Question 1
4 Points

A spherical metal ball has a mass of **6.581g** and a diameter of **9.06mm**. What is the density of the metal in **g/cm^3**   [Volume of a sphere is **(4/3)πr^3**]

$V = (4/3)\pi(0.453cm)^3 =$ **0.389 cm^3**

$d = m/V = 6.581g/0.389 \ cm^3 =$ **16.9 g/cm^3**

Question 2
7 Points

1. A neutral atom has 60 protons and 83 neutrons. Fill in the three blanks to complete the atomic symbol $^{143}_{60}$**Nd**

2. Which if any of the following species has the same number of **neutrons** as it does **electrons**? Circle the correct answer(s).

$^{47}_{24}Cr^+$ $^{24}Mg^{2+}$ $^{59}Co^{2+}$ $^{35}Cl^-$ $^{125}_{50}Sn$ ^{90}Sr

Question 3
10 Points

Use the Periodic Table accompanying this exam to answer the following questions:

1. Name the only **diatomic gas** in **Group VA**   **Nitrogen**

2. Symbol for the **heaviest Alkali Earth** Metal.   **Ra**

3. Symbol for **transition metal** in **Group VIB, Period 5.**   **Mo**

4. The **Lanthanides** belong to what Period?   **6**

5. Group **VIIA** are collectively referred to as: **Halides or Halogens**

Question 4
8 Points

Give the **sign** and **magnitude** of the charge associated with the following:

1. Phosphate ion   **–3**

2. Phosphide ion   **–3**

3. Ammonium ion   **+1**

4. Group IIIA elements   **+3**

Question 5
4 Points

Eu has two naturally occurring isotopes:

Isotope	Exact Mass	Natural Abundance
^{151}Eu	**150.920**	**47.80%**
^{153}Eu	**152.921**	**52.20%**

What is the average atomic mass of Eu? (Give your answer to **3 decimal places**)

150.920(0.4780) + 152.921(0.5220) = **151.965**

Question 6
4 Points

A sample of citric acid, $C_6H_8O_7$, contains **0.0645 mol** of the compound. What is the mass of this sample, in grams? **[Show All Work]**

Molar Mass = 6(12.01) + 8(1.01) + 7(16.00) = **192.14 g/mol**

$$\frac{0.0645 \text{ mol } C_6H_8O_7}{} \quad \Bigg| \quad \frac{192.14g\ C_6H_8O_7}{1mol\ C_6H_8O_7} \quad = \quad \textbf{12.4g}$$

Question 7
4 Points

Calculate the mass percent of boron in B_2O_3.

Molar Mass = 2(10.81) + 3(16.00) = **69.62 g/mol**

% Boron = (21.62/69.62)×100 = **31.05%**

Question 8
6 Points

An organic acid is composed of 58.80% carbon, 9.87% hydrogen, and 31.33% oxygen. Its molar mass is 204.26 g/mol. Determine the molecular formula of the compound.
[Show All Work]

C	H	O
58.80g	9.87g	31.33g
4.896	**9.772**	**1.958**
$\frac{4.896}{1.958}$	$\frac{9.772}{1.958}$	$\frac{1.958}{1.958}$
2.50	4.99	1.00
5.00	**9.98**	**2.00**

$C_5H_{10}O_2$ = 5(12.01) + 10(1.01) + 2(16.00) = **102.15g/mol**

$C_{10}H_{20}O_4$

Question 9
4 Points

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

1. **2** $AgNO_3(aq)$ + **1** $K_2CrO_4(aq)$ = **1** $Ag_2CrO_4(s)$ + **2** $KNO_3(aq)$

2. **2** $C_2H_6(g)$ + **7** $O_2(g)$ = **6** $H_2O(g)$ + **4** $CO_2(g)$

Question 10
6 Points

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

1. $Ca(HCO_3)_2$ **Calcium hydrogen carbonate**

2. Na_3P **Sodium phosphide**

3. $Fe_2(SO_3)_3$ **Iron(III) sulfite**

Question 11   Give the **correct formula** for each of the following ionic compounds.
6 Points

    1. Ammonium hydroxide NH_4OH

    2. Potassium chlorite $KClO_2$

    3. Aluminum chromate $Al_2(CrO_4)_3$

Question 12   With respect to **infrared**, **visible** and **ultraviolet** electromagnetic radiation.
4 Points   Which of these has:

    1. The **shortest** wavelength: **Ultraviolet**

    2. The **greatest** frequency: **Ultraviolet**

Question 13   A chemical reaction can be initiated by light that carries energy of 4.87×10^5 J.mol^{-1}. Only
6 Points   light less than a certain wavelength will initiate the reaction.
    What is the longest wavelength, in meters, that can deliver the required energy?
    [Show All Work]

$$E = (4.87 \times 10^5 \text{ J.mol}^{-1})/(6.023 \times 10^{23} \text{ mol}^{-1}) = \mathbf{8.086 \times 10^{-19} \ J}$$

$$\nu = (8.086 \times 10^{-19} \text{ J})/(6.626 \times 10^{-34} \text{ J.s}) = \mathbf{1.220 \times 10^{15} \ s^{-1}}$$

$$\lambda = (2.998 \times 10^8 \text{ m.s}^{-1})/(1.220 \times 10^{15} \text{ s}^{-1}) = 2.457 \times 10^{-7} \text{ m}$$

$$\lambda = \mathbf{2.46 \times 10^{-7} m}$$

Question 14   A general trend in atomic size is that as one progresses down a group the size increases.
5 Points   Which one of the following salts might you expect to be **insoluble** in water?

    MgS   CaS   BaS

    Briefly justify your choice.

    Coulomb's Law, All three have the same charge thus the one with the shortest distance between the charges would have the greatest force of attraction and the least tendency to dissolve in water, thus MgS.
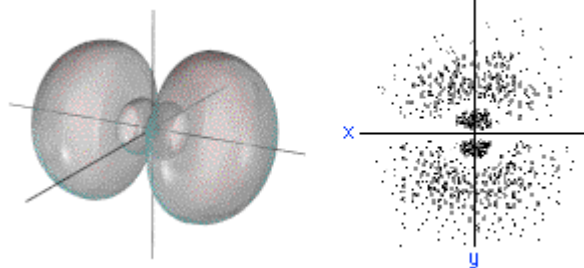
Question 15
10 points

1. How many orbitals are there with an **n** value equal to 4?   **16**

2. How many **nodal** surfaces are associated with a 4p orbital?   **3**

3. The orbital depicted on the left is:

   What type of orbital?   **p**

   Its n value is?   **3**

   Its specific designation?   **$3p_y$**

Question 16
12 Points

1. Give the **complete electronic configuration** for:

   S: **$1s^2 2s^2 2p^6 3s^2 3p^4$**

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

2. Give the **Noble Gas** (Valence) configuration for

   I: **$[Kr]5s^2 4d^{10} 5p^5$**

   K: **$[Ar]4s^1$**

3. Give the **symbol(s)** of the **Period 3** element(s) that is/are **diamagnetic**:

   Mg and Ar

Do Not Write Below This Line

| Exam I Score | |