Question 1
6 Points

A piece of copper has a mass of 640 kg. Using dimensional analysis and the conversion data given below, what is the volume of the sample, in units of liters?

$1\ cm^3\ Cu = 8.8\ g\ Cu$
$1\ kg = 1000 g$
$1L = 1000\ cm^3$

9.5×10^{21} atoms Cu = 1 g Cu
$1\ cm^3 = 1\ mL$

$$\frac{640\ kg\ Cu \quad | \quad 1000 g}{\quad\quad\quad\quad | \quad 1\ kg} = 6.4 \times 10^5 g\ Cu$$

$$\frac{6.4 \times 10^5\ g\ Cu \quad | \quad 1\ cm^3\ Cu}{\quad\quad\quad\quad\quad | \quad 8.8\ g\ Cu} = 7.3 \times 10^4 cm^3\ Cu$$

$$\frac{7.3 \times 10^4\ cm^3\ Cu \quad | \quad 1\ L}{\quad\quad\quad\quad\quad\quad | \quad 1000\ cm^3} = \mathbf{73L\ Cu}$$

Question 2
4 Points

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

Ca	**+2**	F	**-1**
S	**-2**	K	**+1**

Question 3
4 Points

Fill in the blanks in the following table:

Protons	Neutrons	Electrons	Complete Atomic Symbol
39	**51**	**38**	$^{90}_{39}Y^{+}$
20	20	18	$^{40}_{20}Ca^{+2}$

Question 4
8 Points

Classify each of the following elements as:
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	
68	**Lanthanide**	12	**Alkali Earth Metal**
86	**Noble Gas**	19	**Alkali Metal**
27	**Transition Metal**	13	**Metal**
53	**Halide**	16	**Non Metal**

* Element number 13 when it reacts likes to loose electrons

Question 5
6 Points

Eu has two naturally occurring isotopes:

Isotope	Exact Mass	Natural Abundance
^{151}Eu	150.919860	47.80%
^{153}Eu	152.921243	52.20%

What is the average atomic mass of Eu? (Give your answer to 6 decimal places)

150.919860(0.4780) + 152.921243(0.5220) = **151.964582**

Question 6
6 Points

A sample of cinnamaldehyde, C_9H_8O, has a mass of 23.53g. Who many moles of cinnamaldehyde does this represent?

C_9H_8O = 9(12.01) + 8(1.01) + (16.00) = 132.17 g/mol

$$\frac{23.50\text{g } C_9H_8O}{} \left| \frac{1 \text{ mol}}{132.17 \text{ g}} \right. = \mathbf{0.1778 \text{ mol } C_9H_8O}$$

Question 7
6 Points

Analysis of a compound found it to contain:

K 49.413% S 20.259% O 30.330%

What is the empirical formula of this compound?

K	S	O
49.413g	20.259g	30.330g
1.2638	0.63171	1.8956
$\frac{1.2638}{0.63171}$	$\frac{0.63171}{0.63171}$	$\frac{1.8956}{0.63171}$
2.006	1	3.007

K_2SO_3

Question 8
9 Points

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

1. $C_3H_8 + \mathbf{5}\ O_2 = \mathbf{4}\ H_2O + \mathbf{3}\ CO_2$
2. $2\ Fe_2O_3 + \mathbf{3}\ C = \mathbf{4}\ Fe + \mathbf{3}\ CO_2$
3. $\mathbf{2}\ CH_3OH + \mathbf{3}\ O_2 = \mathbf{4}\ H_2O + \mathbf{2}\ CO_2$

Question 9 (7 Points)

A chemical reaction can be initiated by light that carries energy of 3.79×10^5 J.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?

$$\frac{3.79 \times 10^5 \text{ J.mol}^{-1} \mid \text{mol}}{\mid 6.023 \times 10^{23}} = 6.29 \times 10^{-19} \text{ J}$$

$$E = h\nu$$
$$6.29 \times 10^{-19} \text{ J} = (6.626 \times 10^{-34} \text{ J.s})\,\nu$$
$$\nu = 9.49 \times 10^{14} \text{ s}^{-1}$$

$$\lambda\nu = c$$
$$\lambda(9.49 \times 10^{14} \text{ s}^{-1}) = 2.998 \times 10^8 \text{ m.s}^{-1}$$
$$\lambda = \mathbf{3.16 \times 10^{-7} \text{ m}}$$

Question 10 (4 Points)

Give the correct name for each of the following ionic compounds.

1. MgO — **Magnesium oxide**
2. $Ca(NO_2)_2$ — **Calcium nitrite**
3. FeP — **Iron(III) phosphide**
4. $CuCl_2$ — **Copper(II) chloride**

Question 11 (4 Points)

Give the correct formula for each of the following ionic compounds.

1. Ammonium nitrate — **NH_4NO_3**
2. Lithium hydrogen sulfate — **$LiHSO_4$**
3. Potassium chlorate — **$KClO_3$**
4. Aluminum phosphate — **$AlPO_4$**

Question 12 (6 Points)

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

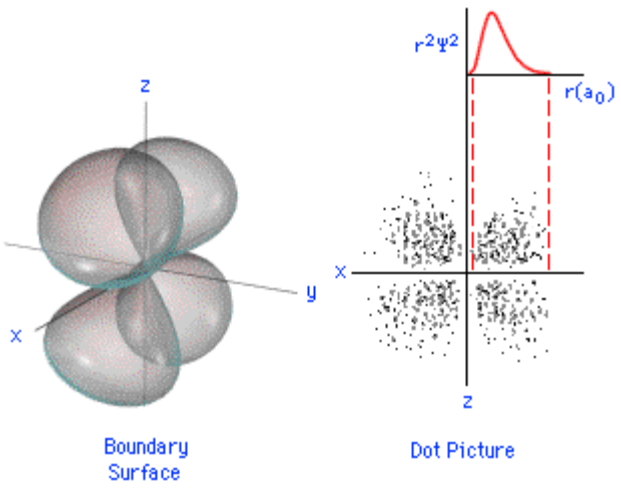
D

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

3

c. What is the specific designation for this orbital?

$3D_{xz}$



Question 13 (6 Points) Which of the following orbital designations are solutions to the Schrodinger Equation. [Check those that apply]

8s **4p** 2d 3f **2p**

Question 14 (6 Points) Give the Complete Electronic Configuration (Spectroscopic Notation) for the following:

1. C **$1s^2 2s^2 2p^2$**
2. Al **$1s^2 2s^2 2p^6 3s^2 3p^1$**
3. Br **$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$**

Question 15 (6 Points) Give the Noble Gas Electronic Configuration for the following:

1. Cl **$[Ne]3s^2 3p^5$**
2. Ca **$[Ar]4s^2$**
3. Se **$[Ar]4s^2 3d^{10} 4p^4$**

Question 16 (6 Points) Which of the following elements are paramagnetic? [Check those that are]

Li Mg **C** Ar **O**

Question 17 (6 Points) In the visible region of the electromagnetic spectrum, red and blue light lie at the extremes. Which of these has:

1. The longest wavelength: **Red**
2. The highest frequency: **Blue**
3. The smallest energy: **Red**