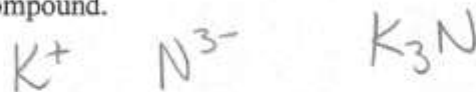


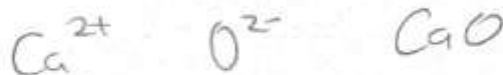
CHM 150/151 Exam 1 - Chapters 1, 2, 5, and 6**Show all work, report all units and clearly mark answers to receive credit!**

1) Write the formula for each compound.

a. Potassium nitride



b. Calcium oxide



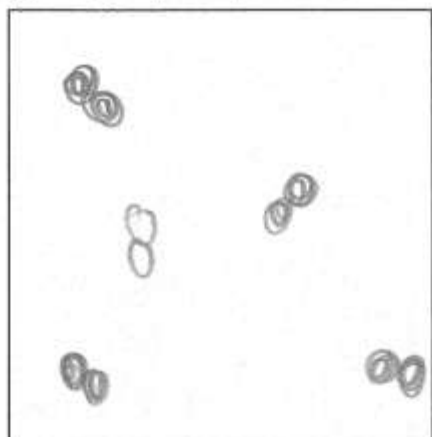
2) Which of the following are chemical processes? Circle all that apply.

a. deposition of water





 b. electrolysis of water c. combustion of magnesium d. photosynthesis

e. dissolution of sodium chloride

3) Pretend that you could see molecules and draw a representation of air in the box below. To the right of your picture, describe what air is in words, phrases and chemical symbols.



Air is a clear, colorless mixture of gases. Dry air consists of

78%	nitrogen (N_2)	
21%	oxygen (O_2)	
1%	argon (Ar)	
0.3%	carbon dioxide	

4) Circle the numbers below that are assumed to have 2 significant figures.

 1201.30 $\times 10^{-3}$

1.200

104

 0.030

4.62

5) Complete the following conversion (SHOW ALL WORK):

a) $578 \text{ cm}^2 = \text{_____} \text{ in}^2$

$$578 \text{ cm}^2 \times \frac{1 \text{ in}}{2.54 \text{ cm}} \times \frac{1 \text{ in}}{2.54 \text{ cm}} = 89.6 \text{ in}^2$$

6) The density of aluminum is 2.700 g/mL. What is the volume of 46.5g of aluminum?
Clearly show all work.

$$2.700 \text{ g} = 1 \text{ mL}$$

$$46.5 \text{ g Al} \times \frac{1 \text{ mL}}{2.700 \text{ g}} = 17.2 \text{ mL}$$

7) Below each box, write the identity of the depicted atom or ion using the ${}^A_ZX^q$ notation

○ Proton ⊕ Neutron ● Electron

a.	b.	c.	d.	e.
${}^6_3\text{Li}$	${}^7_3\text{Li}$	${}^7_3\text{Li}^+$	${}^7_4\text{Be}^+$	${}^7_4\text{Be}^-$

8a) What did Thomson determine?

The charge to mass ratio for electrons.

b) Who levitated oil drops to determine the charge of electrons?

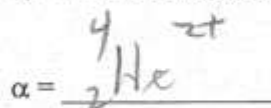
Milliken

c) Describe how Becquerel separated radioactive emissions into their components.

He passed them through an electric field. The charged particles changed direction



d) What are the specific identities of alpha, beta and gamma emissions?



$\gamma =$ electromagnetic radiation (photons)

9a) What is the energy of a mole of photons if each photon has a wavelength of $6.08 \times 10^{-7} \text{ m}$?

$$c = \lambda \nu$$

$$E = h\nu$$

$$\nu = \frac{c}{\lambda} = \frac{2.998 \times 10^8 \frac{\text{m}}{\text{s}}}{6.08 \times 10^{-7} \text{ m}} = 4.931 \times 10^{14} \frac{1}{\text{s}}$$

$$E = h\nu = 6.626 \times 10^{-34} \text{ J}\cdot\text{s} \left(4.931 \times 10^{14} \frac{1}{\text{s}} \right) = 3.267 \times 10^{-19} \text{ J per photon}$$

$$3.267 \times 10^{-19} \text{ J} \times \frac{6.0221 \times 10^{23}}{\text{mol}} = 1.97 \times 10^5 \frac{\text{J}}{\text{mol}}$$

9b) Draw an energy diagram of the first 4 energy levels of the H atom, with approximately correct spacing between energy levels.

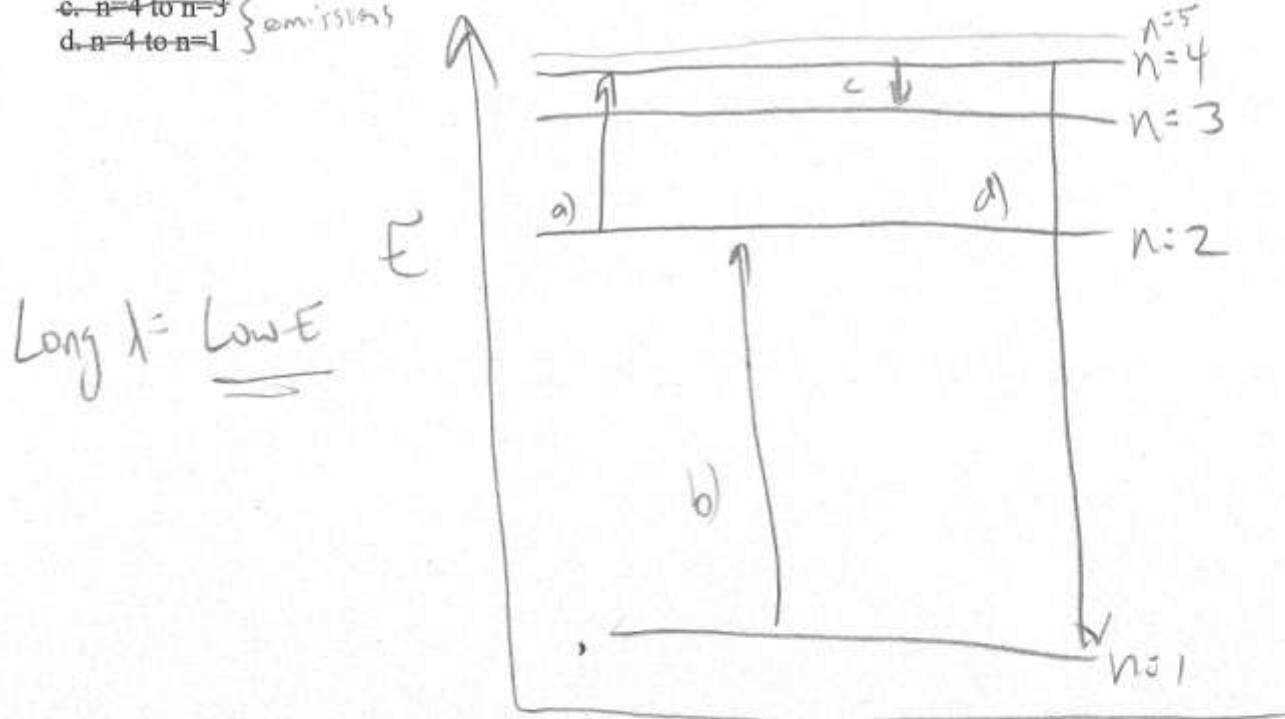
Which absorption is of longest wavelength (circle the letter of your response)

a. $n=2$ to $n=4$

b. $n=1$ to $n=2$

c. $n=4$ to $n=3$ } emissions

d. $n=4$ to $n=1$ }



11) Write electron configurations for atoms or ions of the following elements:

C (long hand): $1s^2 2s^2 2p^2$ $6e^-$

Mg (long hand): $1s^2 2s^2 2p^6 3s^2$ $12e^-$

Cr (abbreviated): $[Ar] 4s^1 3d^5$ $24e^-$

Ti⁺ (abbreviated): $[Ar] 3d^3$ $21e^-$

Ca²⁺ (abbreviated): $[Ar]$ $18e^-$

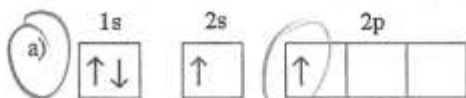
exception!
order changes!

12) Indicate the complete set of quantum numbers for the two lowest energy electrons in C

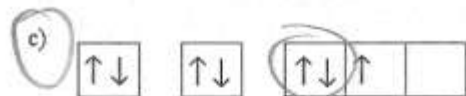
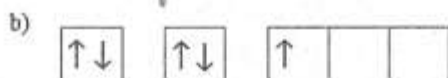
electron	n	l	m	s
1	1	0	0	$+\frac{1}{2}$
2	1	0	0	$-\frac{1}{2}$

Low E $\rightarrow 1s^2 2s^2 2p^2$ s means $l=0!$

13) Circle the letter for each diagram that represents an excited state. To the right of each diagram, identify the atom whose configuration is represented.



promoted e⁻



Hund violation

14a. Which is larger, K or Se? Explain. $K [Ar] 4s^1$ $Se [Ar] 4s^2 3d^{10} 4p^4$
 $n=4 \leftarrow$ same $n \rightarrow n=4$

Se has more protons in the nucleus, attracting e⁻, making it smaller

b. Which is larger, Ca or Ca²⁺? Explain.

Ca $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 \leftarrow n=4$

Ca²⁺ $1s^2 2s^2 2p^6 3s^2 3p^6 \leftarrow n=3$

c. Write the chemical equation that corresponds to the ionization energy of fluorine.

