

**CH 221 Study Questions for the Final Exam**

1. If 97.0 grams of aluminum oxide is produced from the reaction of 65.0 grams of aluminum with unlimited oxygen, what is the theoretical yield of aluminum oxide and the percent yield?
2. If 0.885 g of CO react with 0.352 g of H<sub>2</sub> to form CH<sub>3</sub>OH, what is the limiting reactant? What is the theoretical yield of CH<sub>3</sub>OH? What mass of excess reactant is left at the end of the reaction?
3. How many grams are there in  $5.62 \times 10^{13}$  molecules of C<sub>8</sub>H<sub>18</sub>O<sub>4</sub>?
4. How many atoms of nitrogen are in  $6.5 \times 10^6$  g of Al(NO<sub>3</sub>)<sub>3</sub>?
5. How many atoms of chlorine are there in 943.1 g of chlorine (Cl<sub>2</sub>)?
6. Gallium reacts with iodine to make gallium iodide. Write the balanced equation.
7. Lead(II) nitrate reacts in a double displacement reaction with sodium iodide. Write the balanced equation.
8. Write the electron configuration for the following atoms: Ne, Mg, Cl, Ca, V, Kr
9. Write the electron configuration for the following ions: Na<sup>+</sup>, Al<sup>3+</sup>, F<sup>-</sup>, Cr<sup>5+</sup>.
10. In questions #8 and #9, above, which atoms and ions are paramagnetic? Which atom or ion is the *most* paramagnetic?
11. In questions #8 and #9, above, which atoms and ions are isoelectronic? How many valence electrons do the isoelectronic atoms and/or ions possess?

*Answers appear on the next page*

**CH 221 Study Questions for the Final Exam - Answers**

1. 123 g  $\text{Al}_2\text{O}_3$ , 78.9% yield
2. CO limiting reactant, 1.01 g = theoretical yield, 0.224 g excess reactant unused
3.  $1.66 \times 10^{-8}$  g
4.  $5.5 \times 10^{28}$  atoms N
5.  $1.602 \times 10^{25}$  atoms Cl
6.  $2 \text{ Ga} + 3 \text{ I}_2 \rightarrow 2 \text{ GaI}_3$
7.  $\text{Pb}(\text{NO}_3)_2 + 2 \text{ NaI} \rightarrow 2 \text{ NaNO}_3 + \text{PbI}_2$
8. Ne:  $1s^2 2s^2 2p^6$ , Mg:  $[\text{Ne}]3s^2$ , Cl:  $[\text{Ne}]3s^2 3p^5$ , Ca:  $[\text{Ar}]4s^2$ , V:  $[\text{Ar}]4s^2 3d^3$ , Kr:  $[\text{Ar}]4s^2 3d^{10} 4p^6$
9.  $\text{Na}^+$ :  $[\text{Ne}]$ ,  $\text{Al}^{3+}$ :  $[\text{Ne}]$ ,  $\text{F}^-$ :  $[\text{Ne}]$ ,  $\text{Cr}^{5+}$ :  $[\text{Ar}]3d^1$
10. *Paramagnetic*: Cl (1 unpaired electrons), Vanadium (3 unpaired electrons), chromium(V) (1 unpaired electron). Vanadium is the most paramagnetic.
11. *Isoelectronic*: Ne,  $\text{Na}^+$ ,  $\text{Al}^{3+}$ ,  $\text{F}^-$ . These species have zero valence electrons.