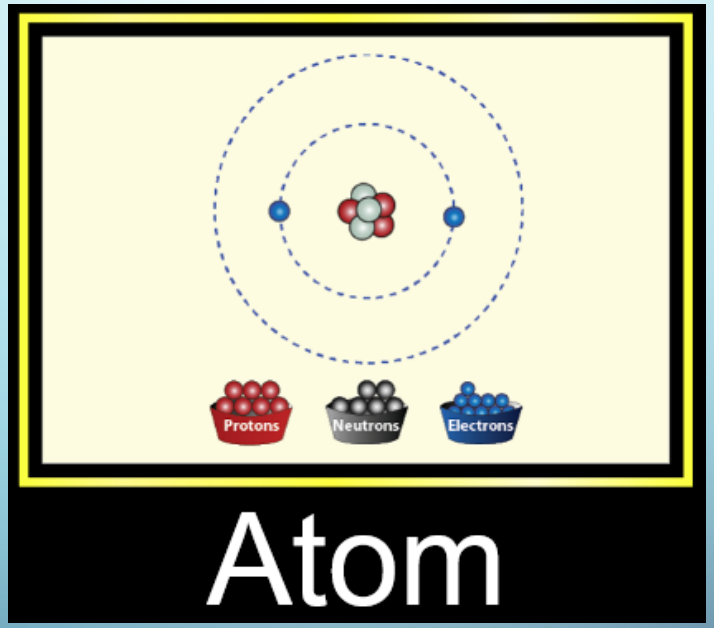
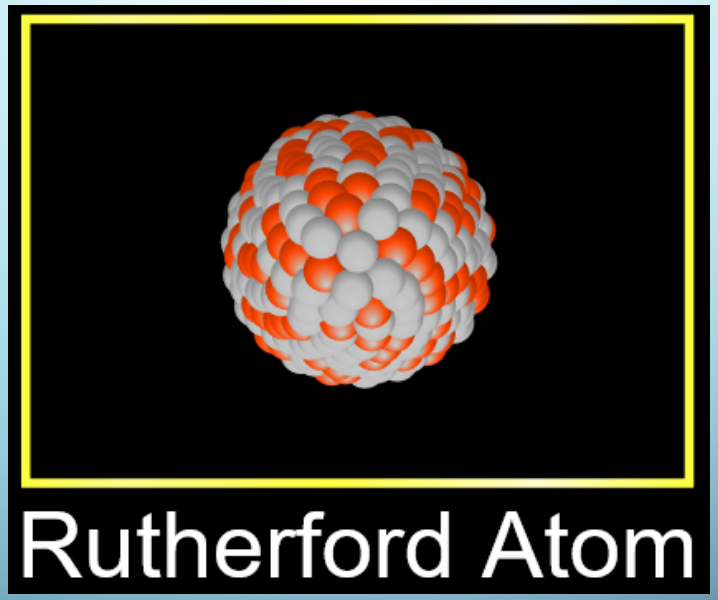
UNIT 1

UNDERLYING STRUCTURE OF MATTER

THE ATOMIC NUCLEUS



DISCOVERY OF THE NUCLEUS



PRACTICE QUESTIONS

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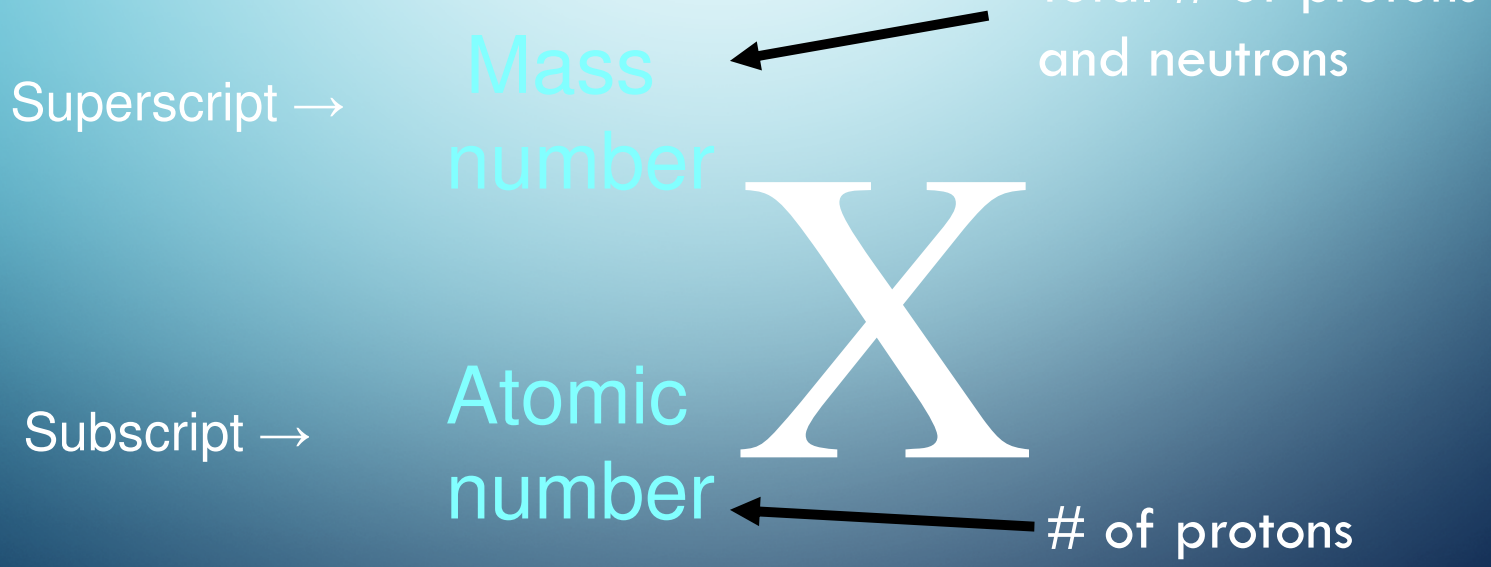
SUBATOMIC PARTICLES

Particle	Charge	Mass (g)	Location
Electron (e^-)	-1	9.11×10^{-28}	Electron cloud
Proton (p^+)	+1	1.67×10^{-24}	Nucleus
Neutron (n^o)	0	1.67×10^{-24}	Nucleus

COMPLETE SYMBOLS

- Contain the symbol of the element, the mass number and the atomic number.



Information from Symbols

- Find each of these:

a) number of protons

b) number of neutrons

c) number of electrons

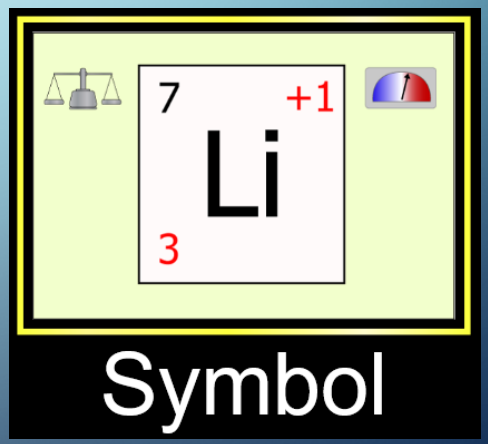
d) Atomic number

e) Mass Number

$$^{80}_{35}\mathrm{Br}$$

ISOTOPES

- Atoms that have the same number of protons, but a different number of neutrons. i.e. the same atomic number but different mass numbers.
- We can also put the mass number *after* the name of the element:
  - carbon-12
  - carbon-14
  - uranium-235



ATOMIC MASS

- How heavy is an atom of oxygen?
  - It depends, because there are different *kinds* of oxygen atoms.
- We are more concerned with the *average atomic mass.*
- This is based on the abundance (percentage) of each variety of that element in nature.
  - We don't use grams for this mass because the numbers would be too small.

MEASURING ATOMIC MASS

- Instead of grams, the unit we use is the Atomic Mass Unit (amu)
- It is defined as one-twelfth the mass of a carbon-12 atom.
- Each isotope has its own atomic mass, thus we determine the average from percent abundance.

ATOMIC MASSES

Atomic mass is the average of all the naturally occurring isotopes of that element.

Isotope	Symbol	Composition of the nucleus	% in nature
Carbon-12	^{12}C	6 protons 6 neutrons	98.89%
Carbon-13	^{13}C	6 protons 7 neutrons	1.11%
Carbon-14	^{14}C	6 protons 8 neutrons	<0.01%

Carbon = 12.011

CALCULATING ATOMIC MASS

- The two most abundant isotopes of carbon are carbon-12 (mass 12.00 amu) and carbon-13 (mass 13.00 amu). Their relative abundances are 98.9% and 1.10%, respectively. Calculate the atomic mass of carbon.

ANOTHER EXAMPLE

- Using the information below, calculate the approximate atomic mass of silicon.

$^{28}_{14}Si$	$^{29}_{14}Si$	$^{30}_{14}Si$	$^{31}_{14}Si$
92.2%	4.7%	3.1%	trace

REVIEW QUESTIONS

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