

Question 1 A piece of copper has a mass of 770 kg. Using dimensional analysis and the conversion data given below, what is the volume of the sample, in units of liters?
6 Points

$$1 \text{ cm}^3 \text{ Cu} = 8.8 \text{ g Cu}$$

$$1 \text{ kg} = 1000\text{g}$$

$$1\text{L} = 1000 \text{ cm}^3$$

$$9.5 \times 10^{21} \text{ atoms Cu} = 1 \text{ g Cu}$$

$$1 \text{ cm}^3 = 1 \text{ mL}$$

$$\frac{770 \text{ kg Cu}}{1 \text{ kg}} = 770,000 \text{ g Cu}$$

$$\frac{770,000 \text{ g Cu}}{8.8 \text{ g Cu}} = 87,500 \text{ cm}^3 \text{ Cu}$$

$$\frac{87,500 \text{ cm}^3 \text{ Cu}}{1,000 \text{ cm}^3} = 87.5 \text{ L Cu}$$

Question 2 What is the charge of the ions formed from: (Give both magnitude and sign.)
4 Points

Al +3

S -2

Cl -1

Mg +2

Question 3 Fill in the blanks in the following table:
4 Points

Protons	Neutrons	Electrons	Complete Atomic Symbol
21	24	20	${}^{45}_{21}\text{Sc}^+$
17	18	18	${}^{35}\text{Cl}^-$ or ${}^{35}_{17}\text{Cl}^-$

Question 4 Classify each of the following elements as:
8 Points
Pick the most appropriate from the following:
Metal, Non Metal, Halide, Noble Gas, Alkali Metal, Alkali Earth Metal, Transition Metal, Lanthanide or Actinide.

Element Number	Element Number
4 Alkali Earth Metal	18 Noble Gas
35 Halide	24 Transition Metal
13* Metal	19 Alkali Metal
8 Non Metal	60 Lanthanide

* Element number 13 when it reacts becomes a cation (likes to loose electrons)

Question 5 Bromine (Br) has two naturally occurring isotopes:

4 Points

Isotope	Exact Mass	Natural Abundance
^{79}Br	78.918336	50.69%
^{81}Br	80.916290	49.31%

What is the average atomic mass of Br?

$$78.918336(0.5069) + 80.916290(0.4931) = 79.903527$$

Question 6 A sample of cinnamaldehyde, $\text{C}_9\text{H}_8\text{O}$, contains 0.178 mol of the compound. What is the mass of this sample in grams?

4 Points

$$9(12.01) + 8(1.01) + 16.00 = 132.17 \text{ g}\cdot\text{mol}^{-1}$$

$$\frac{0.178 \text{ mol } \text{C}_9\text{H}_8\text{O}}{1 \text{ mol}} \times \frac{132.17 \text{ g}}{1 \text{ mol}} = 23.53\text{g}$$

Question 7 Analysis of a compound found it to contain:

4 Points

N 18.888% Mg 16.388% O 64.727%

What is the empirical formula of this compound?

N	Mg	O
18.888g	16.388g	64.727g
1.348 mol	0.674 mol	4.045 mol
2.000	1.000	6.001
N_2MgO_6		

Question 8 Using the smallest whole number integers possible, balance the following chemical equations.

6 Points

- $\text{CH}_4 + 2 \text{O}_2 = 2 \text{H}_2\text{O} + \text{CO}_2$
- $2 \text{AgNO}_3 + \text{K}_2\text{CrO}_4 = \text{Ag}_2\text{CrO}_4 + 2 \text{KNO}_3$
- $2 \text{CH}_3\text{OH} + 3 \text{O}_2 = 4 \text{H}_2\text{O} + 2 \text{CO}_2$

Question 9 6 Points A chemical reaction can be initiated by light that carries energy of $385 \text{ kJ}\cdot\text{mol}^{-1}$. Only light less than a certain wavelength will initiate the reaction.

What is the longest wavelength, in meters, that can deliver the required energy?

$$385,000 \text{ J}\cdot\text{mol}^{-1}$$

$$6.3922 \times 10^{-19} \text{ J}$$

$$\nu = 9.647 \times 10^{14} \text{ s}^{-1}$$

$$\lambda = 3.107 \times 10^{-7} \text{ m}$$

Question 10 8 Points Give the correct name for each of the following ionic compounds.

- | | | | |
|---------------------------------|---------------------|-------------------------------|----------------------------|
| 1. AlCl_3 | Aluminum chloride | 5. Li_2HPO_4 | Lithium hydrogen phosphate |
| 2. BaI_2 | Barium iodide | 6. $\text{Cu}(\text{CN})_2$ | Copper(II) cyanide |
| 3. $\text{Fe}(\text{OH})_3$ | Iron(III) hydroxide | 7. $\text{Cr}(\text{NO}_2)_2$ | Chromium(II) nitrite |
| 4. $(\text{NH}_4)_2\text{SO}_4$ | Ammonium sulfate | 8. KNO_3 | Potassium nitrate |

Question 11 6 Points a. What type of orbital is depicted on the right? (s, p, d, f, g)

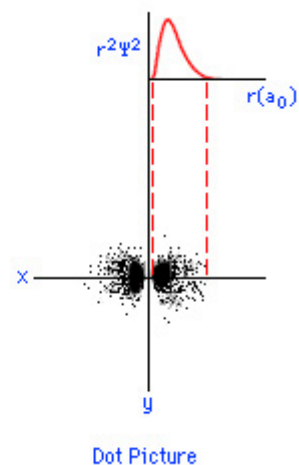
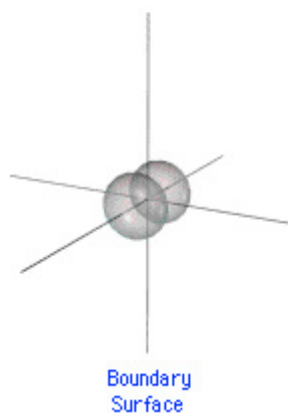
b. What is the principal quantum number for this orbital?

c. What is the specific designation for this orbital?

p

2

$2p_x$



Question 12 5 Points Which of the following orbital designations are solutions to the Schrodinger Equation. [Check those that apply]

8s

4p

2d

4f

1p

Question 13 Give the Complete Electronic Configuration (Spectroscopic Notation) for the following:

6 Points

1. O $1s^2 2s^2 2p^4$
2. P $1s^2 2s^2 2p^6 3s^2 3p^3$
3. Br $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$

Question 14 Give the Noble Gas Electronic Configuration for the following:

6 Points

1. Fe $[\text{Ar}]4s^2 3d^6$
2. I $[\text{Kr}]5s^2 4d^{10} 5p^5$
3. Cu $[\text{Ar}]4s^1 3d^{10}$

Question 15 Which of the following elements are paramagnetic?

5 Points

[Check those that are]

B N Zn Sc Mg

Question 16 Give the Noble Gas Electronic Configurations for the following ions.

6 Points

1. Br^- $[\text{Kr}]$ or $[\text{Ar}]4s^2 3d^{10} 4p^6$
2. Co^{2+} $[\text{Ar}]3d^7$
3. Na^+ $[\text{Ne}]$

Question 17 An unknown metal X, that contains no d or f electrons, reacts with oxygen to form a compound whose empirical formula is X_2O_3 . Answer the following questions with regards to X.

6 Points

1. How many valence electrons does X have? 3
2. What group in the periodic table does X belong to? IIIA
3. What type of orbitals does X lose its electrons from? s & p

Question 18 Consider the four elements, Be, Ca, Mg and Sr. Which of these has:

6 Points

1. The greatest atomic radius: Sr
2. The largest first ionization energy: Be
3. The smallest electron affinity: Sr

