{Na}^+$ $5e^-$ and $10e^-$**
- c) $^{14}\text{N}^{3-}$ and $^{16}\text{O}^{2-}$ both have $10e^-$
- d) ^{57}Co and ^{59}Co both have $27e^-$
- e) all pairs have the same number of electrons

6. The diagram represents a mixture of F_2 (g) and Cl_2 (g) molecules in a closed container.



Which diagram shows the results after the mixture reacts as completely as possible according to the equation:



Answer is A

7. Copper (atomic weight 63.546 amu) has two naturally-occurring isotopes. One is ^{63}Cu , with a mass of 62.9298 amu and an abundance of 69.09 percent. Calculate the mass of the other isotope.

- a) 61.8210 b) 63.5460 c) 63.9819 d) 64.5289 **e) 64.9233**

$$69.09 (0.629298) + x(0.3091) = 63.546$$

$$x = 64.923$$

8. Identify the TRUE statement

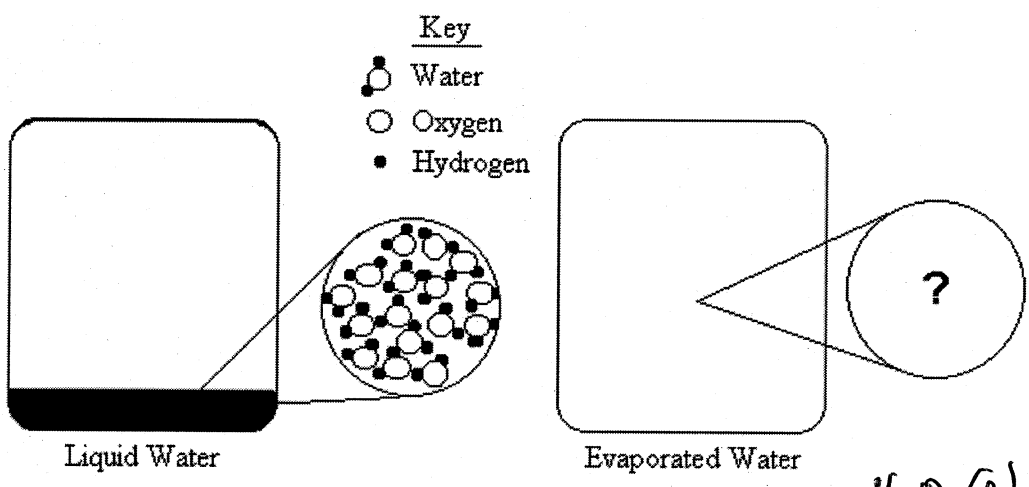
- T** a) Ionic compounds, such as NaCl, are written as empirical formulas because there is no discrete "NaCl" molecule. **F**
- b) Each group on the periodic table includes at least one metal and one nonmetal. **F**
- c) Most molecular compounds contain metals. **F**
- d) The chemical properties of ions are very similar to the chemical properties of the atoms from which they are derived. **F**

9. Which of the following results in a chemical change?

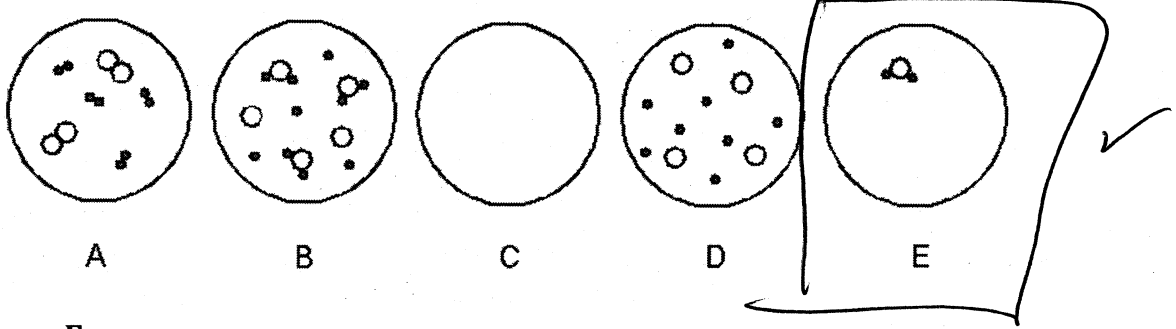
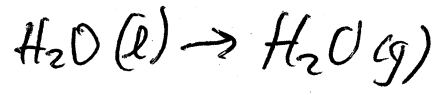
- a) Mixing together aqueous solutions of lead nitrate and potassium iodide.**
- ~~x~~ b) Boiling distilled water.
- ~~x~~ c) Combining NaCl (aq) and KOH (aq). *all spectator ions*
- ~~x~~ d) Adding Ca(OH)₂ (aq) to NaI (aq). *all spectator ions*
- e) All of these are chemical changes

ppt forms

10. The circle on the left shows a magnified view of a very small portion of liquid water in a closed container.



What would the magnified view show after the water evaporates?



Answer, E



11. The formula for ammonium carbonate is

- a) **$(\text{NH}_4)_2\text{CO}_3$** b) NH_4CO_2 c) $(\text{NH}_3)_2\text{CO}_3$ d) $(\text{NH}_3)_3\text{CO}_3$ e) NH_4CO_3

12. The oxidation state of chromium in Li_2CrO_4 is

- a) +3 b) +4 c) +5 **d) +6** e) +7

$$\begin{aligned} & \text{Li}_2\text{CrO}_4 \\ & 2(+1) + Cr + 4(-2) = 0 \\ & Cr = +6 \end{aligned}$$

13. Which of the following name, formula combinations is **INCORRECT**.

- a) hydrobromic acid, HBr
 b) iron (III) phosphate, FePO_4
 c) dinitrogen pentoxide, N_2O_5
d) disodium monoxide, Na_2O
 e) nitric acid, HNO_3

ionic uses charges for naming
+ has no prefixes

14. Iron combines with oxygen and water from the air to form rust. If an iron nail were placed in a beaker and allowed to rust for a month, one should find that the rusty nail weighs:

- a) Less than the original nail. b) The same as the original nail.
c) More than the original nail. d) It is impossible to predict.

Law of conservation of mass \Rightarrow If Fe combines w/ something it must weigh more

15. How many oxygen atoms are in a 125 mg sample of aspirin?

The molar mass of aspirin is 180.15 g/mol and its molecular formula is $\text{C}_9\text{H}_8\text{O}_4$.

- a) 4.18×10^{23}
 b) 4.18×10^{20}
c) 1.67×10^{21}
 d) 1.36×10^{25}
 e) 8.68×10^{23}

$$\begin{aligned} & 0.125 \text{ g } \text{C}_9\text{H}_8\text{O}_4 \times \frac{1 \text{ mol } \text{C}_9\text{H}_8\text{O}_4}{180.15 \text{ g}} + \frac{4 \text{ mol O}}{1 \text{ mol } \text{C}_9\text{H}_8\text{O}_4} \times \frac{6.022 \times 10^{23} \text{ atoms}}{1 \text{ mol O}} \\ & = \boxed{1.67 \times 10^{21}} \end{aligned}$$

16. Analysis of an iron oxide showed that it is 72.4% iron, by mass. What is the empirical formula?

- a) FeO b) Fe₂O₃ **c) Fe₃O₄** d) Fe₂O₅ e) Fe₃O₇



$$72.4 \text{ g Fe} \times \frac{1 \text{ mol Fe}}{55.845 \text{ g}} = 1.2964 \text{ mol} / 1.2964 = 1 \times 3 = 3$$

$$27.6 \text{ g O} \times \frac{1 \text{ mol O}}{16.00 \text{ g}} = 1.725 \text{ mol} / 1.2964 = 1.33 \times 3 = 4$$

17. Which of the following is a weak electrolyte? → weak acid / weak base

a) NH₃ solution

b) HNO₃ solution

c) potassium iodide solution

d) sodium nitrate solution

e) KOH solution

weak base

↓
weak
electrolyte

18. Which of the following ion pairs would be expected to form a precipitate when dilution solutions of the ions are mixed?

a) Ag⁺, SO₄²⁻

b) Ca²⁺, NO₃⁻

c) K⁺, S²⁻

d) Fe³⁺, PO₄³⁻

e) Ca²⁺, OH⁻

Use Sol. Guidelines

19. What is the molarity of the KCl solution formed by dissolving 32.0 g of potassium chloride (74.55 g/mol) in water to form 325 mL of solution?

a) 0.429 M

b) 1.32 M

c) 0.230 M

d) 0.00132 M

e) 2.32 M

$$32.0 \text{ g KCl} \times \frac{1 \text{ mol KCl}}{74.55 \text{ g}} = 0.42924 \text{ mol KCl} \\ \frac{0.42924 \text{ mol KCl}}{0.325 \text{ L}} = 1.32 \text{ M}$$

When the hydrocarbon propane, C_3H_8 , (MW= 44.1 g/mol) is combusted it reacts with oxygen gas to form carbon dioxide (44.0 g/mol) and water (18.0 g/mol). Use this reaction to answer questions 20-22.



20. What is the theoretical yield of **carbon dioxide**, if 3.00 g of propane is reacted with a solution containing 165 g of oxygen. Assume the limiting reagent is completely consumed.

- a) 3.00 g b) 4.90 g **c) 8.98 g** d) 19.2 g e) None of these

$$3.00g C_3H_8 \times \frac{1 \text{ mol}}{44.1g} \times \frac{3 \text{ mol } CO_2}{1 \text{ mol } C_3H_8} \times \frac{44.0g}{1 \text{ mol } CO_2} = 8.98g CO_2$$

21. How much of the excess reactant remains after the reaction is complete (based on the theoretical yield)?

- a) 165 g b) 162 g **c) 154 g** d) 147 g e) 1.1 g

$$3.00g C_3H_8 \times \frac{1 \text{ mol}}{44.1g} \times \frac{4 \text{ mol } H_2O}{1 \text{ mol } C_3H_8} \times \frac{18.0g}{1 \text{ mol } H_2O} = 4.8979g$$

$$\frac{4.25g}{4.8979g} \times 100\% = 86.7\%$$

22. If the actual yield of **water** is determined to be 4.25 g, what is the percent yield?

- a) 142% **b) 87%** c) 47% c) 18% e) 12%

$$8.98g CO_2 \times \frac{1 \text{ mol } CO_2}{44.0g} \times \frac{5 \text{ mol } O_2}{3 \text{ mol } CO_2} \times \frac{32.0g}{1 \text{ mol } O_2} = 10.88g$$

$$165g - 10.88g = 154.1g$$

23. How many grams of NaOH (MW=40.00 g/mol) are needed to precipitate the Ag^+ ions from 39.66 mL of 0.650 M silver nitrate?

- a) 26.00 g
b) 15.86 g
c) 1.031 g
d) 2.062 g
e) $6.44 \times 10^{-4} g$

$$0.650 \text{ mol } AgNO_3 \times 0.03966L = 0.025779 \text{ mol } Ag^+ \times \frac{1 \text{ mol } OH^-}{1 \text{ mol } Ag^+}$$

$$\frac{1 \text{ mol } NaOH}{1 \text{ mol } OH^-} \times \frac{40.00g}{1 \text{ mol } NaOH} = 1.03116g$$

24. A chemist has a 3.50 M NaOH solution. If they add 25.00 mL of this solution to a 500 mL volumetric flask and fill it up to the line with water, what is the concentration of the final solution?

- a) It is still 3.50 M
- b) 0.175 M**
- c) 0.0875 M
- d) 0.35 M
- e) 0.00875 M

$$3.50 \frac{\text{mol NaOH}}{\text{L}} \times 0.02500 \text{ L} = \frac{0.0875 \text{ mol NaOH}}{0.500 \text{ L}} = 0.175 \text{ M}$$

25. A chemist adds 1.00 g of KI(s) (molar mass = 166 g/mol) to 30.0 mL of 0.20 M Pb(NO₃)₂ (aq). The KI(s) completely dissolves, and a precipitate forms. Which statement is **TRUE** regarding the final solution?

- a) The concentration of NO₃⁻ (aq) > the concentration of K⁺ (aq)**
- b) The concentration of I⁻ (aq) = the concentration of K⁺ (aq)
- c) The concentration of NO₃⁻ < the concentration of Pb²⁺ (aq)
- d) The concentration of I⁻ (aq) = the concentration of Pb²⁺ (aq) ×
- e) No ions remain in the solution. They are all part of the precipitate. ×

$$0.20 \frac{\text{mol Pb(NO}_3)_2}{\text{L}} \times 0.030 \text{ L} = 0.006 \text{ mol Pb}^{2+} \quad [\text{NO}_3^-] > [\text{Pb}^{2+}]$$

$$0.012 \text{ mol NO}_3^-$$

$$1.00 \text{ g KI} \times \frac{1 \text{ mol KI}}{166 \text{ g}} = 0.006024 \text{ mol KI} \quad [\text{NO}_3^-] > [\text{K}^+]$$

$$0.006 \text{ mol K}^+$$

$$0.006 \text{ mol I}^-$$

