# CHEM 1310 Reading Day Study Session

1. The only two significant isotopes of group 3A element gallium are $^{69}Ga$ (68.9256amu) and $^{71}Ga$ (70.9247 amu). What are the natural abundances of the two isotopes?

| | $^{69}Ga$ | $^{71}Ga$ |
|---|---|---|
| A) | 39.89% | 60.11% |
| B) | 69.93% | 30.07% |
| C) | 60.11% | 39.89% |
| D) | 30.07% | 69.93% |
| E) | 31.00% | 69.00% |

2. How many atoms of nitrogen are in 20.85 g $Ba(NO_3)_2$ ?

3. A sample of an orange compound is 26.59% K, 35.36% Cr, and 38.08% O by mass. What is the empirical formula for the compound?

4. Write and balance the a chemical equation to represent the reaction between aqueous solutions of a salt made from the most common monatomic ion of calcium and the nitrate ion and the salt that forms from the ammonium ion and the phosphate ion. Be sure to include phases for each reactant and product.

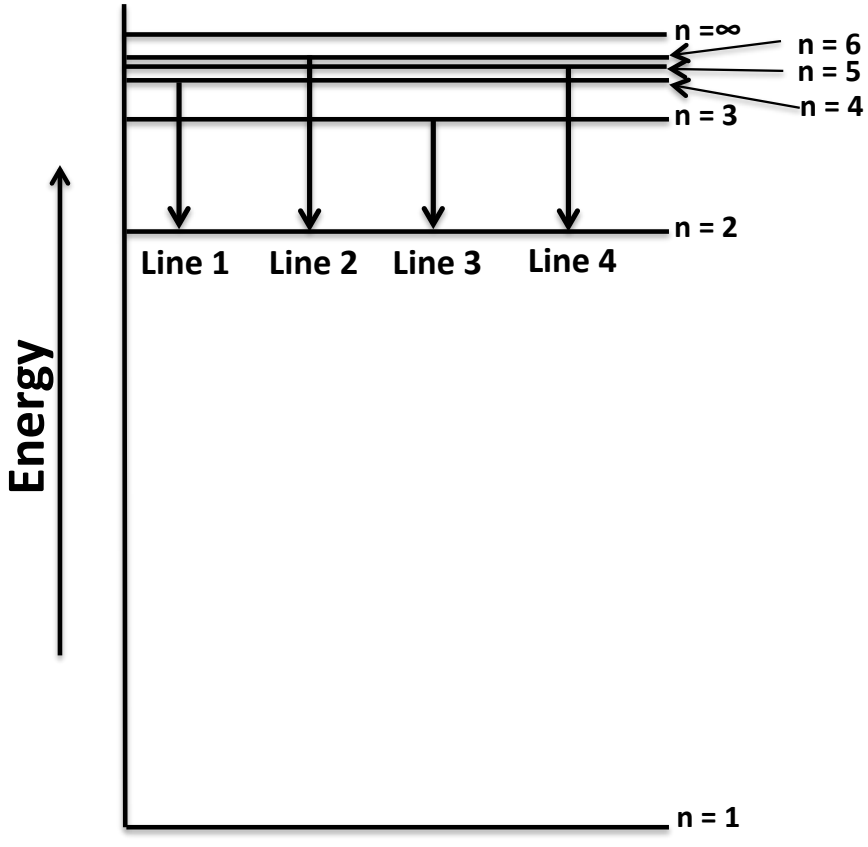
5. What mass of $Na_2CO_3$ is required to produce 150. mL of a solution that is 0.500 *M* in sodium ions?

6. If 42.5 g of $O_2$ reacts with excess Mg according to the following equation to produce 65.1 g of MgO, then what is the percent yield for the reaction?

7. A gas is held under conditions of standard temperature and pressure. It is found that 44.0 grams of the gas occupies a volume of 22.4 L under these conditions. What is the gas?
   A) $CO_2$
   B) $Cl_2$
   C) $F_2$
   D) $N_2$
   E) $O_2$

8. How many photons with wavelength equal to 465 nm are required to produce 15 J of energy?

9. The Lyman series refers to transitions of photons of light correlating to electrons in hydrogen atoms. All of the spectral lines in the Lyman series end at *n* =1. The four lowest energy lines have wavelengths at 91.2 nm, 97.2 nm, 102.6 nm, and 121.6 nm. Draw and label these *emission* lines on the graph provided.

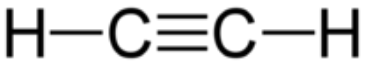


10. Which statement best explains why nitrogen has a greater ionization energy than oxygen?

A) Oxygen is more electronegative.
B) Nitrogen has a smaller atomic radius.
C) Nitrogen has greater ionic radius.
D) Nitrogen has more stable ground state electron configuration.
E) Nitrogen does NOT have a more positive ionization energy than does oxygen.

11. The last electron in the ground state electron configuration for selenium (Se) is in which type of atomic orbital?

12. Which statement best describes the pi bonding in ethyne?



A) There are two pi bonds created through the overlap of unhybridized 2*p* atomic orbitals on each C atom.
B) There are two pi bonds created through overlap of *sp* hybrid orbitals on each C atom.
C) There is one pi bond created through overlap of a 2*p* hybridized atomic orbital on each C atom.
D) There is one pi bond created through overlap of *sp* unhybridized atomic orbitals on each C atom.
E) There are two pi bonds created through overlap of an *sp* hybrid orbital on each C atom and a 1*s* unhybridized atomic orbital on each H atom.

13. Which molecule does *not* have a linear shape?

A) $CO_2$
B) $SO_2$
C) HCN
D) $I_3^-$
E) $CS_2$

14. If two molecules, both in the condensed phase, have the same molecular masses, which has the highest vapor pressure?

A) a molecular solid (or liquid) whose primary intermolecular force is dispersion
B) a molecular solid (or liquid) whose primary intermolecular force is hydrogen bonding
C) an ionic compound
D) an aqueous solution of an ionic compound
E) a highly polar, but non-hydrogen bonded molecular solid (or liquid)

15. The combustion of one gallon of gasoline produces $3.3 \times 10^4$ kJ of heat. Considering the thermochemical equation below, how many grams of ethanol, $C_2H_5OH$, are required to produce the same amount of heat as the combustion of one gallon of gasoline? Assume 100% yield and an excess of $O_2(g)$.

Molar masses: ethanol = 48.08 g/mol; $O_2$ = 32.00 g/mol; $CO_2$ = 44.01 g/mol; $H_2O$ = 18.02 g/mol

$$C_2H_5OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O\ (l) + 1368\ kJ$$

16. Consider the melting of ice at –10°C. For this process what are the signs for $\Delta H$, $\Delta S$, and $\Delta G$, respectively?

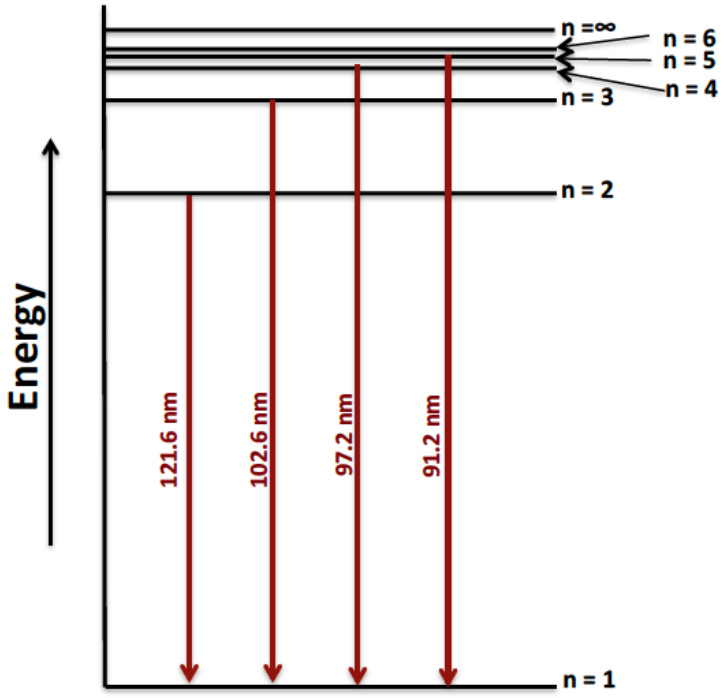
17. The reaction A → B + C is first order in A with $k = 0.034\ s^{-1}$ at 25° C. If $[A]_0 = 2.4\ M$, then what is [A] after 4.2 s?

18. A 1.00 atm sample of $H_2S$ is allowed to decompose at 1405 K until equilibrium is achieved. At equilibrium, the partial pressure of $S_2$ is 0.0370 atm. What is the value of $K$ for this reaction?

$$2H_2S(g) \rightleftharpoons S_2(g) + 2H_2(g)$$

# CHEM 1310 Reading Day Study Session - Fall 2017 (Solutions)

1. C) $^{69}GA : 60.11\%$ $^{71}Ga : 39.89\%$
2. $9.61 \times 10^{22}$ atoms $N$
3. $K_2Cr_2O_7$
4. $3Ca(NO_3)_2(aq) + 2(NH_4)_3PO_4(aq) \rightarrow 6NH_4NO_3(aq) + Ca_3(PO_4)_2(s)$.
   Spectator Ions = $NH_4^+(aq)$ and $NO_3^-(aq)$.
5. 3.97 $g$
6. 60.8%
7. A) $CO_2$
8. $3.5 \times 10^{19}$ photons
9. .




10. D) Nitrogen has more stable ground state electron configuration.
11. $4p$
12. A) There are two pi bonds created through the overlap of unhybridized $2p$ atomic orbitals on each $C$ atom.
13. B) $SO_2$
14. A) a molecular solid (or liquid) whose primary intermolecular force is dispersion
15. 1200 $g$
16. $-$, $+$, $+$
17. 2.08 $M$
18. $2.36 \times 10^{-4}$