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Category 1 – Matter and Energy

8-5.A 8-5.B STRUCTURE OF ATOMS AND IDENTITY OF ELEMENTS CR

matter: anything that has mass and takes up space

atom: smallest complete part (building block) of matter

Atom Part	Location	Mass	Electrical Charge
proton	nucleus (center)	~1 amu	positive, +
neutron	nucleus (center)	~1 amu	neutral/no charge
electron	electron cloud*	~1/2000 amu	negative, –

**mostly empty space surrounding nucleus where electrons move*

Note: An atom's mass is mostly in its nucleus (center). An atomic mass unit ("amu") is about (~) equal

element: substance made of only one kind of atom

Examples: copper wire: Cu;

chemical symbol: element's first letter is capitalized and

Examples: gold's symbol is A

atomic number: number of p the identity of an element (n

atomic mass: the average m

Example: How many protons

How do you know the atom model is of lithium?
it shows 3 protons (+)

How many electrons does Lithium have?
3 *(equal to protons)*

How could the usual number of neutrons be calculated from the data?

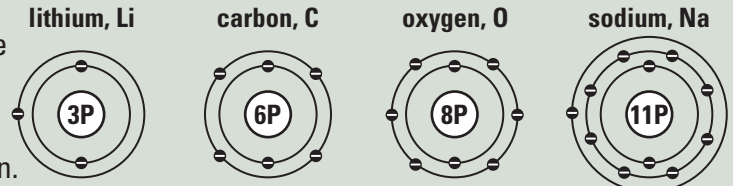
Model not to scale.

because the atomic mass is about 7 amu (6.94), it must usually have 4 neutrons: 7 amu (total) – 3 amu (protons) = 4 amu (neutrons)

8-5.B,C 6-6.A PROPERTIES OF ELEMENTS AND THE PERIODIC TABLE CR

valence electrons: electrons in element's outermost level (available for chemical reactions); number of valence electrons determines chemical properties, including **reactivity** (likelihood and rate of a chemical reaction)

Example: Which of these elements reacts most similarly to lithium? Explain.



sodium (Na), because it also has one valence electron.

periodic table: chart that organizes elements based on their properties

- group: vertical column; elements have same number of valence electrons and, therefore, similar chemical properties; a group is also called a family

Examples: Each element in group 1A or 1 (alkali metal family), such as lithium (Li) or sodium (Na), has one valence electron and is highly reactive. Each element in group 8A or 18 (noble gases family) has a full outer level of electrons—2 for helium (He); 8 for neon (Ne), argon (Ar), krypton (Kr), xenon (Xe), and radon (Rn) – and is not reactive.

- period: horizontal row; elements in the same period have the same number of electron levels (period 2 elements have 2 electron levels)

Lithium (Li). Its first electron level To its right is beryllium (Be), e electron in its second which has a full second he first element in period ctron in the third level.

												13 3A	14 4A	15 5A	16 6A	17 7A	18 8A
												B	C	N	O	F	He
9 8B	10	11 1B	12 2B									Al	Si	P	S	Cl	Ne
Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr								
Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe								
Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn								
Mt																	
Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu								
Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr								

Type	Physical Properties of Elements
metal	high luster/shiny; good conductor of heat/electricity; ductile (can draw into wire); malleable (can hammer/flatten); solid (except Hg)
metalloid	properties of metals and nonmetals; conducts heat/electricity under some conditions (semiconductors used in computer chips)
nonmetal	most are gases; solids are dull, poor conductors, and brittle

Examples: Identify whether each is a metal, nonmetal, or metalloid.

yellow block; crumbles into a powder when hit with hammer	*nonmetal*
silver block; dents when hammered; top gets hot soon after placing block on hot plate; can complete an electric circuit	*metal*
silver block; crumbles when hammered; slightly conductive	*metalloid*
solid material is reactive; element has 2 valence electrons	*metal*
gas is not reactive; each atom has 8 valence electrons	*nonmetal*
atom has 33 protons and 42 neutrons	*metalloid*

Global wind circulation (modified), Hawaii rain shadow image credit: NOAA National Weather Service; Galaxies, Spectrum, nebula, Hertzsprung-Russell Diagram (modified), multispectral sun, Suns, Earth, Moon, Cascades rain shadow Photo credit: NASA/courtesy of nasaimages.org

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