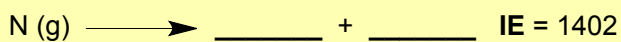
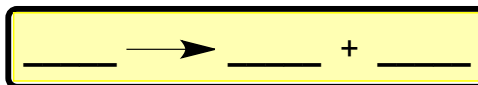


CONCEPT: PERIODIC TREND: SUCCESSIVE IONIZATION ENERGIES

- The First Ionization Energy (IE_1) is the energy absorbed to remove the first electron from a gaseous atom.



- With more energy you can remove additional electrons in *successive ionizations* giving $\text{ } , \text{ } ,$ and on.
- Successive ionizations:** Removing additional electrons in stages instead of all at once.
 - The second and third ionizations of nitrogen are:



EXAMPLE: Provide the fourth ionization energy equation for a manganese atom.

Successive Ionization Energies

- An ever-increasing amount of energy is required each time an electron is removed.
 - Traditionally, elements lose **valence electrons** to become isoelectronic to the noble gases.
 - A large **jump** in ionization energy results when we begin to remove the **inner core electrons**.

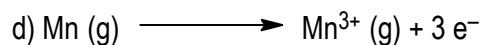
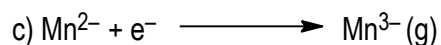
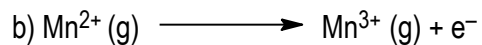
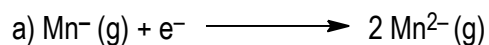
Successive Ionization Energies								
Element	Configuration	IE ₁	IE ₂	IE ₃	IE ₄	IE ₅	IE ₆	IE ₇
Li	1s ² 2s ¹	520.2	7298	11815				
Be	1s ² 2s ²	899.5	1757	14848	21007			
B	1s ² 2s ² 2p ¹	800.6	2427	3660	25026	32827		
C	1s ² 2s ² 2p ²	1087	2353	4621	6223	37831	47277	
N	1s ² 2s ² 2p ³	1402	2856	4578	7475	9445	53267	64360
O	1s ² 2s ² 2p ⁴	1314	3388	5301	7469	10990	13327	71330
F	1s ² 2s ² 2p ⁵	1681	3374	6050	8408	11023	15164	17868
Ne	1s ² 2s ² 2p ⁶	2081	3952	6122	9371	12177	15238	19999

EXAMPLE: Of the following atoms, which has the smallest increase for its **second** ionization energy?

- a) Al b) Li c) Rb d) Mg e) Be

CONCEPT: PERIODIC TREND: SUCCESSIVE IONIZATION ENERGIES

PRACTICE: Which of the following represents the **third ionization** of Mn?



PRACTICE: Of the following atoms, which has the largest **third** ionization energy?

a) Al

b) Ca

c) K

d) Ba

e) Cs

PRACTICE: The successive ionization energies for an unknown element are:

$$\text{IE}_1 = 896 \text{ kJ/mol}$$

$$\text{IE}_2 = 1752 \text{ kJ/mol}$$

$$\text{IE}_3 = 14,807 \text{ kJ/mol}$$

$$\text{IE}_4 = 17,948 \text{ kJ/mol}$$

To which family in the periodic table does the unknown element most likely belong?

a) 1A

b) 2A

c) 3A

d) 4A

e) 5A