

# Chemistry 1210 Test 1 Fall 1999, Jordan

Name Key

ID yes

By submitting this test, I certify that I have received no help on this quiz from any other person or used any unauthorized material.

Please show all work near the relevant question when applicable. Failure to show work will result in partial or total deduction of points. Remember, significant figures count.

Helpful formulas and conversion factors: mass/volume, moles/liters,  $^{\circ}\text{F} = 1.8(^{\circ}\text{C}) + 32$ ,  $\text{K} = ^{\circ}\text{C} + 273$ ,  $1\text{lb} = 0.454\text{ kg}$ ,  $1\text{oz} = 28.4\text{ g}$  /m =

(1) List 4 of the SI base units and give the property they measure and list two derived units and the property measure.

meter - length

kilogram - mass

second - time

Kelvin - temperature

mole - ~~amount~~ amount

candela - luminous intensity

ampere - current

density -  $\frac{\text{g}}{\text{mL}}$

volume -  $\text{m}^3$ , L, mL

etc.

(2) Two samples containing only hydrogen and oxygen were analyzed. Sample A was found to contain 4.10 g of carbon and 10.9 g of oxygen. Sample B was found to contain 6.00 g of carbon and 16.0 g of oxygen. What law is demonstrated by these two compounds (show work)?

$$A \quad \frac{10.9\text{g O}}{4.10\text{g C}} = 2.66$$

$$B \quad \frac{16.0\text{g O}}{6.00\text{g C}} = 2.66$$

same

Law of Constant Composition.

main point  
↑

(3) What did Dalton propose in his Atomic Theory? How does this lead to the Law of Conservation of Mass?

- Dalton proposed that matter was composed of atoms.
- Elements were composed of atoms of the same type.
- In a chemical reaction, atoms are just rearranged.

If all mass is composed of atoms, and atoms are just rearranged in a reaction, then the mass of the products and reagents in a reaction are identical.

(4) What part of Dalton's Atomic Theory did J.J. Thompson disprove and how did he do it?

Dalton thought atoms were indestructible and indivisible.

Thompson discovered the electron which was part of the atom.  
This proved the atom was not indivisible.

(5) Classify the following as a compound, element or a mixture. If it is a mixture, classify it as heterogeneous or homogeneous (solution).

(a) sulfur element

(b) a plate of french fries with ketchup heterogeneous mixture

(c) distilled water compound

(d) window cleaner mixture - solution

(6) Name the following compounds

(a)  $\text{Li}_2(\text{HSO}_4)$  lithium hydrogen sulfate

(b)  $\text{Co}(\text{Cl})_2$  cobalt (II) chloride

(c)  $\text{SCl}_2$  sulfur dichloride

(d)  $\text{BaS}$  barium sulfide

(7) Write the formulas of the following compounds from their names

(a) chromium (III) oxide  $\text{Cr}_2\text{O}_3$

(b) phosphorus tribromide  $\text{PBr}_3$

(c) magnesium nitrate  $\text{Mg}(\text{NO}_3)_2$

(c) carbon disulfide  $\text{CS}_2$

(8) An unknown compound found in mothballs was sent for analysis. The results found that the compound was 93.70% C by mass and 6.30% H by mass.

(a) What is the empirical formula for the compound

assume a 100.0g sample

then

$$\text{C: } 93.70 \text{ g} \times \frac{\text{mol}}{12.01 \text{ g}} = 7.80 \text{ moles} \div 6.24 \text{ moles} = \cancel{1.25} 1.25$$

$$\text{H: } 6.30 \text{ g} \times \frac{\text{mol}}{1.01 \text{ g}} = 6.24 \text{ moles} \div 6.24 \text{ moles} = 1$$

$$4(\text{C}_{1.25}\text{H}_1) = \text{C}_5\text{H}_4$$

~~1.25~~

empirical formula  $\text{C}_5\text{H}_4$

(b) A mass spectrum of the unknown compound consisted mainly of a peak with mass 128 and no peaks to higher mass. What is the formula for the unknown.

$$\text{C}_5\text{H}_4 \text{ FW} = 64.09 \quad \frac{128}{64.09} \Rightarrow 2$$
$$\therefore 2(\text{C}_5\text{H}_4) = \text{C}_{10}\text{H}_8 = \text{formula}$$

(9) Frozen carbon dioxide (dry ice) has a temperature of  $-78^\circ\text{C}$ . Convert this temperature to

(a) K  $K = ^\circ\text{C} + 273$   ~~$K = -78^\circ\text{C} + 273$~~

$$K = -78 + 273 = 195 \text{ K}$$

(b)  $^\circ\text{F} = 1.8(^{\circ}\text{C}) + 32$   $^\circ\text{F} = 1.8(-78) + 32 = -108^\circ\text{F}$

(10) A can of coke contains 355 mL of fluid. If the density of the drink is 1.0 g/mL, express the contents of the can in

(a) g  $355 \text{ mL} \times \frac{1.0 \text{ g}}{\text{mL}} = 355 \text{ g} = 360 \text{ g}$

(b) kg ~~0.355 kg~~  $360 \text{ g} \times \frac{1 \text{ kg}}{1000 \text{ g}} = 0.36 \text{ kg}$

(c) oz  $360 \text{ g} \times \frac{1.02}{28.4 \text{ g}} = \text{~~12.67~~ } 13 \text{ oz}$

(11) Archimedes put a crown in water to determine its density. If he put a crown into a large graduated flask and the water rose from 10.25 L to 11.60 L and the mass of the crown is 15,500 g (15.5 kg).

(a) What is the density of the crown.

$$11.60 \text{ L} - 10.25 \text{ L} = 1.35 \text{ L} \quad 1.35 \text{ L} \times \frac{1000 \text{ mL}}{1 \text{ L}} = 1,350 \text{ mL}$$

(volume of crown)

$$D = \frac{\text{mass}}{\text{volume}} = \frac{15,500 \text{ g}}{1,350 \text{ mL}} = 11.5 \frac{\text{g}}{\text{mL}}$$

(b) If the density of gold is 19.31 g/mL, is the crown pure gold?

no, it would have the wrong density

(12) List the number of protons, neutrons, and electrons for each of the following species

	protons	electrons	neutrons
(a) $^{57}_{26}\text{Fe}$	26	26	31
(b) $^{79}_{35}\text{Br}$	35	35	44
(c) $^{235}_{92}\text{U}$	92	92	143
(d) $^{23}_{11}\text{Na}^+$	11	10	12

(13) If the natural abundances of carbon were  $^{12}\text{C}$  (67.00 %, mass = 12.00 amu) and  $^{14}\text{C}$  (33.00%, mass = 14.00 amu), what would be the atomic mass for carbon listed on the periodic table (these are not the actual abundances).

$$\text{weighted average } 0.6700(12.00 \text{ amu}) + 0.3300(14.00 \text{ amu}) = 12.66 \text{ amu}$$

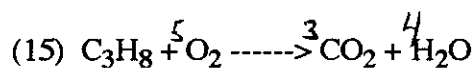
(14) What type of bonding is present in following species (ie ionic and covalent bonding)

(a)  $\text{Li}_2\text{S}$  ionic

(b)  $\text{H}_2\text{O}$  covalent

(c)  $\text{LiClO}_4$  ionic and covalent

(d)  $\text{N}_2\text{O}_4$  covalent



(a) Balance the formula above and write it below.



(b) If 15.0 moles of  $\text{C}_3\text{H}_8$  is burned, how much  $\text{O}_2$  is required (in moles and grams)?

$$15.0 \text{ moles } \text{C}_3\text{H}_8 \times \frac{5 \text{ moles } \text{O}_2}{1 \text{ mole } \text{C}_3\text{H}_8} = 75.0 \text{ moles } \text{O}_2$$

$$75.0 \text{ moles} \times \frac{32.00 \text{ g}}{\text{mole}} = 2.40 \times 10^3 \text{ g}$$

moles (16) If 15.0 moles of  $\text{C}_3\text{H}_8$  is reacted with with 112 g of  $\text{O}_2$  (the equation in problem 15), how much  $\text{CO}_2$  will be produced? (in moles)

need  $2.40 \times 10^3 \text{ g } \text{O}_2$  to react with 15.0 moles  $\text{C}_3\text{H}_8$  i.

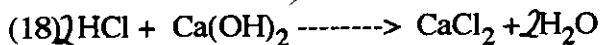
$\text{O}_2$  is the limiting reagent

$$112 \text{ g } \text{O}_2 \times \frac{\text{moles}}{32.00 \text{ g}} = 3.50 \text{ moles } \text{O}_2$$

$$3.50 \text{ moles } \text{O}_2 \times \frac{3 \text{ moles } \text{CO}_2}{5 \text{ moles } \text{O}_2} = 2.10 \text{ moles } \text{CO}_2$$

~~scribble~~  
just moles  
(17) If a 675 mL solution of HCl has a concentration of 0.235 M, how much HCl (in moles and grams) is in the solution?

$$675 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} = 0.675 \text{ L}$$
$$0.235 \frac{\text{moles}}{\text{L}} \times 0.675 \text{ L} = 0.159 \text{ moles HCl}$$



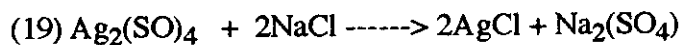
(a) If all of the solution of HCl from problem 17 (all 675 mL of it) was needed to neutralize a 1.00 L solution of  $\text{Ca(OH)}_2$  (in a titration), how much  $\text{Ca(OH)}_2$  was there in the unknown solution (in moles)?

0.159 moles HCl neutralized the  $\text{Ca(OH)}_2$

$$\therefore 0.159 \text{ moles HCl} \times \frac{1 \text{ mole Ca(OH)}_2}{2 \text{ moles HCl}} = 0.0793 \text{ moles Ca(OH)}_2$$

(b) What was the concentration of the original 1.00 L solution of  $\text{Ca(OH)}_2$ ? in M

$$M = \frac{\text{moles}}{\text{L}} = \frac{0.0793 \text{ moles}}{1.00 \text{ L}} = 0.0793 \text{ M}$$



If 1.00 mole of  $\text{Ag}_2(\text{SO}_4)$  and 2.00 moles of NaCl are mixed,

(a) what is the theoretical yield of AgCl (in moles)

$$2.00 \text{ moles}$$

(b) if 1.80 moles of AgCl are recovered, what is the yield in %?

$$\frac{1.80 \text{ moles}}{2.00 \text{ moles}} = 0.900 \times 100\% = 90.0\%$$

<sup>content</sup>  
(20) In football, the field is  $1.00 \times 10^2$  yards (3 feet to a yard) from goaline to goaline. Teams must move the ball 10 yards (2 sig figs) to get a 1st down.

(a) convert the distance from goaline to goaline ( $1.00 \times 10^2$  yards) to meters.

$1.00 \times 10^2$  yards

(b) convert the distance needed for a 1st down (10 yards (2 sig figs)) to km.

#### Bonus Question:

What was Lavoisier's definition of an acid? Arrhenius' definition of an acid and a base?  
The Brønsted-Lowry definition of acid and base?

Lavoisier - acids contain O atoms

Arrhenius - acids produce  $H^+$  ions in water

bases - produce  $OH^-$  ions in water

Brønsted-Lowry - acid -  $H^+$  donor

base -  $H^+$  acceptor