
Charlie Werts

Atomic Structure

SPS1. Students will investigate our current understanding of the atom.

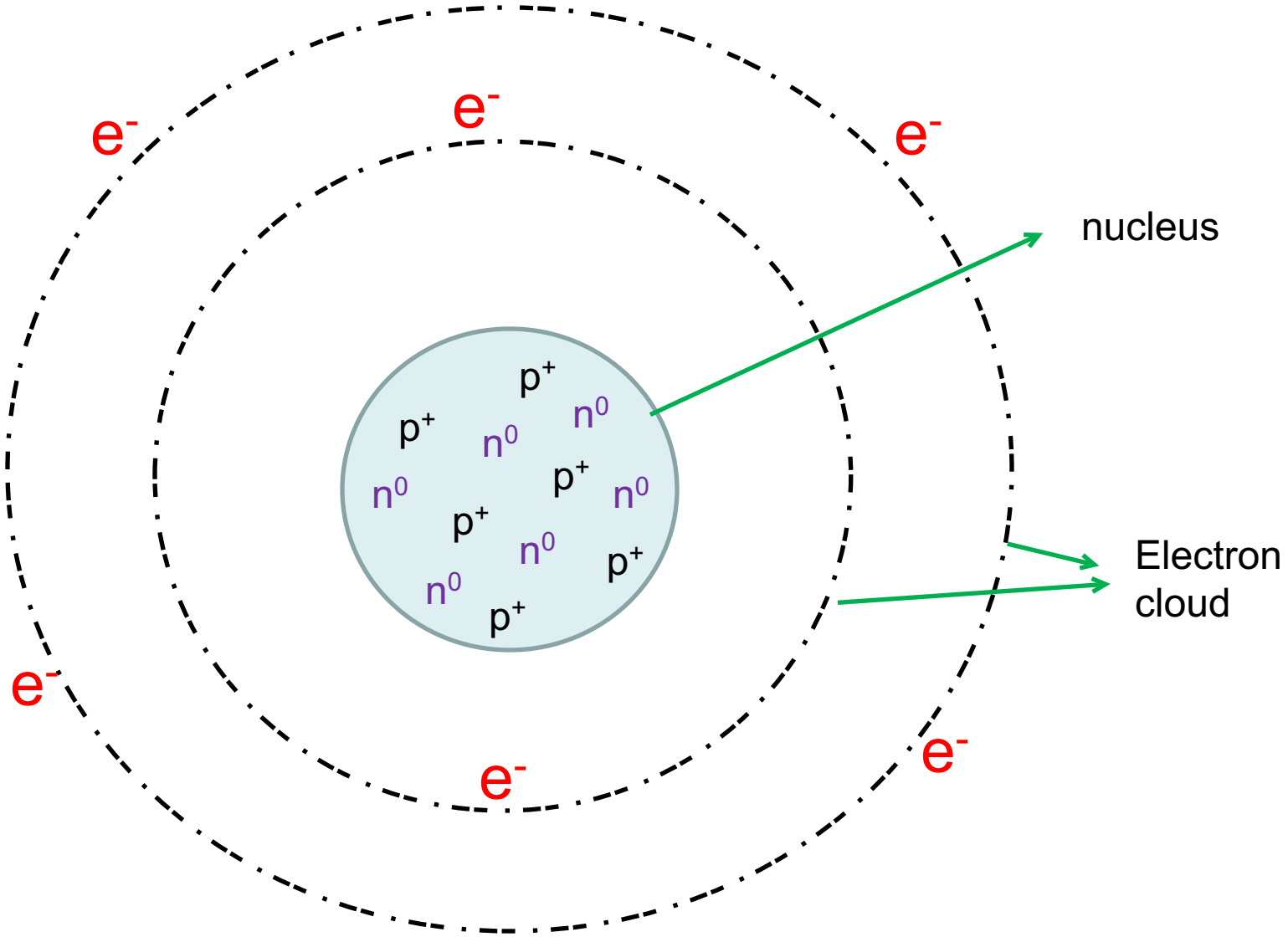
a. Examine the structure of the atom in terms of

- proton, electron, and neutron locations.
- atomic mass and atomic number.
- atoms with different numbers of neutrons (isotopes).
- explain the relationship of the proton number to the element's identity.

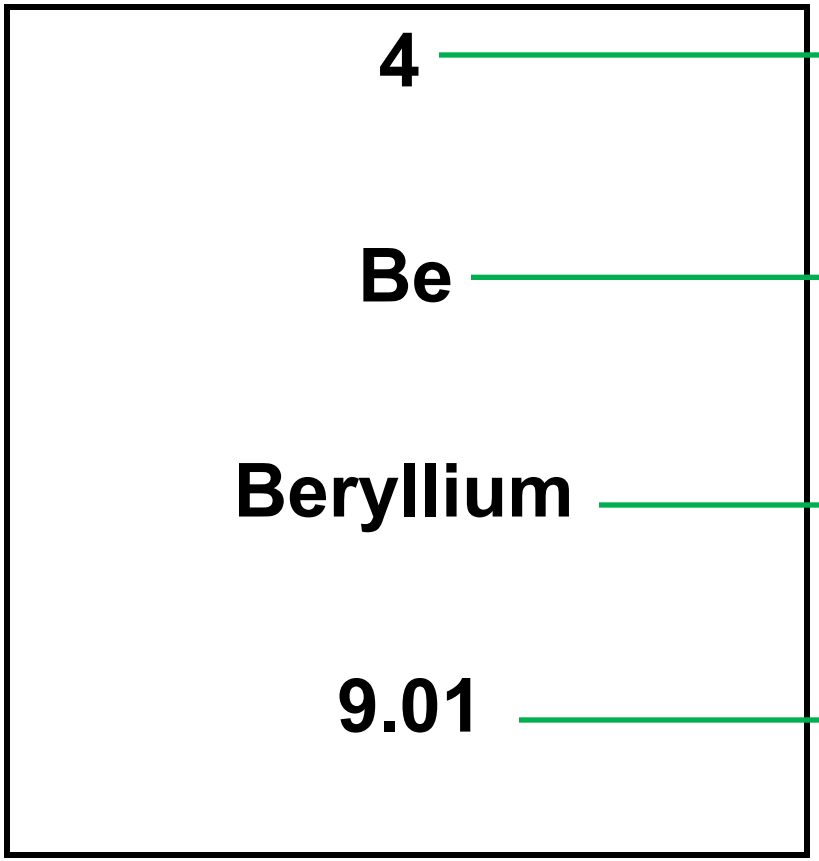
Characteristics of the Subatomic Particles

Particle	Location	Mass	Charge
Neutron n^0	nucleus	1 atomic mass unit (AMU)	Neutral 0
Proton p^+	nucleus	1 AMU	Positive +1
Electron e^-	Electron cloud in energy levels	0	Negative -1

Carbon



How to read a Periodic Table Tile



Atomic Number
Number of protons
Atoms identity

Element Symbol

Element Name

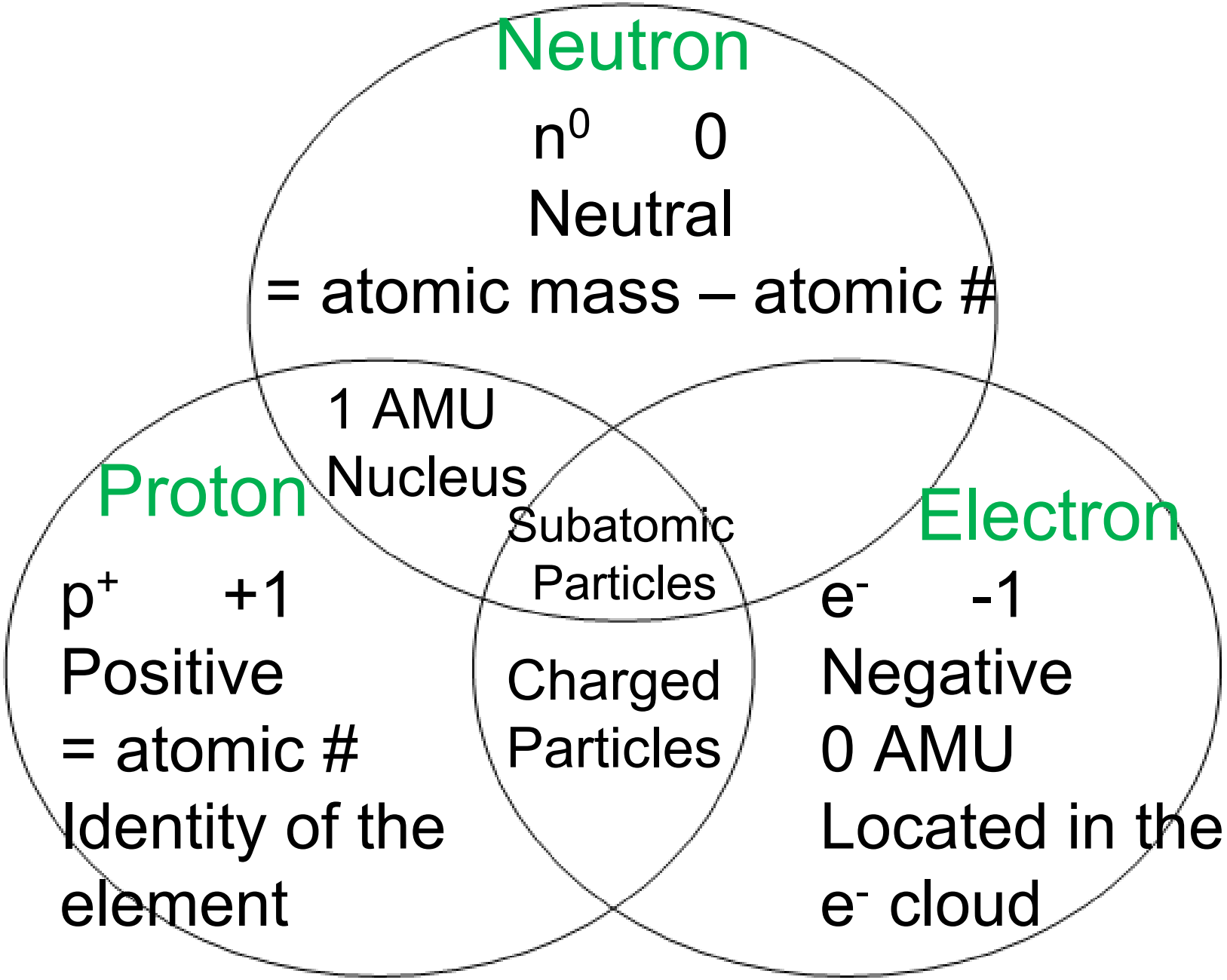
Atomic Mass
= # p^+ and # n^0

How to Determine the Number of Subatomic Particles

Subatomic Particle	How to Find the Number of Particles
Neutron	= atomic mass – atomic number
Proton	= atomic number
Electron	= # p^+ **if** the atom is neutral

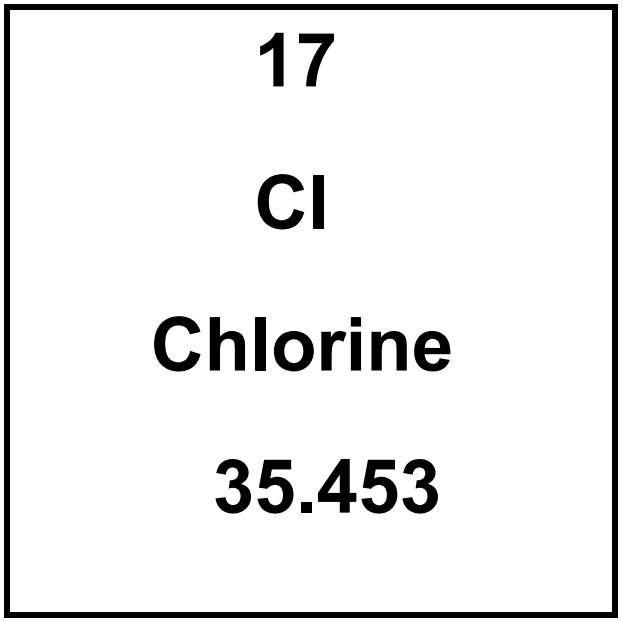
Name	Symbol	p^+	n^0	e^-
Hydrogen	H	1	0	1
Sodium	Na	11	12	11
Boron	B	5	6	5
Neon	Ne	10	10	10
Aluminum	Al	13	14	13
Sulfur	S	16	16	16

Proton vs. Neutron vs. Electron



Activator

Draw the periodic table tile and label the atomic number and mass number. How do you determine the number of protons? How do you determine the number of neutrons? What number represents the identity of the element?



hydrogen 1 H 1.0079																	helium 2 He 4.0026
lithium 3 Li 6.941	beryllium 4 Be 9.0122											boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	neon 10 Ne 20.180
sodium 11 Na 22.990	magnesium 12 Mg 24.305											aluminium 13 Al 26.982	silicon 14 Si 28.086	phosphorus 15 P 30.974	sulfur 16 S 32.065	chlorine 17 Cl 35.453	argon 18 Ar 39.948
potassium 19 K 39.098	calcium 20 Ca 40.078	scandium 21 Sc 44.956	titanium 22 Ti 47.867	vanadium 23 V 50.942	chromium 24 Cr 51.996	manganese 25 Mn 54.938	iron 26 Fe 55.845	cobalt 27 Co 58.933	nickel 28 Ni 58.693	copper 29 Cu 63.546	zinc 30 Zn 65.39	gallium 31 Ga 69.723	germanium 32 Ge 72.61	arsenic 33 As 74.922	selenium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.80
rubidium 37 Rb 85.468	strontium 38 Sr 87.62	yttrium 39 Y 88.906	zirconium 40 Zr 91.224	niobium 41 Nb 92.906	molybdenum 42 Mo 95.94	technetium 43 Tc [98]	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.91	palladium 46 Pd 106.42	silver 47 Ag 107.87	cadmium 48 Cd 112.41	indium 49 In 114.82	tin 50 Sn 118.71	antimony 51 Sb 121.76	tellurium 52 Te 127.60	iodine 53 I 126.90	xenon 54 Xe 131.29
caesium 55 Cs 132.91	barium 56 Ba 137.33	57-70 *	lutetium 71 Lu 174.97	hafnium 72 Hf 178.49	tantalum 73 Ta 180.95	tungsten 74 W 183.84	rhenium 75 Re 186.21	osmium 76 Os 190.23	iridium 77 Ir 192.22	platinum 78 Pt 195.08	gold 79 Au 196.97	mercury 80 Hg 200.59	thallium 81 Tl 204.38	lead 82 Pb 207.2	bismuth 83 Bi 208.98	polonium 84 Po [209]	astatine 85 At [210]	radon 86 Rn [222]
francium 87 Fr [223]	radium 88 Ra [226]	89-102 * *	lawrencium 103 Lr [262]	rutherfordium 104 Rf [261]	dubnium 105 Db [262]	seaborgium 106 Sg [266]	bohrium 107 Bh [264]	hassium 108 Hs [269]	meitnerium 109 Mt [268]	ununnilium 110 Uun [271]	ununununium 111 Uuu [272]	ununbium 112 Uub [277]		ununquadium 114 Uuq [289]			

*Lanthanide series	lanthanum 57 La 138.91	cerium 58 Ce 140.12	praseodymium 59 Pr 140.91	neodymium 60 Nd 144.24	promethium 61 Pm [145]	samarium 62 Sm 150.36	europium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.04
**Actinide series	actinium 89 Ac [227]	thorium 90 Th 232.04	protactinium 91 Pa 231.04	uranium 92 U 238.03	neptunium 93 Np [237]	plutonium 94 Pu [244]	americium 95 Am [243]	curium 96 Cm [247]	berkelium 97 Bk [247]	californium 98 Cf [251]	einsteinium 99 Es [252]	fermium 100 Fm [257]	mendelevium 101 Md [258]	nobelium 102 No [259]

Activator

- How do you calculate the number of protons in an element?
- How do you calculate the number of neutrons in an element?
- How do you calculate the number of electrons in an element?

Activator

Particle	Location	Mass	Charge
Neutron			
Proton			
Electron			

Write the questions

1. You have 18 protons, 18 electrons and 23 neutrons, which element do you have? How do you know?

   Ar because of 18 protons

2. You have 4 protons, 4 electrons and 5 neutrons, which element do you have? How do you know?

   Be because of 4 protons

3. What is the atomic number of Ca?

   20

4. What is the atomic mass of Ar? 39.948

5. If you have a neutral atom, you have an equal number of protons and electrons.

6. How do you determine the number of neutrons?

   Atomic mass – Atomic number

7. What is the mass of an electron?

   0 AMU

8. A neutral atom of sodium has 11 protons, how many electrons does it have?

   11

9. What subatomic particles are located in the nucleus?

Protons and Neutrons

What does the atomic number tell you?

What does the mass number tell you?

protons and # electrons, if neutral

Atoms of the same element must have the same number of _____.

protons = # neutrons or it is equal to the # of subatomic particles found in the nucleus

protons

13. A scientist has found the following isotope of Oxygen: $^{19}_{8}$ O. How many neutrons does it have?

    11

14. How many electrons are on the:
    - 1st energy level? 2
    - 2nd energy level? 8
    - 3rd energy level? 8
    - 4th energy level? 2, can hold more

Activator

- Determine the number of protons, neutrons and electrons in Argon (Ar).

- Draw an atom of Argon (Ar).

Summarizer

1. How did you do on the assessment?
2. Which learning activities from this week and last helped you the most?
3. How could the instruction this week or last been better?
4. What concerns do you have about Physical Science?

Quick Review for Quiz

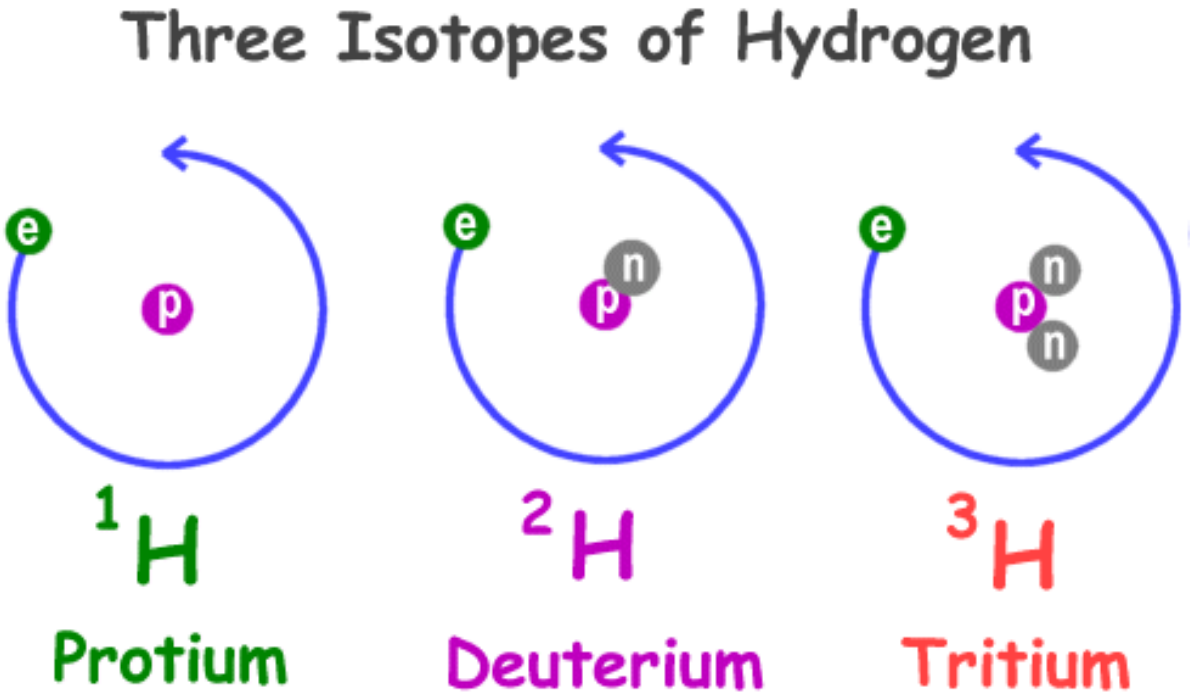
1. Name the 3 subatomic particles and identify where they are located, their mass and their charge.
2. Draw an atom of Fluorine (F) and label the neutrons, protons, electrons, nucleus and energy levels.
3. What is an electron shell configuration?

Activator

- **What is the name and atomic mass of an atom that has**
- **20 neutrons**
- **17 protons**
- **17 electrons**

Isotope

- Atom of the same element (same number of protons) but has a different number of neutrons and atomic mass.



Isotope Notation

- It provides the Atomic mass of an isotope. It is written with the element symbol dash atomic mass. Example H-2.
- Memory hint: I-So-Fat same atom just fatter with neutrons

Examples of Isotopes

Isotope Name	Atomic Mass	Number of Protons	Number of electrons	Number of neutrons
*H-1				
H-2				
H-3				

Examples of Isotopes

Isotope Name	Atomic Mass	Number of Protons	Number of electrons	Number of neutrons
*C-12				
C-13				
C-14				

How do you determine the name of an element?

- The number of protons in the atom is the atomic number

How do you determine the atomic mass of an isotope?

- Add the number of neutrons plus the number of protons.

Name the following isotope using it's isotope notation.

Number of Neutrons	1
Number of Protons	2
Number of Electrons	2
Name of Isotope	

Name the following isotope using its isotope notation.

Number of Neutrons	**3**
Number of Protons	3
Number of Electrons	3
Name of Isotope	

Name the following isotope using its isotope notation.

Number of Neutrons	**5**
Number of Protons	5
Number of Electrons	5
Name of Isotope	

Name the following isotope using it's isotope notation.

Number of Neutrons	**8**
Number of Protons	7
Number of Electrons	7
Name of Isotope	

Name the following isotope using it's isotope notation.

Number of Neutrons	**9**
Number of Protons	8
Number of Electrons	8
Name of Isotope	

Name the following isotope using it's isotope notation.

Number of Neutrons	**11**
Number of Protons	10
Number of Electrons	10
Name of Isotope	

Name the following isotope using it's isotope notation.

Number of Neutrons	**14**
Number of Protons	12
Number of Electrons	12
Name of Isotope	

Name the following isotope using it's isotope notation.

Number of Neutrons	**15**
Number of Protons	14
Number of Electrons	14
Name of Isotope	

Name the following isotope using it's isotope notation.

Number of Neutrons	**16**
Number of Protons	14
Number of Electrons	14
Name of Isotope	

Name the following isotope using it's isotope notation.

Number of Neutrons	**17**
Number of Protons	16
Number of Electrons	16
Name of Isotope	

Name the following isotope using it's isotope notation.

Number of Neutrons	**24**
Number of Protons	20
Number of Electrons	20
Name of Isotope	

Name the following isotope using it's isotope notation.

Number of Neutrons	**22**
Number of Protons	19
Number of Electrons	19
Name of Isotope	

Complete the electron shell configuration for the following elements:

CCl

BMg

Complete the electron shell configuration for the following elements:

CaO

O-18C-14

Activator

Write the questions:

1. What is the mass of 9 protons?

2. What is the mass of 11 neutrons?

3. What is the symbol and mass of the above isotope?

Activator

Define Isotope in your own words.

Draw the following:

C-12H-1

C-13H-2

C-14H-3

Summary

- Name three things you have learned about isotopes
- Name two things you need more practice on with isotopes
- Name one thing you do not understand about isotopes

Activator

Write the question:

An isotope of Hydrogen has an atomic mass of 3. How many subatomic particles are in the nucleus?

a. 1

b. 2

c. 3

d. 4

Complete the electron shell configuration for the following atoms:

PNe-21

SiSi-29

Complete the electron shell configuration for the following atoms:

O-17K

Ca-44Be

Identify the following isotopes:

Neutrons	Protons	Electrons	Name
28	22	22	
20	17	17	
20	18	18	
30	24	24	
20	16	16	

Identify the following Isotopes:

Neutrons	Protons	Electrons	Name
22	20	20	
27	22	22	
20	16	16	
8	6	6	

Summary

- List three things you have learned about Isotopes?
- List two things you are not yet comfortable with for isotopes.
- Is there anything we need to work on some more with isotopes?