MULTIPLE CHOICE (3pts each): Write the ONE letter corresponding to the correct answer on the line next to each question. The LETTER ASSOCIATED WITH THE CORRECT ANSWER MUST BE WRITTEN ON THE LINE NEXT TO THE QUESTION in order to receive full credit.

1.) Which response provides an appropriate set of quantum numbers for the last electron added to complete an atom of sulfur? 1.) D

a.) $n=2, l=1, m_l=+1, m_s=+1/2$ b.) $n=3, l=0, m_l=0, m_s=-1/2$

c.) $n=2, l=0, m_l=0, m_s=+1/2$ d.) $n=3, l=1, m_l=+1, m_s=-1/2$

2.) Which of the following is an example of a homogeneous mixture? 2.) C

a.) table salt b.) CO_2 c.) gatorade d.) salad

3.) How many electrons are present in an ion of magnesium (Mg^{2+})? 3.) A

a.) 10 b.) 14 c.) 12 d.) 24

4.) Convert $2.34\times10^{16}\ nm^2$ into m^2. 4.) A

a.) $2.34\times10^{-2}\ m^2$ b.) $2.34\times10^{7}\ m^2$ c.) $2.34\times10^{25}\ m^2$ d.) $2.34\times10^{-11}\ m^2$

5.) If the frequency of a wave is 578kHz, what is its wavelength? 5.) D

a.) 519km b.) 1.73×10^{8} km c.) 1.73×10^{5} km d.) 0.519km

6.) How many unpaired electrons are present in an atom of nickle? 6.) D

a.) 8 b.) 5 c.) 3 d.) 2

7.) Select the most appropriate answer to the following problem: 7.) B

(2.484cm−2.33cm)/1.87s

a.)0.0824cm/s b.) 0.082cm/s c.) 0.0823cm/s d.) 0.08cm/s

8.) Which of the following is an example of a chemical change? 8.) C

a.) dissolving salt in water b.) boiling water

c.) burning wood d.) all are examples of chemical changes

9.) The modern periodic table is arranged according to 9.) B

a.) atomic mass b.) number of protons

c.) mass number d.) number of electrons

10.) How many kilometers are equal to 528 meters? 10.) C

a.) 0.0528km b.)528000km c.) 0.528km d.) 52800km

SHORT ANSWER (10 pts each): Completely answer all of the following questions. Read all questions carefully!!! SHOW ALL WORK. Make sure to include units and report all mathematical answers to the correct number of significant figures. Write final answers in designated locations when indicated.

1.) Fill in the table with the requested information.

Element	# protons	# electrons	# neutrons	Molar Mass (include correct units)
$^{111}_{47}Ag$	47	47	111-47 64	107.868 g/mol
$^{16}_{9}F$	9	9	16-9 7	18.9984 g/mol

2.) A small cube of iron with sides measuring 2.38mm has a density of 7.874g/mL. How many atoms are contained in the cube?

Answer: 1.14×10^{21} atoms

$2.38\ mm\left(\frac{1m}{1000mm}\right)\left(\frac{100cm}{1m}\right) = 0.238cm$

$(0.238cm)^3 = 0.0134813\ cm^3\left(\frac{1mL}{cm^3}\right)$

$= 0.0134813 mL\left(\frac{7.874g}{mL}\right)$

$= 0.1061515g\left(\frac{1mol}{55.845g}\right)$

$= 0.001900824\ mol\left(\frac{6.022 \times 10^{23}\ atoms}{mol}\right)$

$= 1.144676 \times 10^{21}\ atoms$

3.) a.) How many moles are present in 126.8g iron?

Answer: 2.271 mol

$$126.8\,g\left(\frac{1\,mol}{55.845\,g}\right) = 2.27057\,mol$$

b.) What is the mass, in grams, of 1.359×10^{20} atoms of iron? Answer: $1.260\times10^{-2}\,g$ / 0.01260 g

$$1.359\times10^{20}\,atoms\left(\frac{1\,mol}{6.022\times10^{23}\,atoms}\right)$$

$$= 2.256725\times10^{-4}\,mol\left(\frac{55.845\,g}{mol}\right) = 1.260277\times10^{-2}\,g$$

c.) What is the mass, in grams, of 8.643×10^{-2} moles of iron? Answer: 4.827 g

$$8.643\times10^{-2}\,mol\left(\frac{55.845\,g}{mol}\right)$$

$$= 4.826685\,g$$

4.) The wavelength of a certain wave is 648nm.

a.) What is the frequency of the wave? Answer: 4.63×10^{14} Hz / $4.63\times10^{14}\,s^{-1}$

$$648\,nm\left(\frac{1\,m}{1\times10^{9}\,nm}\right) = 6.48\times10^{-7}\,m$$

$$\upsilon = \frac{3.00\times10^{8}\,m/s}{6.48\times10^{-7}\,m} = 4.62963\times10^{14}\,s^{-1}$$

b.) What is the energy of a single photon with this wavelength? Answer: $3.07\times10^{-19}\,J/photon$

$$E = \frac{(6.626\times10^{-34}\,J\cdot s)(3.00\times10^{8}\,m/s)}{6.48\times10^{-7}\,m}$$

$$= 3.06759\times10^{-19}\,J$$

c.) What is the energy of a mole of photons with this wavelength? Answer: $1.85\times10^{5}\,J/mol$

$$3.06759\times10^{-19}\,\frac{J}{photon}\left(\frac{6.022\times10^{23}\,photons}{mol}\right)$$

$$= 1.8473\times10^{5}\,J/mol$$

5.) Write electron configurations for the following elements in the format indicated. Make sure to list the orbitals in the order in which they are filled. Assume there are no exceptions to the Aufbau principle.

a.) Nitrogen (orbital notation)

$\frac{1\downarrow}{1s}\ \frac{1\downarrow}{2s}\ \frac{1}{2p}\ \frac{1}{2p}\ \frac{1}{2p}$

b.) Iron (III) (Fe^{3+}) (electron configuration notation)

$1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$

c.) Palladium (noble gas configuration, either orbital or electron configuration notation)

$[Kr]\ 5s^2 4d^8$

d.) Which has a larger ionization energy: oxygen, sulfur, or selenium? oxygen

e.) Which atom is smaller: calcium, cobalt, or arsenic? arsenic

f.) Which has a lower electronegativity: lithium, potassium, or cesium? cesium

g.) Which ion is larger: strontium, silver, or iodine? iodine

6.) A given elements has three isotopes with the following atomic masses and abundances: 56.9822amu (37.036%), 52.8762 (48.557%) and 58.6247 (14.407%).

b.) What is the average atomic mass for this element? Answer: 55.225 amu

$56.9822\ amu\ (0.37036) = 21.10393\ amu$

$52.8762\ amu\ (0.48557) = 25.675096\ amu$

$58.6247\ amu\ (0.14407) = 8.446496\ amu$

$55.225\overline{8}65\ amu$

c.) How many moles would be present in 50.0g of this element? Answer: 0.905mol

$50.0g\left(\frac{1mol}{55.225g}\right) = 0.905387\ mol$

7.) a.) What is the energy associated with an electron moving from the 5th to the 3rd energy level?

$-2.18 \times 10^{-18} J \left(\frac{1}{3^2} - \frac{1}{5^2}\right)$

$= -2.18 \times 10^{-18} J \left(\frac{1}{9} - \frac{1}{25}\right)$

$= -2.18 \times 10^{-18} J (0.1111 - 0.04)$

$= -2.18 \times 10^{-18} J (0.0711111)$

$= -1.550222 \times 10^{-19} J$

Answer: $1.55 \times 10^{-19} J$

b.) Is energy released or absorbed in this transition? Answer: released

c.) Briefly explain your answer to part b.

Energy value is negative

or

Moving from higher to lower energy level requires the e- to lose/release energy