Introduction to Chemistry 1311

Exam 2

Review Packet

Suggested Reading (5.1-5.7, 7.3-7.5, 11.1-11.4)

Suggested Problems:

Chapter 5 (9, 12, 13, 14, 15, 17, 18, 19, 20, 21, 25, 27, 28, 39, 41, 43, 45, 55)

Chapter 11 (1, 3, 5, 8, 9, 11, 15, 21, 27, 29, 36, 37, 39, 41, 43, 45, 47, 49, 51, 53)

Chapter 7 (21a, 22a, 25c, 30b, 32a)

Sample exam questions:

1. Circle the correct statement.(2 pts. Ea)

1 mole of NH_3 and 1 mole of N_2 have the same number of particles.

Or

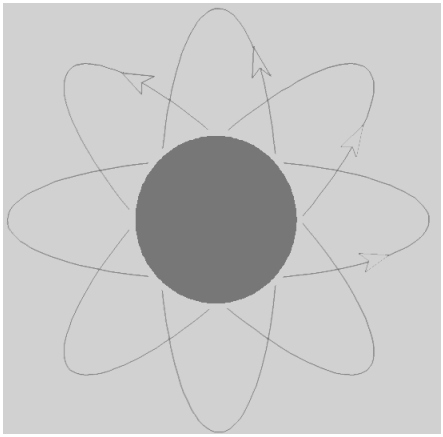
1 mole of NH_3 and 1 mole of N_2 have the same mass.

1 mole of C has 12g of mass and 6.02 X 10^{23} atoms

Or

1 mole of C and 1 mole of O have the same mass.

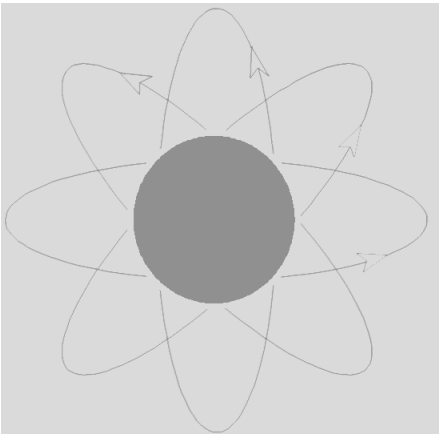
2. Please complete the following drawing. Please fill in the correct number of protons, electrons, and neutrons for the element Li. You may use the symbol *p* for proton, *n* for neutron, and *e* for electron.(3 pt)



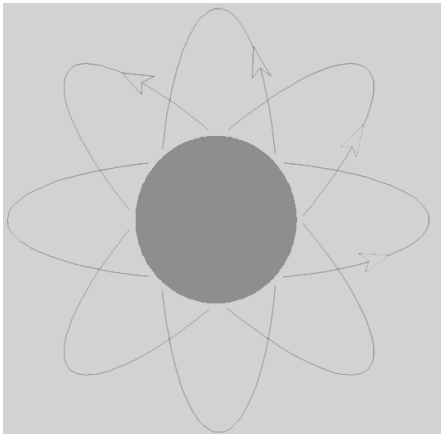
What is the atomic number for Li?

3. Please complete the following drawing. Please fill in the correct number of protons, electrons, and neutrons for each Li atom below. You may use the symbol *p* for proton, *n* for neutron, and *e* for electron.(3 pt each)

A) an isotope of Li



B) Li^{+1} ion



1. In 1909, Robert Millikan performed his famous "oil drop" experiment. He was able to determine the charge of one electron. How? Choose A, B, C, or D.
    A. By bombarding small drops of oil with α-particles
    B. By measuring the energy of the oil drop
    C. By measuring the wavelengths emitted from the oil drops
    D. By finding just the right amount of energy required to suspend the "oil drop" between competing forces of the cathode and gravity.
2. In the late 19^{th} century, Johann Balmer and Johannes Rydberg showed that the various lines in the absorption and emission spectrum of hydrogen can be related with a methematical equation. In 1913 Niels Bohr, provided an explanation for these observations. What important scientific conclusion came out of this experiment? Choose A, B, C, or D.
    A. That electrons travel around the nucleus in circular orbits with a specific amount of energy associated with each orbital
    B. Electrons exist as waves and emit light while orbiting around the nucleus
    C. Atoms can absorb electromagnetic radiation
    D. Atoms contained negatively charged particles called electrons

3. The mathematical approach of quantum mechanics involves treating electrons as ……? Choose A, B, C, or D.
    A. photons
    B. particles
    C. waves
    D. standing waves
4. What is the quantum mechanical definition of an atomic orbital? (5pt.)
5. A. Draw the complete ground-state electron configuration of a lithium +2 cation (Li^{+2}) atom using orbital notation (↑↓). (6 pt)

B. If energy is absorbed by the Li^{+2} cation in its ground state and is excited to a higher energy level, draw the complete electron configuration of the excited cation.

C. If the excited electron moves from the n=1 to n=4 energy levels and/or the n=1 to the n=2 energy levels, which movement corresponds to the greatest energy?

D. Considering part C, which movement corresponds to the shortest wavelength?

6. Write the complete ground state electron configuration for the following elements. Start with 1s. (5 pt ea)
    A. Cr
    B. Se
7. Write the short-hand (using the noble gas) notation ground-state electron configuration for the following elements. (5 pt ea)
    A. Sr
    B. Os
8. Draw the ground state electron configuration for the following elements. Please indicate whether each element is paramagnetic or diamagnetic. (5 pt ea)
    A. Al

    B. Mg
9. The ground state electron configuration for the last 3 electrons of an element is $4s^2 3d^3$, what is the element? (4 pt)
10. At the turn of the 19^{th} century, Humphrey Davy, experimented with passing an electric current through chemical substances, those substances decomposed. What was his conclusion? Choose A, B, C, or D.
    A. Chemical substances are made up of tiny particles called atoms.
    B. Chemical substances are held together with electric forces.
    C. Chemical substances undergo decomposition into their individual elements.
    D. Chemical substances are readily changed into other chemical substances.
11. In 1897, J. J. Thomson studied electrons in a cathode ray tube extensively. He was able to measure the angle of deflection of the electrons and determined the ratio of …..?
    A. electrons charge to mass (*e/m*)
    B. electrons mass to charge (*m/e*)
    C. electrons energy to mass (*E/m*)
    D. electrons mass to energy (*m/E*)
12. In 1909, Robert Millikan performed his famous “oil drop” experiment. He was able to determine the charge of one electron. How?
    A. By bombarding small drops of oil with α-particles
    B. By using the exact amount of energy required to suspend the oil drop between the cathode and the anode
    C. By using the exact amount of energy required to suspend the oil drop between the cathode and the bottom
    D. By finding just the right amount of energy required to suspend the “oil drop” between competing forces of the cathode and gravity.
13. Also in 1909, Ernest Rutherford, established that α-particles were positively charged particles spontaneously emitted by some radioactive substances. The next year his research group used

these particles to bombard a piece of gold foil. This experiment was later known as the famous "gold-foil" experiment. What important scientific conclusion came out of this experiment?

A. Atoms contained electrons suspended in a dense mass of protons, like "plum pudding".
B. Atoms contained protons which were in "orbit" around a center of electrons
C. Atoms contained a positively charged nucleus surrounded by very light electrons and a lot of space
D. Atoms contained negatively charged particles called electrons

14. H. G. J. Moseley studied the X-rays given off by certain elements extensively, during these studies he aimed a beam of these X-rays at a solid target made up of an element. He "photographed" the result and observed a series of lines. He tried the experiment again with another element and observed a different series of lines. He examined several elements and mathematically studied the relationship of these lines, from this relationship he came up with the idea of ……?
    A. atomic weight
    B. atomic number
    C. isotopes
    D. ions
15. What is electromagnetic radiation? Include an example.
16. In class we discussed halogen light bulbs and how they work. Assuming the bulb is full of mercury gas and the inner bulb is coated with a phosphorus coating, what is generating the light we see from the bulb?
    A. electrons in mercury being excited and moving to a higher energy level
    B. electrons in phosphorus being excited and moving to higher energy level
    C. electrons being removed from the mercury gas
    D. electrons from the phosphorus coating "relaxing" from a higher energy level back to a lower energy level
17. Write the complete ground state electron configuration for the following elements. Start with 1s.
    A. Ti
    B. As
18. Write the short-hand (using the noble gas) notation ground-state electron configuration for the following elements.
    A. Ca
    B. Au