

PART I: ATOM MODE

Open the *Atom* mode of the PhET simulation.

(<http://phet.colorado.edu/en/simulation/build-an-atom>).

Questions

1. What different kinds of particles do you have as building materials for an atom?

- protons
- neutrons
- electrons

2. Are you limited as to where you can put any of these particles? If so, briefly describe any limitations in the space below.

The protons and neutrons are limited to the nucleus while the e^- can only be placed outside of the nucleus.

3. Which particle/particles affect the element name of the atom you build?

The element name is determined by the # of protons.

4. What do all oxygen atoms have in common?

All oxygen atoms have the same # of protons (and therefore e^- since all atoms are neutral)

5. Which particle/particles are responsible for the mass of the atom you build? Provide examples as evidence to support your answer.

The mass is determined by the sum of protons + neutrons.

ex) ${}^7_3\text{Li}$ $3 p^+ + 4 n^0 = 7$ total particles in nucleus.

6. How many different uncharged (neutral) stable hydrogen atoms can you build? 2
In the space below, briefly describe the similarities and differences in their composition.

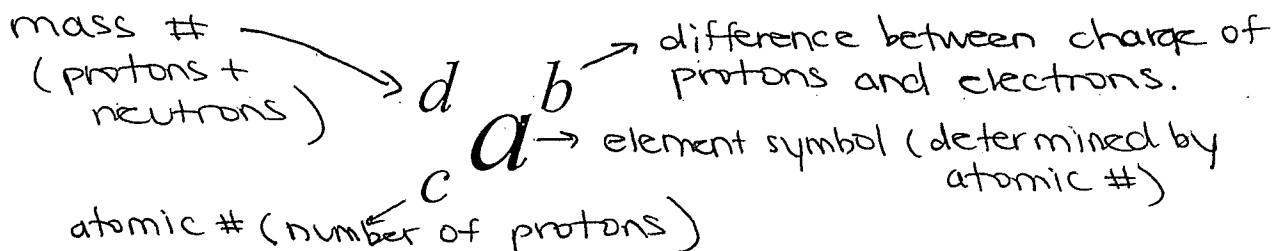
${}^1\text{H}$ and ${}^2\text{H}$ are stable, but after more than 1 neutron is added to the nucleus, the atom becomes unstable. Both of these atoms of hydrogen have the same # of protons, but a different # of neutrons.

PART II: SYMBOL MODE

7. Using the *Symbol* mode, figure out **which particles** affect each component of the atomic symbol.

a) In the atomic symbol below, label each letter (*a*, *b*, *c*, and *d*) with:

- the **particle(s)** used to determine the letter, and
- **how** the value of each letter is determined.



8. Create a definition (using a complete sentence) for each of these items based on your labels from the atomic symbol above.

a) Element Symbol - determined by the # of protons in the nucleus (atomic number)

b) Charge - difference between the (+) charged in the nucleus and (-) charge outside nucleus.

c) Atomic Number - number of protons.

d) Mass Number - protons + neutrons (both inside nucleus)

9. Use the simulation in "Symbol" mode to (a) complete the first row of the table below, and then to (b) build stable neutral atoms of 3 other elements. Record information about each atom in the table below. (other answers possible too!)

Element Name	Symbol	#protons	#neutrons	#electrons	Mass Number	Atomic Number
Hydrogen	${}^1_1\text{H}$	1	0	1	1	1
Lithium	${}^7_3\text{Li}$	3	4	3	7	3
Boron	${}^{11}_5\text{B}$	5	6	5	11	5
Helium	${}^4_2\text{He}$	2	2	2	4	2

ALL ATOMS WILL ALWAYS HAVE EQUAL #'s of protons and electrons because they are neutral.