Unit 4 Review

Name: _____ **Period:** _____

Speed of light: $c = 3.0 \times 10^8$ m/s Planck's constant: $h = 6.63 \times 10^{-34}$ J·s $c = \lambda\nu$ $E = h\nu$

1. Calculate the energy of a photon with a wavelength of 4.50×10^{-7} m. Hint: 2-step problem.

$E = ?$ J, $\lambda = 4.50 \times 10^{-7}$ m

① $c = \lambda\nu$

$3.00 \times 10^8 = (4.50 \times 10^{-7})\nu$

$\nu = \frac{3.00 \times 10^8}{4.50 \times 10^{-7}}$

$\nu = 6.67 \times 10^{14}$ Hz

② $E = h\nu$

$E = (6.63 \times 10^{-34})(6.67 \times 10^{14})$

$E = 4.42 \times 10^{-19}$ J

2. When an electron in a hydrogen atom drops from the fifth to the second energy level, $4.58 \cdot 10^{-19}$ J of energy is released. Find the frequency of the photon that is produced.

$E = 4.58 \times 10^{-19}$ J, $\nu = ?$

$E = h\nu \rightarrow 4.58 \times 10^{-19} = (6.63 \times 10^{-34})\nu \rightarrow \nu = \frac{4.58 \times 10^{-19}}{6.63 \times 10^{-34}} \rightarrow \nu = 6.91 \times 10^{14}$ Hz

3. What is the wavelength of light if its frequency is 4.2×10^{14} Hz?

$\lambda = ?$ m, $\nu = 4.2 \times 10^{14}$ Hz

$c = \lambda\nu$

$3.00 \times 10^8 = \lambda(4.2 \times 10^{14})$

$\lambda = \frac{3.00 \times 10^8}{4.2 \times 10^{14}} \rightarrow \lambda = 7.1 \times 10^{-7}$ m

4. What is the frequency of ultraviolet light with a wavelength of 220 nm? **First convert nm to m. (1m = 1×10^9 nm)

$\lambda = 220 \text{ nm} \cdot \frac{1 \text{ m}}{1 \times 10^9 \text{ nm}} = 2.20 \times 10^{-7}$ m

$\nu = ?$ Hz

$c = \lambda\nu$

$3.00 \times 10^8 = (2.20 \times 10^{-7})\nu$

$\nu = 1.36 \times 10^{15}$ Hz

nm →

5. Who described orbitals by mathematical modeling?

Schrodinger

6. Define an orbital:

A region that shows high probability where electrons could be.

7. Energy levels are the horizontal periods on the periodic table ranging from 1 to 7. What are the 4 sublevels?

s, p, d, f

8. Sublevel s has a sphere shape and 1 orbital.

9. Sublevel p has a dumbbell shape and 3 orbital.

10. Sublevel d has a cloverleaf shape and 5 orbital.

11. Sublevel f has a complex / flower shape and 7 orbital.

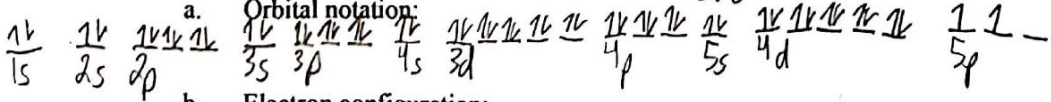
12. Define Hund's Rule for orbital notations: electrons enter orbitals one @ a time to minimize repulsion. • electrons spread out before pairing up.

13. Define Aufbau's Principle: electrons fill energy levels & orbitals from lowest to highest.

14. Define Pauli's Exclusion Principle: each orbital can hold 2 e⁻ w/ opposite spins.

15. Fill out the following information for Tin (Sn): → 50 e⁻

a. Orbital notation:



b. Electron configuration:

$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^2$

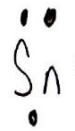
c. Shorthand (Noble Gas) configuration:

$[Kr]\ 5s^2 4d^{10} 5p^2$

d. Number of valence electrons:

4 valence e⁻

e. Lewis dot diagram:



f. Ion formed: Sn^{+4} or Sn^{-4}

16. Fill out the following information for sulfide ion (S^{-2}): ↗ 18e⁻

a. Orbital notation: 1s ↑↓ | 2s ↑↓ | 2p ↑↓ ↑↓ ↑↓ | 3s ↑↓ | 3p ↑↓ ↑↓ ↑↓

b. Electron configuration: $1s^2 2s^2 2p^6 3s^2 3p^6$

f. Shorthand (Noble Gas) configuration: [Ar]

c. Number of valence electrons: 8 valence e⁻ (octet)

Valence Electrons

The valence electrons are the electrons in the outermost/ highest energy level. They are always the outermost "s" or "s and p" electrons. Since the total number of electrons possible in the "s and p" sublevels is eight, there can be no more than eight valence electrons.

Based on the electron configuration below, determine the ELEMENT and the VALENCE electrons:

17. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$ Element: Br Valence electrons: 7

18. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$ Element: K Valence electrons: 1

19. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^8$ Element: Ni Valence electrons: 2

Lewis Dot Diagrams - Lewis Dot diagrams are a visual way to indicate the number of valence electrons around an atom. Draw Lewis dot diagrams for each of the following atoms. The following problems below are the same exact elements from the previous problems (17-18). Draw the Lewis dot diagram for the following electron configuration.

20. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$ Br

21. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$ K

22. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^8$ Ni

Periodic Trends: Circle the correct answers.

23. Which has the greatest atomic radius? (cesium) magnesium silver fluorine iodine

24. Which is the most electronegative? cesium magnesium silver (fluorine) iodine

25. Which has the greatest first ionization energy? cesium magnesium silver (fluorine) iodine

26. Which is largest? (Na) Al Cl Ar

27. Which is smallest? (Be) Mg Sr Ra

~~28.~~ Which has the greatest metallic character? (cesium) magnesium silver fluorine iodine

*Make sure to look over the symbols and units for wavelength, frequency, and energy.
**Remember the relationships between wavelength, frequency, and energy.