Announcements – Lecture III – Tuesday, Sep 11th

PRS Credit starts Thursday

2 Absences ... use them wisely

2.4 What Are Atoms Made Of? – *The Three Subatomic Particles*

Name	Symbol	Mass (g)	Charge	Mass*1 (amu)*2
Proton	${}^{1}_{1}p$	1.673×10^{-24}	+1	1
Neutron	${}^{1}_{0}n$	1.675×10^{-24}	0	1
Electron	${}^{0}_{-1}e$	9.109×10^{-28}	-1	0.0005

a) Chemists tend to ignore the mass of the electron

b) # protons ... the atom determinator ... #p = Atomic Number (Z)

c) # neutrons ... the other mass contributor ... #n + #p = Mass Number (A)

d) # electrons ... determines the charge on the atom.

$${}^{A}_{Z}X$$

X = symbol

A = mass number

Z = atomic number

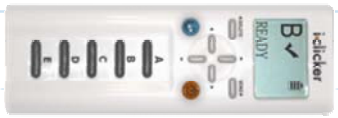
*1: Rounded to 1 significant figure

*2: 1 amu = 1.6605×10^{-24} g

2.4 What Are Atoms Made Of? – *The Three Subatomic Particles*

2.4 Example_1

Which if any of the following species has the same number of Neutrons as it does Electrons?



a) $^{47}_{24}Cr$ b) $^{24}Mg^{2+}$ c) $^{59}_{27}Co^{2+}$
d) $^{35}Cl^{-}$ e) $^{125}_{50}Sn$

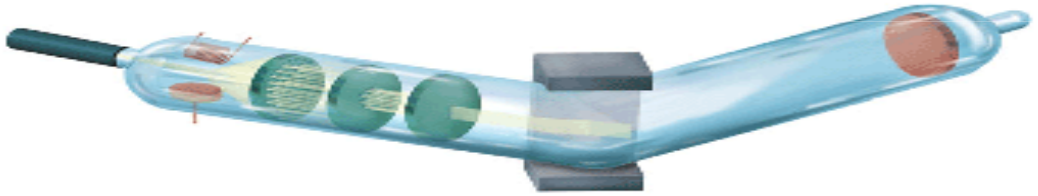
	# Protons	# Neutrons	# Electrons	
$^{47}_{24}Cr$	24	23	24	
$^{24}Mg^{2+}$	12	12	10	
$^{59}_{27}Co^{2+}$	27	32	25	
$^{35}Cl^{-}$	17	18	18	✓
$^{125}_{50}Sn$	50	75	50	

2.4 What Are Atoms Made Of? – *Isotopes*

Isotope : Atoms with the same number of protons but different number of neutrons

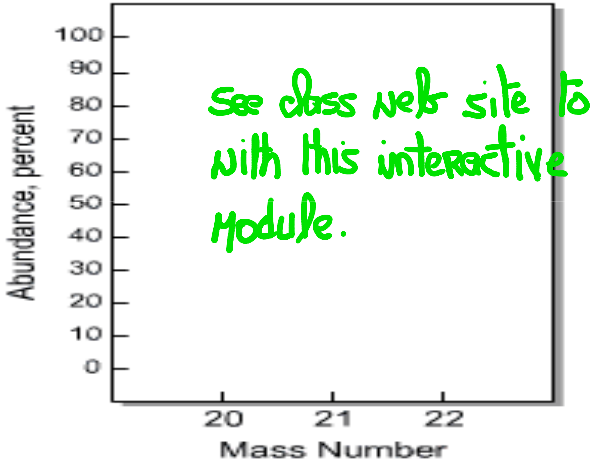
	#p	#n	#e
^{12}C	6	6	6
^{14}C	6	8	6

Active Figure 2.04: Mass Spectrometer



Gas
- F
- Ne
- Na

Magnet Strength



See class web site to play with this interactive module.

2.4 What Are Atoms Made Of? — *Atomic Weight*

2.4 Example_2

Chlorine has two naturally occurring isotopes:

^{35}Cl, 75.77% Abundant, Exact Mass 34.96885 amu

^{37}Cl, 24.23% Abundant, Exact Mass 36.96590 amu

What is the Atomic Weight of Chlorine?

Atomic Weight : simply the weighted average of the naturally occurring isotopes

$$0.7577(34.96885) + 0.2433(36.96590)$$

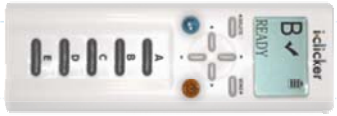
$$= 35.45271 \text{ amu}$$

2.4 Example_3

Neon has 3 naturally occurring isotopes:

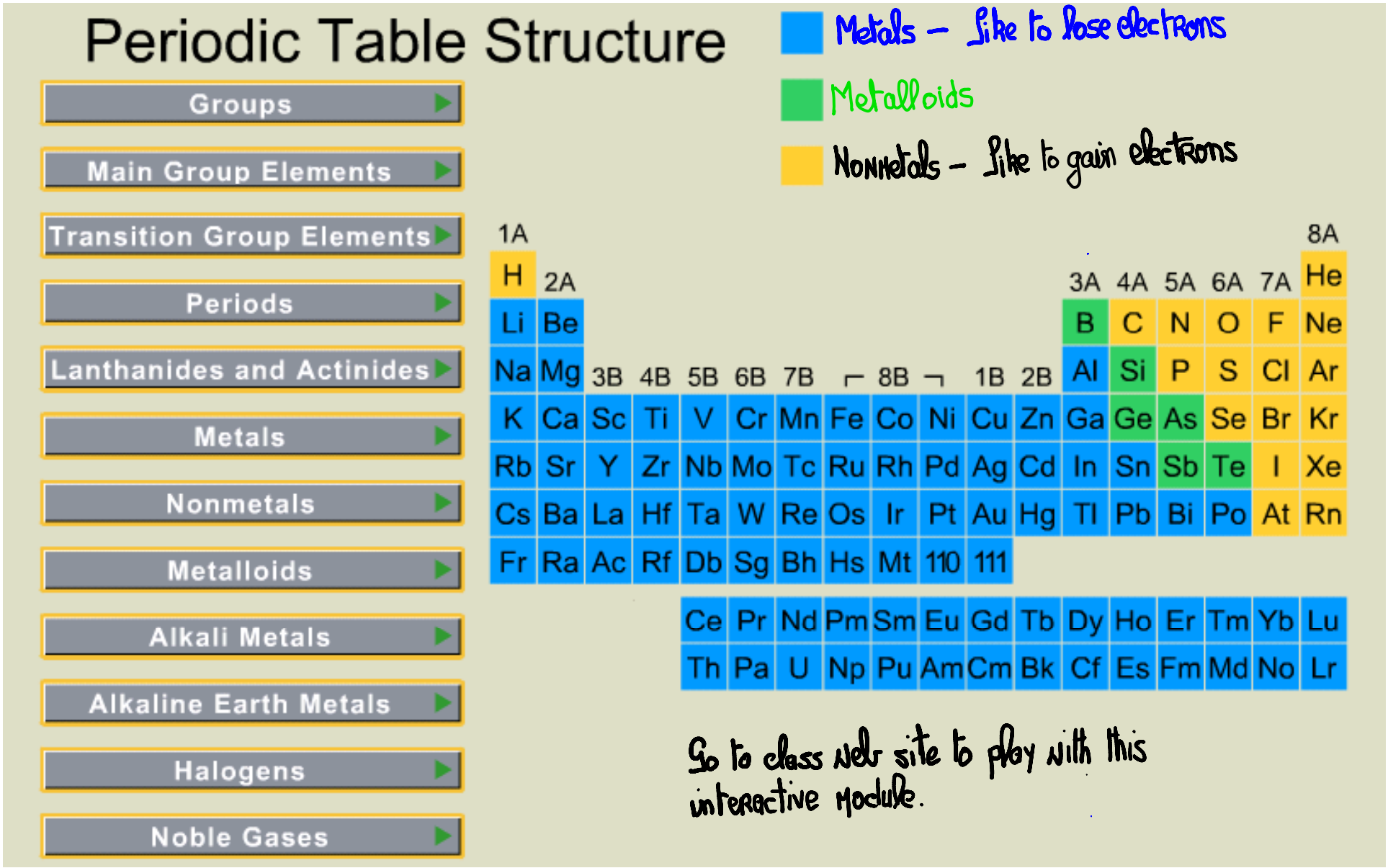
^{20}Ne, 90.92% Abundant, Exact Mass 19.9989 amu
^{21}Ne, 0.26% Abundant, Exact Mass 20.9975 amu
^{22}Ne, 8.82% Abundant, Exact Mass 21.9979 amu

What is the Atomic Weight of Neon?



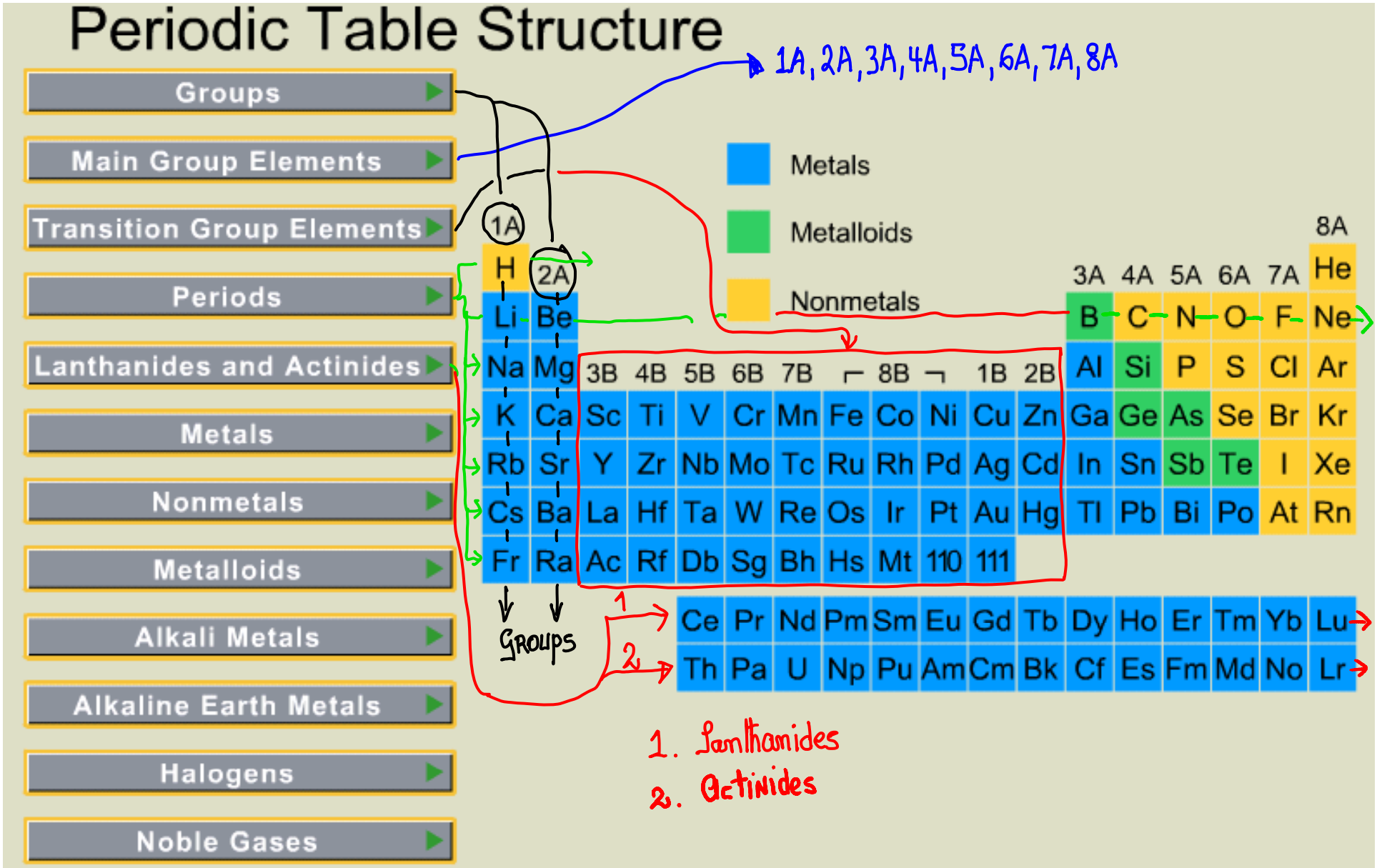
The 4th decimal place in the answer is
a) 5 b) 6 c) 7 d) 8 e) 9

$0.9092(19.9989) + 0.0026(20.9975) + 0.0882(21.9979) = 20.1778$ amu


Periodic Table Structure
Groups
Main Group Elements
Transition Group Elements
Periods
Lanthanides and Actinides
Metals
Nonmetals
Metalloids
Alkali Metals
Alkaline Earth Metals
Halogens
Noble Gases
Metals – like to lose electrons
Metalloids
Nonmetals – like to gain electrons
1A 2A 3B 4B 5B 6B 7B 8B 8B 1B 2B 3A 4A 5A 6A 7A 8A
H He
Li Be B C N O F Ne
Na Mg Al Si P S Cl Ar
K Ca Sc Ti V Cr Mn Fe Co Ni Cu Zn Ga Ge As Se Br Kr
Rb Sr Y Zr Nb Mo Tc Ru Rh Pd Ag Cd In Sn Sb Te I Xe
Cs Ba La Hf Ta W Re Os Ir Pt Au Hg Tl Pb Bi Po At Rn
Fr Ra Ac Rf Db Sg Bh Hs Mt 110 111
Ce Pr Nd Pm Sm Eu Gd Tb Dy Ho Er Tm Yb Lu
Th Pa U Np Pu Am Cm Bk Cf Es Fm Md No Lr
Go to class web site to play with this interactive module.

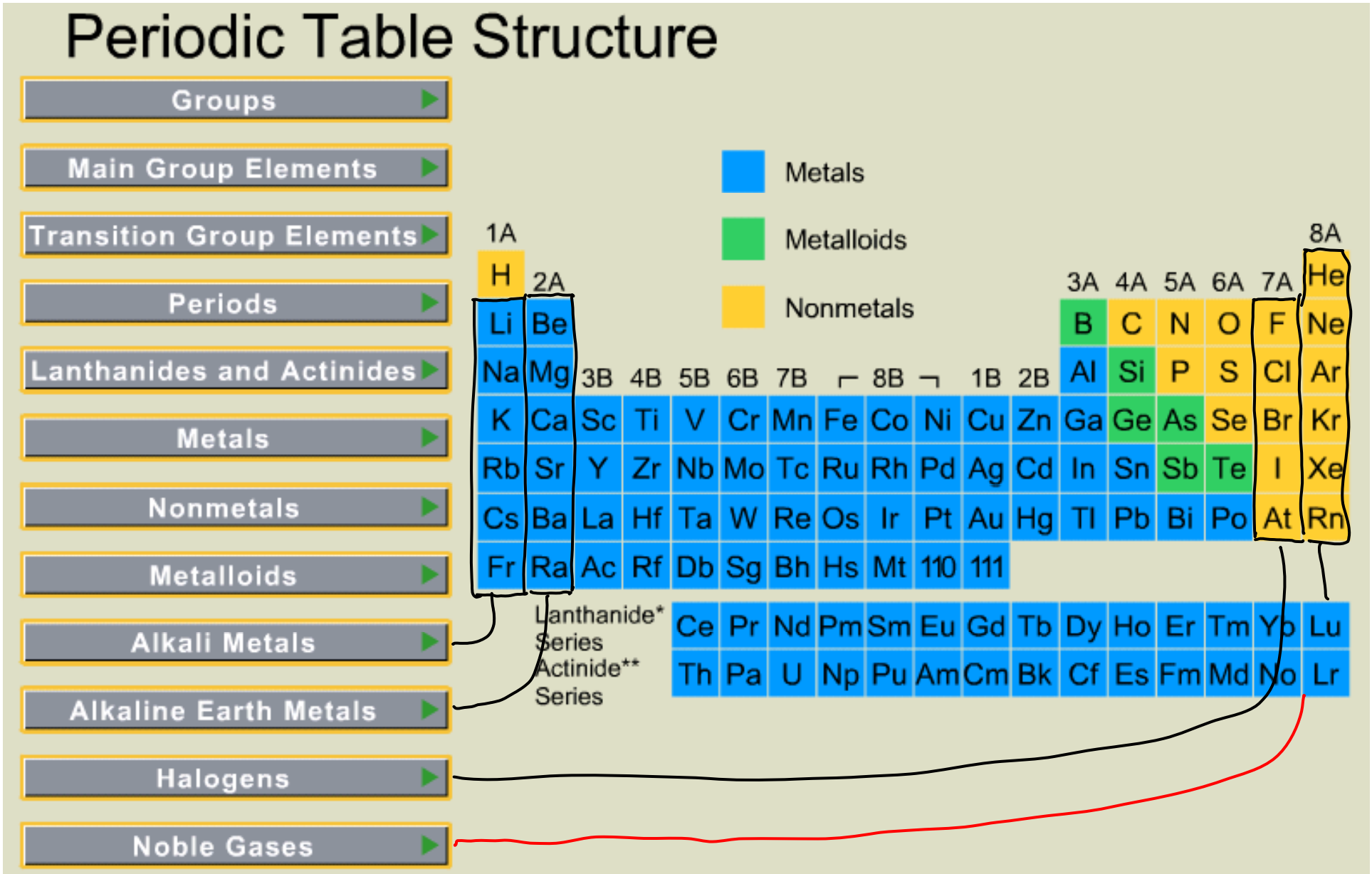
2.5 What Is the Periodic Table

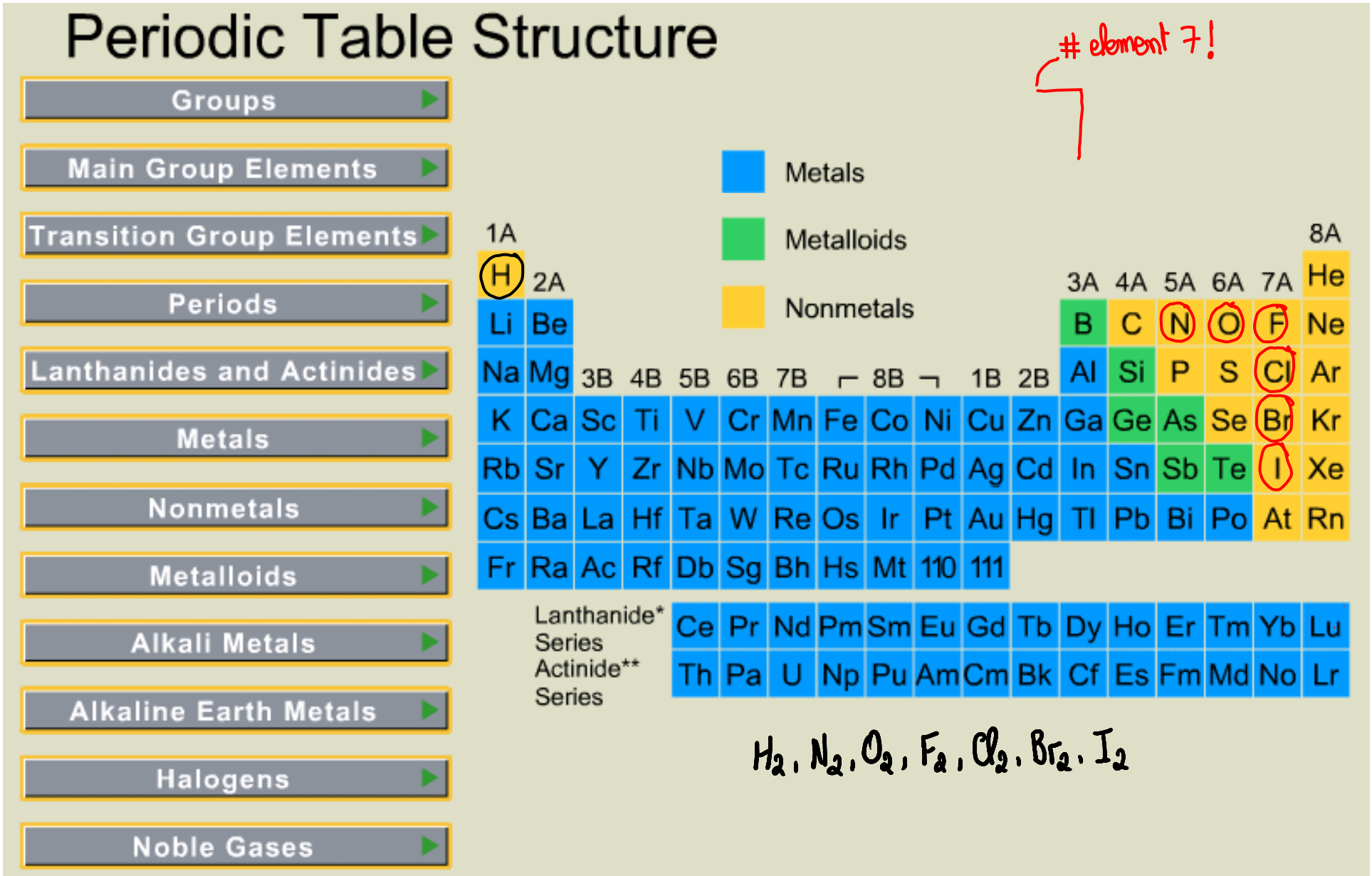
Groups – Periods – Main Group – Transition Metal – Lanthanide – Actinide



2.5 What Is the Periodic Table

Alkali Metals – Alkaline Earth Metals – Halogens – Noble Gases

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Metals
Metalloids
Nonmetals
element 7!
1A 2A 3A 4A 5A 6A 7A 8A
H He
Li Be B C N O F Ne
Na Mg 3B 4B 5B 6B 7B 8B 1B 2B Al Si P S Cl Ar
K Ca Sc Ti V Cr Mn Fe Co Ni Cu Zn Ga Ge As Se Br Kr
Rb Sr Y Zr Nb Mo Tc Ru Rh Pd Ag Cd In Sn Sb Te I Xe
Cs Ba La Hf Ta W Re Os Ir Pt Au Hg Tl Pb Bi Po At Rn
Fr Ra Ac Rf Db Sg Bh Hs Mt 110 111
Lanthanide* Series
Actinide** Series
Ce Pr Nd Pm Sm Eu Gd Tb Dy Ho Er Tm Yb Lu
Th Pa U Np Pu Am Cm Bk Cf Es Fm Md No Lr
H2, N2, O2, F2, Cl2, Br2, I2