Final Packet Instructions: Do your best and do not be anxious. Read the question, re-read the question, write down all given or valuable information, and write down what you want to find. As on all graded events, the loving of moles applies.

1. A laser emits photons with \( \lambda = 700 \text{ nm} \). Additionally, the laser produced an overall energy of 517 kJ. How many photons were in the laser?

   (1) \( 2.56 \times 10^{21} \) photons (2) \( 5.18 \times 10^{20} \) photons (3) \( 9.51 \times 10^{23} \) photons

   (4) \( 1.82 \times 10^{24} \) photons (5) \( 6.62 \times 10^{19} \) photons

2. A certain element (X) has the following valence electron configuration: \([A]n^2n^5\) and element M has the following valence electron configuration: \([B]n^2\). Let \( A \) and \( B \) = the number of core electrons for \( Y \) and \( M \) respectively and \( n \) = the energy level. If an ionic compound was made between \( M \) and \( Y \), what would the chemical formula most likely look like?

   (1) \( MX \) (2) \( M_2X \) (3) \( MX_2 \) (4) \( M_3X_2 \) (5) \( M_3X_4 \)

3. Rank the following ions in order of increasing ionization energy: \( O^{2-}, Mg^{2+}, F^-, Na^+ \)

   1) \( O^{2-} < Mg^{2+} < F^- < Na^+ \)

   2) \( Mg^{2+} < O^{2-} < Na^+ < F^- \)

   3) \( Mg^{2+} < Na^+ < F^- < O^{2-} \)

   4) \( O^{2-} < F^- < Na^+ < Mg^{2+} \)

   5) \( O^{2-} < F^- < Mg^{2+} < Na^+ \)

4. What is the noble gas electron configuration of \( Cr^{2+} \)?

   1) \([Ar]\ 3d^4\) 2) \([Ar]3d^1\) 3) \([Ar]\ 4s^23d^4\) 4) \([Ar]\ 4s^13d^5\) 5) \([Ar]\ 3d^6\)
5. Select the false statement below:

1) Fe has 2 outer electrons, 8 valence electrons, and 18 core electrons

2) Fe²⁺ has more unpaired electrons than Fe³⁺

3) Fe³⁺ is has the same electron configuration as Mn²⁺

4) none of these ions (Fe²⁺, Fe³⁺, Mn²⁺) have any electrons in the 4s subshell

5) All are true

6. Which of the following is false? Note: in this question, n = highest energy level of atom

1) Transition metals have valence electrons in both the ns and the n-1 d sublevels

2) ns sublevels are smaller than n-1 d sublevels

3) p sublevels are higher in energy than s sublevels

4) f sublevels have an energy level of n - 2

5) All of the above are true

7. What type of elements exist as [NG]ns²?

1) Group I metals  2) Group II metals  3) nonmetals  4) transition metals  5) noble gases

8. Rank the following five ions in order of increasing ionic radius: Na, Na⁺, Cs⁺, Ar, Br⁻

(1) Na < Na⁺ < Cs⁺ < Ar < Br⁻

(2) Cs⁺ < Na⁺ < Na < Ar < Br⁻

(3) Br⁻ < Na⁺ < Cs⁺ < Ar < Na

(4) Na⁺ < Cs⁺ < Ar < Na < Br⁻

(5) Br⁻ < Na < Ar < Cs⁺ < Na⁺
9. What is the formal charge of the following molecules

I) CO$_3^{2-}$  II) BF$_3$  III) NH$_3$

1) 0, 0, 0  2) -2, 0, 0  3) 3, 3, 3  4) 1, 2, 3  5) 1, 1, 1

10. Suppose in organic chemistry, an ethyl group (C$_2$H$_5$) is burned in a calorimeter. However, when the reaction was occurring, the oxygen gas in the fuel tank used had only a small amount (6 grams) of oxygen gas left. Additionally, suppose that a 3 gram ethyl sample was burned. How much energy could be produced from the reaction given that the balanced reaction is:

$$2 \text{C}_2\text{H}_5 \text{(g)} + 5 \text{O}_2 \text{(g)} \rightarrow 4 \text{CO}_2 \text{(g)} + 2 \text{H}_2\text{O} \text{(g)} \Delta H = -2510 \text{ kJ}$$

1) 94.1 kJ  
2) 129.56 kJ  
3) 25.00 kJ  
4) 2510 kJ  
5) None of the above

11. The Citric Acid Cycle is a fundamental biochemical reaction used by all aerobic organisms where stored energy is released through the oxidation of acetyl-coA. This cycle consists of ten different steps. The very first step of the citric acid cycle is called citrate synthase. Here, acetyl-coA undergoes a type of reaction called Claisen Condensation with oxaloacetate and water. The reaction produces a substance called citrate. The reaction for citrate synthase is shown below.

$$\text{C}_{23}\text{H}_{38}\text{N}_7\text{O}_{17}\text{P}_3\text{S} + \text{C}_4\text{H}_4\text{O}_5 + \text{H}_2\text{O} \rightarrow \text{C}_{21}\text{H}_{36}\text{N}_7\text{O}_{18}\text{P}_3\text{S} + \text{C}_6\text{H}_8\text{O}_7 + 32.2 \text{kJ/mol}$$

Given the equation, what is true about this reaction?

1. The rxn is endothermic and delta H will be negative.  
2. The rxn is endothermic and delta H will be positive.  
3. The rxn is exothermic and delta H will be negative.  
4. The rxn is exothermic and delta H will be positive.  
5. The rxn is endothermic and delta H will be zero
12. How many lone pairs does the central atom have for the following molecules?

I. \( \text{H}_2\text{O} \) II. \( \text{NH}_3 \) III. \( \text{CO}_2 \)

1) 1, 2, 3
2) 0, 0, 0
3) 2, 1, 0
4) 0, 1, 2
5) 4, 4, 4

13. Which of the following DOES not have the same electron configuration as the others?

(1) \( \text{Mg}^{2+} \) (2) \( \text{Na}^{+} \) (3) \( \text{O}^{2-} \) (4) \( \text{Ar} \) (5) \( \text{Ne} \)
GOOD LUCK, SMILE ON THE EXAM, and remember to love your moles: all $6.022 \times 10^{23}$ of them!

-UF Teaching Center