

Chm.1.1.1 Analyze the structure of atoms, isotopes, and ions

- Characterize protons, neutrons, electrons by location, relative charge, relative mass ( $p=1$ ,  $n=1$ ,  $e=1/2000$ ). (*questions 19, 23, 25, 26, 27*)
- Use symbols:  $A$ = mass number,  $Z$ = atomic number (*questions 22, 24*)
- Use notation for writing isotope symbols:  ${}^{235}_{92}\text{U}$  or U-235 (*questions 22, 24*)
- Identify isotope using mass number and atomic number and relate to number of protons, neutrons and electrons. (*questions 17-24*)
- Differentiate average atomic mass of an element from the actual isotopic mass and mass number of specific isotopes. (Use example calculations to determine average atomic mass of atoms from relative abundance and actual isotopic mass to develop understanding). (*question 1*)

Chm.1.1.2 Analyze an atom in terms of the location of electrons

- Analyze diagrams related to the Bohr model of the hydrogen atom in terms of allowed, discrete energy levels in the emission spectrum. (*questions 4, 6, 11, 16*)
- Describe the electron cloud of the atom in terms of a probability model. (*questions 4, 6, 11, 16*)
- Relate the electron configurations of atoms to the Bohr and electron cloud models. (*questions 4, 6, 9, 10, 11, 16*)

Chm.1.1.3 Explain the emission of electromagnetic radiation in spectral form in terms of the Bohr model

- Understand that energy exists in discrete units called quanta.
- Describe the concepts of excited and ground state of electrons in the atom:
  1. Gaining energy results in the electron moving from its ground state to a higher energy level (*questions 7, 8, 15*).
  2. When the electron moves to a lower energy level, it releases the energy difference in the two levels as electromagnetic radiation (emissions spectrum). (*question 2*)
- Articulate that this electromagnetic radiation is given off as photons. (*question 2*)
- Understand the inverse relationship between wavelength and frequency, and the direct relationship between energy and frequency. (*questions 2, 3*)
- Use the “Bohr Model for Hydrogen Atom” and “Electromagnetic Spectrum” diagrams from the Reference Tables to relate color, frequency, and wavelength of the light emitted to the energy of the photon. (*questions 2, 3*)
- Explain that Niels Bohr produced a model of the hydrogen atom based on experimental observations. This model indicated that:
  1. an electron circles the nucleus only in fixed energy ranges called orbits;
  2. an electron can neither gain or lose energy inside this orbit, but could move up or down to another orbit;
  3. that the lowest energy orbit is closest to the nucleus.
- Describe the wave/particle duality of electrons.

Chm.1.1.4 Explain the process of radioactive decay by the use of nuclear equations and half-life

- Use the symbols for and distinguish between alpha ( ${}^4_2\text{He}$ ), and beta ( ${}^0_{-1}\text{e}$ ) nuclear particles, and gamma ( $\gamma$ ) radiation include relative mass). (*questions 12*)
- Use shorthand notation of particles involved in nuclear equations to balance and solve for unknowns. (*questions 13*)
- Compare the penetrating ability of alpha, beta, and gamma radiation. (*question 12*)
- Conceptually describe nuclear decay, including:
  1. Decay as a random event, independent of other energy influences
  2. Using symbols to represent simple balanced decay equations (*question 13*)
  3. Half-life (including simple calculations) (*question 14*)
- Compare radioactive decay with fission and fusion

Practice Questions:

- 1) The element Magnesium has three stable isotopes with the following masses and abundances:

<u>Isotope</u>	<u>Mass (amu)</u>	<u>Abundance</u>
$^{24}\text{Mg}$	23.9850	78.99%
$^{25}\text{Mg}$	24.9858	10.00%
$^{26}\text{Mg}$	25.9826	11.01%

Calculate the average atomic mass of magnesium from these data.

- 2) Complete the table with regards to electron transitions. (Use the Bohr model in your reference packet to help answer.)

<b>Electron transition</b>	<b>Energy absorbed or emitted?</b>	<b>Type of electromagnetic wave</b>	<b>If <u>visible</u> light, what <u>COLOR</u> is produced?</b>
n=4 to n=1			
n=2 to n=5			
n=6 to n=3			

- 3) Of x-rays, visible light and radio waves:

- Which is the longest in wavelength?
- Which is the highest in frequency?
- Which is the highest in energy?

- 4) Seven questions about sulfur:

- Write out the electron configuration of sulfur which has \_\_\_\_\_ e<sup>-</sup>.
- Write the orbital diagram for sulfur.



- Explain what stable ion sulfur should form based on its electron configuration (how many electrons would it need to become stable, and what oxidation number would represent that).

- How many valence electrons does sulfur have?

- 5) What block of the periodic table are the following elements in?

Mg = \_\_\_\_\_ Fe = \_\_\_\_\_ U = \_\_\_\_\_ Ar = \_\_\_\_\_

- 6) How many electrons can go into each type of sublevel? s \_\_\_\_\_ p \_\_\_\_\_ d \_\_\_\_\_ f \_\_\_\_\_

- 7) An electron that is in the lowest possible energy level is in the \_\_\_\_\_.

- 8) What do we mean if we say an electron is “excited”?

- 9) How many electrons are in each of the following?

- A filled p orbital
- A filled d sublevel
- The 2<sup>nd</sup> energy level when it's full
- A half-filled p-sublevel
- A half-filled d orbital

10) Write the electron configuration for the following atoms and ions. Identify the element that each ion is isoelectronic (has the same electron configuration) with.

a. Cl

b.  $\text{Br}^{1-}$

$\text{Br}^{1-}$  is isoelectronic with = \_\_\_\_\_

c. Na

d.  $\text{Al}^{3+}$

$\text{Al}^{3+}$  is isoelectronic with = \_\_\_\_\_

11) Write the noble gas configuration for each of the following atoms.

a. Mn

c. Cs

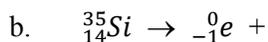
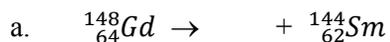
b. As

d. Zr

12) Complete the table:

Type of Radiation	Symbol	Mass	Charge	Penetrating Ability	Stopped by
Alpha	${}^4_2\alpha$				
Beta	${}^0_{-1}\beta$				
Gamma	${}^0_0\gamma$				

13) Balance each nuclear reaction by filling in the missing particle in each case.



14) The half-life of a radioactive isotope is 20.0 minutes. How much of a 1.00 gram sample of this isotope remains after 1.00 hour?

Circle the best answer for each of the following multiple choice questions:

15) Lighting fireworks pushes electrons into a higher energy level. Which of these terms describes the state of these electrons?

A) Energetic

B) Excited

C) Ground

D) Stable

16) Which of these is correct electron configuration for a neutral atom of fluorine?

A)  $1s^22s^22p^5$

C)  $1s^22s^2sp^4$

B)  $1s^22s^22p^6$

D)  $1s^22s^22p^63p^5$

17) How many protons are found in an atom of calcium?

A) 6

B) 20

C) 40

D) 38

