

1) State how each of the following people have contributed to our current understanding of the structure of the atom.

- a) Democritus *proposed idea of atom*
- b) Dalton *Atomic Theory based on exp. evidence*
- c) Thompson *electron*
- d) Rutherford *nucleus/empty space*
- e) Chadwick *neutron*
- f) Bohr *energy levels*

2) How does the Quantum Mechanical Model of the atom differ from the Bohr Model?

↑ probability *≈ e in definite orbits*

3) Fill in the following Table:

	mass	charge	location
Proton	<i>1 amu</i>	<i>+1</i>	<i>in nucleus</i>
Electron	<i>0 amu</i>	<i>-1</i>	<i>outside nucleus</i>
neutron	<i>1 amu</i>	<i>0</i>	<i>in nucleus</i>

4) Find the weighted mass average of the following elements based on the information given:

- A) Li-6 (7.42%); Li-7 (92.58%) *6.93 amu*
- B) B-10 (19.6%); B-11 (80.4%) *10.80 amu*
- C) Ne-20 (90.92%); Ne-21 (0.257%); Ne-22 (8.82%) *20.18 amu*

5) Draw a circle representing the nucleus of each atom below and show the number of each fundamental particle present in the atom.

$^{16}_8\text{O}$ <i>8p</i> <i>8n</i> <i>8e-</i>	$^{56}_{26}\text{Fe}$ <i>26p</i> <i>31n</i> <i>26e-</i>	^4_2He <i>2p</i> <i>2n</i> <i>2e-</i>
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6) A neutral atom has 15 protons and a mass number of 31. Find the...

- a) number of electrons *15*
- b) number of neutrons *16*
- c) atomic number *15*
- d) element symbol *P*
- e) element name *Phosphorus*
- f) atomic notation *$^{31}_{15}\text{P}$*

7) A neutral atom has an atomic number of 11 and 12 neutrons. Find the...

- a) number of protons *11p*
- b) number of electrons *11e-*
- c) mass number *23*
- d) element symbol *Na*
- e) element name *Sodium*
- f) atomic notation *$^{23}_{11}\text{Na}$*

8) Draw a wave that has a higher frequency than the one shown.



9) At what speed does electromagnetic radiation travel? (use units of m/s)

$3.00 \times 10^8 \text{ m/s}$

10) List the symbols representing each quantum number and briefly describe the information that each number provides.

n = energy level *m_l = orientation of orbital*
l = sublevel (shape of orbital) *m_s = spin*

11) Calculate the wavelength of a wave with a frequency of 105.5 MHz. (1 MHz = 1×10^6 Hz)

$$105.5 \text{ MHz} \times \frac{1 \times 10^6 \text{ Hz}}{1 \text{ MHz}} = 1.055 \times 10^8 \text{ Hz}$$

$$c = \lambda \nu$$

$$3.00 \times 10^8 \text{ m/s} = \lambda (1.055 \times 10^8 \text{ Hz})$$

$$\lambda = 2.84 \text{ m}$$

$$E_5 = \frac{-2.178 \times 10^{-18}}{25} = 8.712 \times 10^{-20} \text{ J} \quad E_2 = \frac{-2.178 \times 10^{-18}}{4} = 5.445 \times 10^{-19} \text{ J}$$

$$\Delta E = 4.574 \times 10^{-19} \text{ J} \quad E = h\nu \text{ or } E = \frac{hc}{\lambda}$$

$$4.574 \times 10^{-19} \text{ J} = \frac{(6.63 \times 10^{-34} \text{ J}\cdot\text{s})(3.00 \times 10^8 \text{ m/s})}{\lambda}$$

$$\lambda = 4.348 \times 10^{-7} \text{ m}$$

Honors only
Visible Light
(Blue)

12) Calculate the wavelength of the photon released when an electron moves from the fifth energy level to the second energy level. In which part of the electromagnetic spectrum is this radiation?

13) Find the frequency of green light with a wavelength of 5.35×10^{-7} meters.
 $c = \lambda\nu$
 $\nu = 5.61 \times 10^{14} \text{ s}^{-1}$

14) Write the full electron configurations for each of the following atoms.

- a) Na $1s^2 2s^2 2p^6 3s^1$
- b) He $1s^2$
- c) F $1s^2 2s^2 2p^5$
- d) Ni $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^8$

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

- a) Na $[\text{Ne}]3s^1$
- b) He $1s^2$
- c) F $[\text{He}]2s^2 2p^5$
- d) Ni $[\text{Ar}]4s^2 3d^8$

16) Draw the orbital notation for:

- a) Na $1s^2 \uparrow\downarrow \quad 2s^2 \uparrow\downarrow \quad 2p^6 \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow \quad 3s^1 \uparrow$
- b) He $1s^2 \uparrow\downarrow$
- c) F $1s^2 \uparrow\downarrow \quad 2s^2 \uparrow\downarrow \quad 2p^5 \uparrow\downarrow \uparrow\downarrow \uparrow$
- d) Ni $1s^2 \uparrow\downarrow \quad 2s^2 \uparrow\downarrow \quad 2p^6 \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow \quad 3s^2 \uparrow\downarrow \quad 3p^6 \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow \quad 4s^2 \uparrow\downarrow \quad 3d^8 \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow$

17) How many unpaired electrons are in the following atoms?

- a) Na 1
- b) He 0
- c) F 1
- d) Ni 2

18) Explain what happens to the electrons in an atom when energy is absorbed. *Move to higher E.L.*

19) Explain what happens to the electrons in an atom when energy is released. *Move to lower E.L.*

20) Why do atoms have characteristic line spectra? What does each line represent? *A transition from higher to lower E.L. Each atom has distinct energy levels.*

21) Calculate the molar mass of K_2CO_3 . 138.2 g/mol

22) How many moles are in 10.0 grams of Na_2SO_4 ? $10.0 \text{ g Na}_2\text{SO}_4 \times \frac{1 \text{ mol}}{142.1 \text{ g}} = 0.0704 \text{ mol}$

23) Calculate the number of moles in 4.95×10^{25} atoms of Neon.

24) Calculate the mass of 0.95 moles of MgCl_2 . $4.95 \times 10^{25} \text{ atoms} \times \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ atoms}} = 82.2 \text{ mol}$

$$0.95 \text{ mol} \times \frac{95.3 \text{ g}}{1 \text{ mol}} = 90.535 = 91 \text{ g}$$

25

$$10.811 \text{ amu} = 10(x) + 11(1-x)$$

$$-0.199 = -1x$$

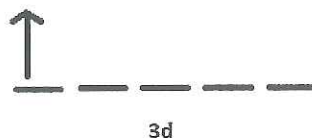
$$x = 19.9\% \text{ B-10}$$

$$81.1\% \text{ B-11}$$

1. What is the energy change that occurs in an atom when an electron falls from the 5th energy level to the 3rd energy level?
- 1.55×10^{-19} J absorbed by the atom
 - 1.55×10^{-19} J released by the atom
 - 5.45×10^{-19} J absorbed by the atom
 - 5.45×10^{-19} J released by the atom

2. A photon has a wavelength of 765nm. What is its frequency?
- 3.92×10^{14} Hz
 - 2.55×10^{-15} Hz
 - 3.92×10^5 Hz
 - 2.55×10^{-6} Hz

3. Which set of quantum numbers describes the electron shown in this partial orbital diagram?
- (3, 3, -2, +1/2)
 - (3, 2, 1, +1/2)
 - (3, 3, 1, +1/2)
 - (3, 2, -2, +1/2)



4. How many atoms are in a 20.0 gram sample of silicon?
- 3.76×10^{23}
 - 4.29×10^{23}
 - 8.46×10^{23}
 - 9.656×10^{23}
5. Which element is found in period four and contains five electrons in its outermost energy level?
- Arsenic
 - Bromine
 - Antimony
 - Iodine
6. Boron has an average atomic mass of 10.81 amu. Boron only contains two isotopes, B-10 and B-11. What are the approximate percent abundances of each isotope?
- 5% B-10 and 95% B-11
 - 20% B-10 and 80% B-11
 - 40% B-10 and 60% B-11
 - 70% B-10 and 30% B-11
7. What is the mass of 122 moles of gold?
- 24.0 kg
 - 24.0 mg
 - 1.61 kg
 - 1.61 mg
8. Which best describes the element that has an electron configuration of $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^1$?
- A metal with 1 valence electron
 - A nonmetal with 1 valence electron
 - A metal with 3 valence electrons
 - A nonmetal with 3 valence electrons