

Name: _____

Chem SOL Processes Block: _____

Record answer with a unit and with correct sig figs.

1. What is percentage error for a mass measurement of 17.7g, given that the correct value is 21.2g?

$$\frac{|21.2 - 17.7|}{21.2} \times 100 = 16.5\%$$

2. A handbook gives the density of calcium as 1.54 g/cm³. Based on lab measurements, what is the percent error of a density calculation of 1.25 g/cm³?

$$\frac{|1.54 - 1.25|}{1.54} \times 100 = 18.8\%$$

3. Calculate the average atomic mass of element X given the following relative atomic masses and abundances of each of the isotopes: 0.063% of 37.96 amu; 0.337% of 35.97 amu; & 99.600% of 39.96 amu.

$$(37.96 \times 0.00063) + (35.97 \times 0.00337) + (39.96 \times 0.996) = 39.95 \text{ amu}$$

4. Determine the electron configuration for the following:

a. Chromium

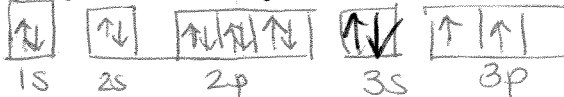


b. Gallium



5. Determine the orbital diagram for the following:

a. Silicon



b. Oxygen



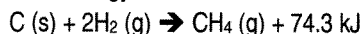
6. How much carbon dioxide is produced in liters assume STP when 25.0 g of calcium carbonate decomposes: $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$

$$\frac{25.0 \text{ g CaCO}_3}{100.09 \text{ g CaCO}_3} \times \frac{1 \text{ mole CaCO}_3}{1 \text{ mole CaCO}_3} \times \frac{1 \text{ mole CO}_2}{1 \text{ mole CaCO}_3} \times \frac{22.4 \text{ L CO}_2}{1 \text{ mole CO}_2} = 5.59 \text{ L CO}_2$$

7. How many molecules are there in 5.23 grams of diphosphorous pentachloride?

$$\frac{5.23 \text{ g P}_2\text{Cl}_5}{239.19 \text{ g P}_2\text{Cl}_5} \times \frac{1 \text{ mole P}_2\text{Cl}_5}{1 \text{ mole P}_2\text{Cl}_5} \times \frac{6.02 \times 10^{23} \text{ molecules P}_2\text{Cl}_5}{1 \text{ mole P}_2\text{Cl}_5} = 1.32 \times 10^{22} \text{ molecules P}_2\text{Cl}_5$$

8. How much energy is associated with this reaction when there is 4.00 grams of hydrogen reacts with excess carbon?



$$\frac{4.00 \text{ g H}_2}{2.02 \text{ g H}_2} \times \frac{1 \text{ mole H}_2}{2 \text{ mole H}_2} \times (-74.3 \text{ kJ}) = -73.6 \text{ kJ}$$

9. What is the percentage of aluminum in aluminum oxide (Al₂O₃)?

$$\% \text{ Al} = \frac{(\text{Al} \times 2)}{(\text{Al}_2\text{O}_3)} =$$

$$\frac{53.96}{101.96} \times 100 = 52.92\%$$

10. A compound is composed of 85.64% carbon and 14.36% hydrogen. What is the empirical formula? What is the molecular formula, when the molecular formula's molar mass is 42.08 g/mole?

$$\frac{85.64 \text{ g C}}{12.01 \text{ g}} \times \frac{1 \text{ mole}}{12.01 \text{ g}} = 7.13 / 7.13 = 1$$

$$\frac{14.36 \text{ g H}}{1.01 \text{ g}} \times \frac{1 \text{ mole}}{1.01 \text{ g}} = 14.22 / 7.13 = 2$$

CH₂ = empirical

$$\frac{\text{MM}_{\text{molec}}}{\text{MM}_{\text{emp}}} = \frac{42.08}{14.03} = 3$$

C₃H₆
molecular

11. If the heat of fusion is 32.2 kJ/mol, the amount of heat energy required to melt 5.67 grams of iron (II) oxide is...

$$\frac{5.67g}{71.85g/mole} \times \frac{32.2kJ}{1mole} = 2.54kJ$$

12. A 17.5 g sample of an unknown metal at 98.0°C is added to a foam cup calorimeter that has 25.2g of water at 14.6°C. What is the specific heat of the metal? what is the heat?

$$Q = mc\Delta T$$

$$25.2g = \frac{4.184J}{g^{\circ}C} \cdot (14.6 - 98)^{\circ}C$$

$$= -8793J$$

13. The hydrogen ion concentration is 1.0×10^{-7} . What is the pH of this solution?

$$pH = -\log[H^+] = 7$$

14. The hydroxide ion concentration is 2.5×10^{-3} . What is the pH of this solution?

$$pOH = -\log[OH^-] = 2.6$$

$$pH = 14 - 2.6 = 11.4$$

15. What is the solution concentration formed from 52.63g of sodium chloride is dissolved into 1.3 L of water?

$$M = \frac{mole}{L}$$

$$\frac{52.63g}{58.44g} = 0.9006mole$$

$$\frac{0.9006mole}{1.3L} = 0.69M$$

16. 1.8 L of a 2.4 M solution of $NiCl_2$ is diluted to 4.5 L. What is the resulting concentration of the diluted solution?

$$\frac{1.8L \times 2.4M}{4.5L} = 0.96M$$

17. A gas storage tank has a volume of 3.5×10^3 L when the temperature is 27°C and the pressure is 101 kPa. What is the new volume of the tank if the temperature drops to -10°C and the pressure drops to 95 kPa?

$$\frac{T_1 P_1 V_1}{T_2 P_2} = \frac{300K \times 101kPa \times 3.5 \times 10^3 L}{308K \times 95kPa}$$

$$3510L = 3500L \text{ or } 3.5 \times 10^3 L$$

18. If 4.50g of methane gas (CH_4) is introduced into an evacuated 2.00L container at 35°C, what is the pressure in the container?

$$\frac{4.50g}{16.05g} = 0.28mole$$

$$P = \frac{nRT}{V} = \frac{0.28mole \times 0.0821atm \cdot L \cdot mol^{-1} \cdot K^{-1} \times 308K}{2.00L} = 3.54atm$$

19. Given that the half-life of carbon-14 is 5730 years, consider a sample of fossilized wood that, when alive would have contained 24g of carbon-14. It now contains 1.5g of carbon-14. How old is the sample?

24g → 12g → 6g → 3g → 1.5g

① → ② → ③ → ④

$$\frac{5730 \text{ yr}}{\ln 2} \times 4 = 22920 \text{ yr}$$

20. determine which element is reduced and which element is oxidized.

