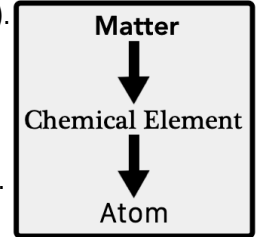
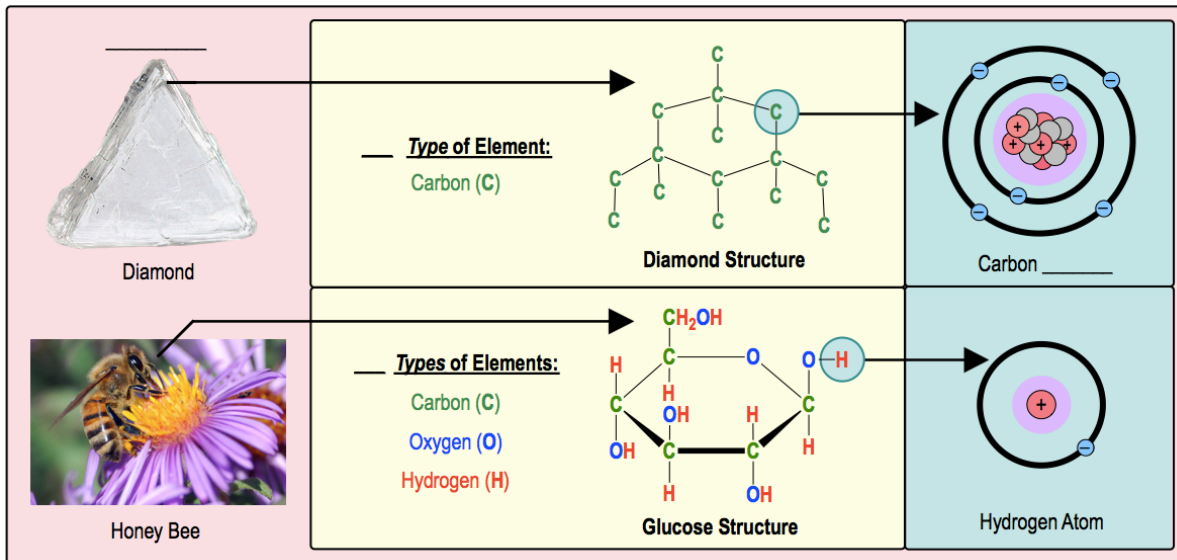


CONCEPT: ATOMS - SMALLEST UNIT OF MATTER

- _____: anything that takes up *space* & has *mass* (ex. organisms, rocks, oceans, etc.).
 - All *matter* consists of at least 1 *chemical* _____.
- *Chemical Elements*: pure substances made of only *one* type of _____.
 - *Atom*: the _____ unit of an *element* (& therefore, the smallest unit of *matter*).
 - Atoms makes up both _____ & _____ matter.



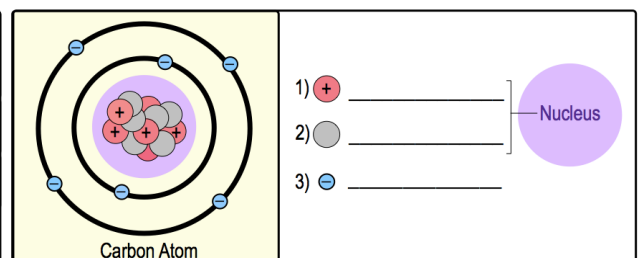
EXAMPLE: Atoms are the Smallest Units of Matter.



Atomic Structure

- *Atoms* are made of _____ *subatomic particles*, each with a characteristic *charge*, *mass* & *location* in the atom.

Subatomic Particle	Electric Charge	Atomic Mass Unit (AMU)	Location
① Proton	—	—	Nucleus
② Neutron	—	—	—
③ Electron	—	—	Orbiting Nucleus



EXAMPLE: Negatively charged particles of atoms with almost no mass are called:

- a) Electrons. b) Protons. c) Neutrons. d) Ions. e) Polymers.

PRACTICE: A proton _____:

- a) Has one positive charge. b) Has one AMU. c) Is found in the nucleus of the atom.
 d) Only a and b are true. e) a, b, and c are true.

CONCEPT: ATOMS - SMALLEST UNIT OF MATTER

Elements of Life

- Of all the known elements, only a _____ subset is found in living organisms.
 - *Periodic Table of _____*: arranges all of the known elements based on their *chemical* properties.
- ~97% of the mass of most life is composed of Carbon, Hydrogen, Nitrogen, Oxygen, Phosphorus & Sulfur (**CHNOPS**).
 - _____ *Elements*: required for life in _____ amounts.

EXAMPLE: Periodic Table of Elements.

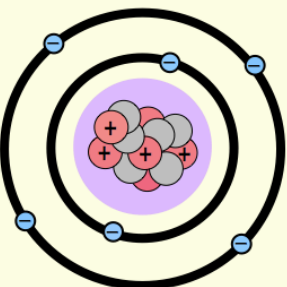
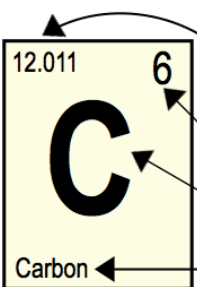
1	<div>_____ Elements</div>																2	
3	4	<div>Trace Elements</div>																10
Li	Be																	Ne
11	12																	18
Na	Mg																	Ar
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
55	56		72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	
Cs	Ba		Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
87	88		104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	
Fr	Ra		Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Fl	Mc	Lv	Ts	Og	

57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

Atomic Properties

- Each atom of an element has *unique* properties:
 - _____ *Number*: # of _____ in the *nucleus* (*atomic number* _____ each element).
 - _____ *Number*: mass of the *nucleus* (# of _____ & _____).
 - *Atomic mass* (or *atomic* _____) = _____ total mass of *all* atoms of an element.

EXAMPLE: Atomic Properties of a Carbon Atom.

 <p>Carbon Atom</p>	<p>⊕ Protons = _____ = Atomic Number</p> <p>● Neutrons = _____</p> <p>_____ + _____ = Mass Number = _____</p>	 <p>Periodic Table View</p> <p>12.011</p> <p>6</p> <p>C</p> <p>Carbon</p> <p>Atomic _____</p> <p>Atomic _____</p> <p>Chemical Symbol</p> <p>Element Name</p>
--	---	---

CONCEPT: ATOMS - SMALLEST UNIT OF MATTER

EXAMPLE: The atomic number of an element is equal to the number of:

- a) Neutrons only.
- b) Protons plus electrons.
- c) Protons plus neutrons.
- d) Neutrons plus electrons.
- e) Protons only.

PRACTICE: The average oxygen atom has a mass number of 16 and an atomic number of 8. This means that the number of neutrons in this oxygen atom is:

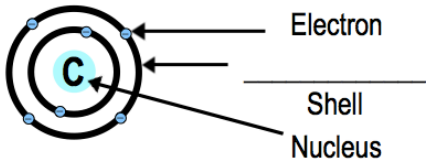

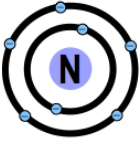
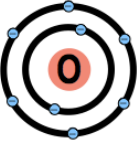
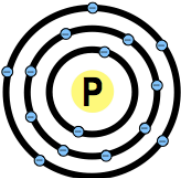

- a) 24.
- b) 8.
- c) 16.
- d) 4.
- e) 2.

Electron Orbitals & Energy Shells

● **Electron** _____: 3D-regions around a nucleus where electrons are found (envisioned in 2D as *energy shells*).

- Shells *closer* to the nucleus are _____ in energy than distant shells, which are *higher* in energy.
- **Valence Electrons**: electrons found in the _____ energy shell (*valence shell*).
- *1st shell* holds up to _____ electrons; *2nd shell* holds up to _____ electrons; each shell holds varying #'s.

EXAMPLE: Energy Shells for C, H, N, O, P, S.

Carbon	Hydrogen	Nitrogen	Oxygen	Phosphorus	Sulfur
					
____ Number → 12 ____ Number → 6 C ← Chemical Symbol	1 H 1	14 N —	16 O —	31 P 15	32 S —

PRACTICE: How many valence electrons does an atom with five total electrons have?

- a) 5.
- b) 7.
- c) 3.
- d) 2.
- e) 1.

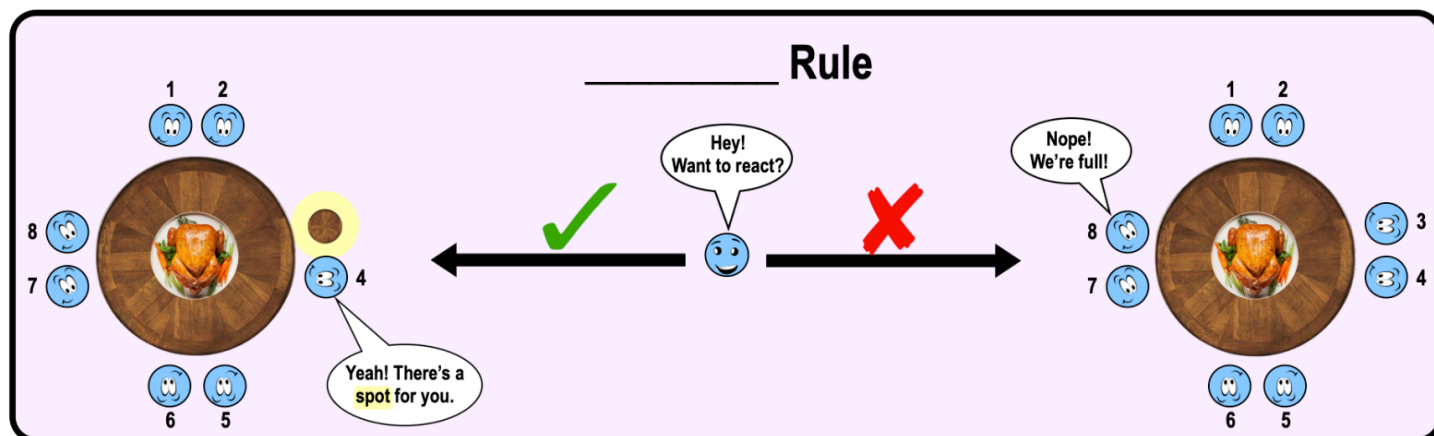
PRACTICE: Which of the following is true about electron energy shells?

- a) They represent regions around the nucleus in which the electrons orbit.
- b) The shells closest to the nucleus contain electrons with higher energy.
- c) They contain electrons of the same energy.
- d) a and b only.
- e) a and c only.

CONCEPT: ATOMS- SMALLEST UNIT OF MATTER

Octet Rule

- _____ Rule: atoms are more stable (less reactive) when their valence shells are *fully occupied*.
 - Recall: 1st energy shell holds up to _____ electrons; 2nd energy shell holds up to _____ electrons.
 - Atoms are _____ reactive when their outer valence shells are _____.



EXAMPLE: According to the octet rule, electron distribution in each shell of a neutral nitrogen atom (atomic number 7) is:

- a) 1,5. b) 2,4. c) 2,5. d) 1,4.

PRACTICE: An average neon atom (Ne) is unreactive for which of the following reasons?

- a) It has 7 valence electrons. b) It has 8 valence electrons.
c) Its valence shell is full of electrons. d) It has 20 valence electrons.
e) b and c only.

20.180	10
Ne	
Neon	

PRACTICE: How many electrons does an Oxygen atom need to fulfill the octet rule by filling its valence shell?

- a) 8.
b) 4.
c) 1.
d) 2.
e) 6.

15.999	8
O	
Oxygen	