

### CONCEPT: PERIODIC TABLE: CHARGES

- Elements lose or gain electrons to be like the noble gases, which have the optimal number of outer shell electrons.
  - **Metals**: tend to \_\_\_\_\_ electrons to become positively charged ions called *cations*.
    - Metals that have \_\_\_\_\_ charge are referred to as *Type I* Metals.
    - Metals that have \_\_\_\_\_ charge are referred to as *Type II* Metals.
  - **Non-metals**: tend to \_\_\_\_\_ electrons to become negatively charged ions called *anions*.

**EXAMPLE:** From what you know about ion formation and the Periodic Table, which ion would be unlikely to occur?

- a)  $\text{Rb}^+$                       b)  $\text{O}^{2-}$                       c)  $\text{Mn}^{5+}$                       d)  $\text{Al}^{3-}$                       e)  $\text{Cl}^-$

## Main Group Elements

- Recall, that the atomic number of an element equals the number of protons within its nucleus.
  - For a neutral element, its number of electrons is equal to the number of protons.
  - EXCEPTION 1: Main Group Metals of Lead (Pb) and Tin (Sn), which can be \_\_\_\_\_ or \_\_\_\_\_.
  - EXCEPTION 2: The heavy metals of Bismuth (Bi), Polonium (Po) and Z = 114 to 118 have variable charges.

	<b>1A</b> (1)																	<b>8A</b> (18)		
1	1 H	<b>2A</b> (2)													<b>3A</b> (13)	<b>4A</b> (14)	<b>5A</b> (15)	<b>6A</b> (16)	<b>7A</b> (17)	2 He
2	3 Li	4 Be	<b>3B</b>	<b>4B</b>	<b>5B</b>	<b>6B</b>	<b>7B</b>	<b>8B</b>			<b>1B</b>	<b>2B</b>	5 B	6 C	7 N	8 O	9 F	10 Ne		
3	11 Na	12 Mg	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar		
4	19 K	20 Ca	Transition Metals (Possess Varying Charges)										31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr		
5	37 Rb	38 Sr											49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe		
6	55 Cs	56 Ba											81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn		
7	87 Fr	88 Ra											113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og		

**EXAMPLE:** Predict the charge that a gallium ion would possess.

- a) +1                      b) +2                      c) +3                      d) -1                      e) -2

**PRACTICE:** Which element possesses a -2 charge when it combines with other elements?

- a) Ca                      b) Mn                      c) P                      d) Se                      e) F

## CONCEPT: PERIODIC TABLE: CHARGES

### Transition Metals (Type II Metals)

- Most transition metals have varying positive charges because of their electron arrangements around the nucleus.
  - More advanced explanations for these varying charges will be discussed in the later chapters.

	1A (1)	2A (2)											3A (13)	4A (14)	5A (15)	6A (16)	7A (17)	8A (18)
1																		
2			3B	4B	5B	6B	7B	8B			1B	2B						
3			(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)						
4			Sc +3	Ti +2,+3,+4	V +2,+3,+4 +5	Cr +2,+3,+6	Mn +2,+3,+4 +5,+7	Fe +2,+3	Co +2,+3	Ni +2,+3	Cu +1,+2	Zn —						
5			Y —		Nb +3,+5		Tc +4,+6,+7			Pd +2,+4	Ag —	Cd —						
6			La —				Re +4,+6,+7	Os +3,+4	Ir +3,+4	Pt +2,+4	Au +1,+3	Hg +1,+2						
7			Ac —															

**EXAMPLE:** Predict the major charge of an ion if it were discovered to be in Period 10, Group 3B.

- a) +2                      b) +5                      c) -2                      d) -3                      e) +3

**PRACTICE:** What is the likely charge of the element with an atomic number of 47?

- a) +4                      b) +3                      c) -1                      d) +1                      e) +2

**PRACTICE:** How many electrons would the cadmium ion possess?

- a) 50                      b) 48                      c) 46                      d) 52                      e) 30