Unit 2A Review: Atomic Structure, Nuclear chemistry, Quantum Theory

Name: **KEY**

Basic Atomic Structure

Complete the table

Subatomic Particle	Location	Charge	Mass
Proton	nucleus	+	1 amu
Neutron	nucleus	0	1 amu
Electron	orbitals	−	0 amu

2. Complete the following chart.

Element/ion	Atomic Number	Atomic mass	Mass number	protons	neutrons	electrons
Ca^{+2}	20	40.1	40	20	20	18
$^{12}_{6}C$	6	12.01	12	6	6	6
$^{7}_{3}Li^{+}$	3	6.9	7	3	4	2
$^{35}_{17}Cl^{-}$	17	35.5	36 35	17	19	18
Ru	44	101.1	101	44	57	44
$^{238}_{92}U$	92	238	238	92	146	92

3. Atomic mass is a decimal. Why? It is a weighted average of all isotopes

4. Define Isotope. ↳ same element → different mass (dif # of neutrons)

5. Positively charged ions are formed when atom **lose** (lose, gain) electrons.

6. Calculate the atomic mass of the following sample of Silicon. 92.21 % ^{28}Si, 4.70% ^{29}Si, and 3.09% ^{30}Si. Answer to 2 decimal places, remember units.

$$(.9221)(28) + (0.0470)(29) + (0.0309)(30)$$
$$\boxed{28.11 amu}$$

7. When at atom gains two electrons, it becomes an ion with a charge of **−2**.

Nuclear Chemistry

Complete the following nuclear decay reactions.

Type of Decay (α, β, γ)

8. **Gamma** $^{99m}_{43}Tc \rightarrow ^{99}_{43}Tc + \underline{^{0}_{0}\gamma}$

9. **Beta** $^{247}_{95}Am \rightarrow ^{0}_{-1}e + \underline{^{247}_{96}Cm}$
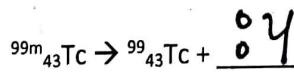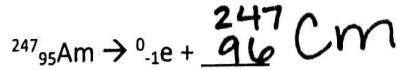
10. **Alpha** $^{175}_{93}Np \rightarrow ^{4}_{2}He + \underline{^{171}_{91}Pa}$
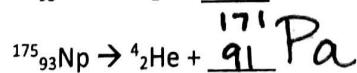
11. What is the difference between fission and fusion?
fission = large atom breaking up into smaller atom
fusion = small atoms fusing together to form larger

12. Write the equation for the alpha decay of Uranium-235.
$$^{235}_{92}U \rightarrow ^{4}_{2}He + ^{231}_{90}Th$$
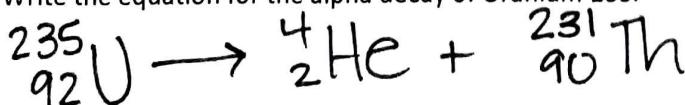
Quantum Theory

1. The probability region through which an electron may move is a(n) __orbital__.

2. At a p sublevel, there are (how many) __3__ orbitals. At an s sublevel, there are __1__ orbitals. At a d sublevel there are __5__ orbitals.

3. The maximum number of electrons possible to any p sublevel is __6__.

4. If an electron has absorbed energy and has shifted to a higher energy level, the electron is said to be in an __excited state__.

5. When all the electrons in an atom are in the lowest available energy levels, the atom is in the __ground state__.

6. What causes spectral lines (emission of light)?
   electrons fall from excited state

   $4s$ ☐

   $3p$ [↑][ ][ ]

   $3s$ [↑↓]

   $2p$ [↑↓][↑↓][↑↓]

7. Fill out the electron diagram for Aluminum
   $13e^-$

   Energy

   $2s$ [↑↓]

   a. What is the electron configuration?

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

   $1s$ [↑↓]
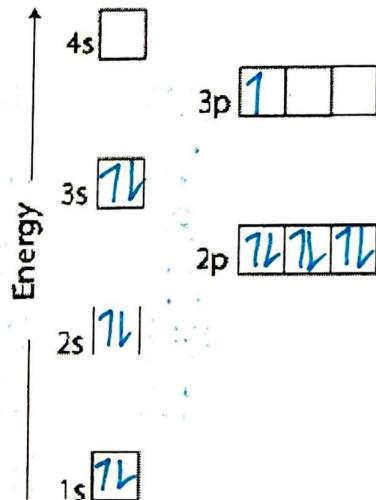
8. Label the electron configuration with what each component represents

   energy level → $2p^4$ ← # of electrons

   ↙ shape of orbital
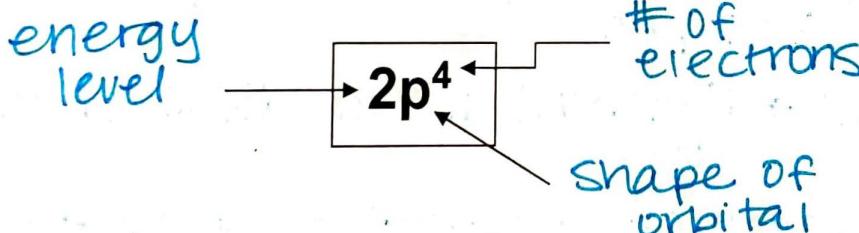
9. Write the full electron configurations (not shortcut) for the following:

   a. S $1s^2 2s^2 2p^6 3s^2 3p^4$

   b. Mn $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^5$

   c. P $1s^2 2s^2 2p^6 3s^2 3p^3$

   d. As $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^3$

10. Write the shortcut electron configuration for the following:

    e. Mg $[Ne] 3s^2$

    f. Br $[Ar] 4s^2 3d^{10} 4p^5$

    g. K $[Ar] 4s^1$