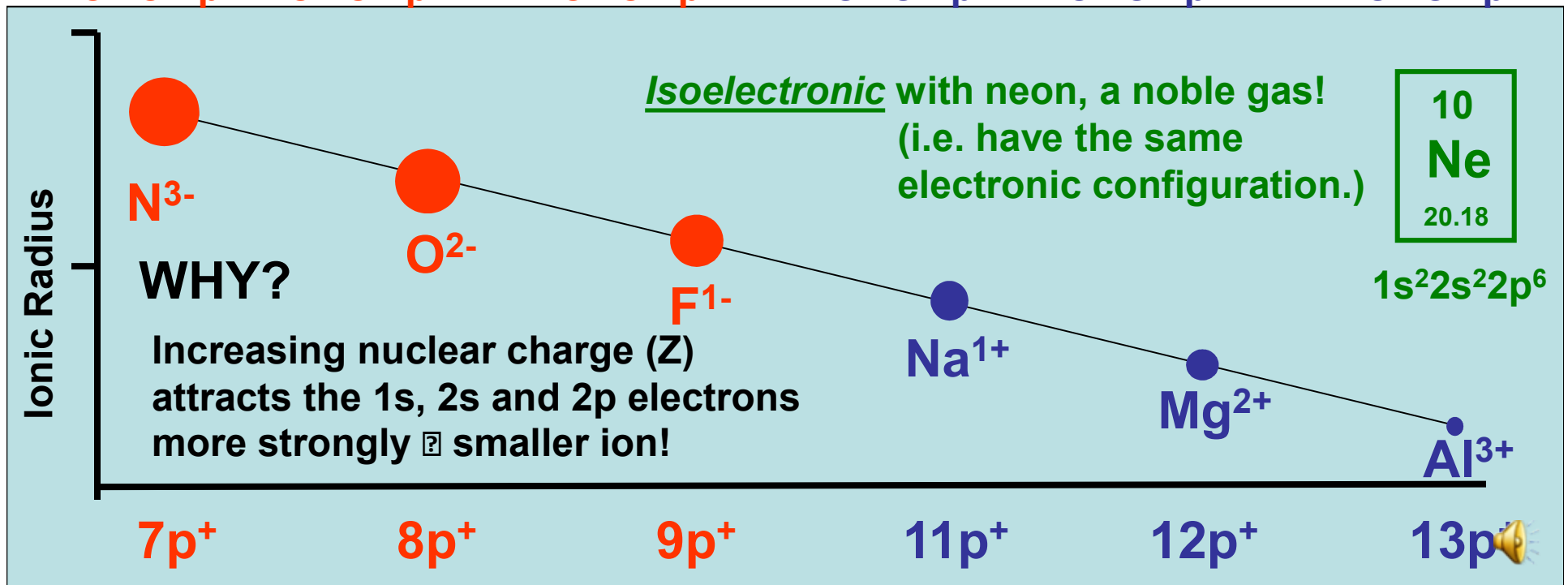


# Atomic Trends: Ionic Size

7 <b>N</b> 14.007	8 <b>O</b> 16.000	9 <b>F</b> 18.998	11 <b>Na</b> 22.990	12 <b>Mg</b> 24.305	13 <b>Al</b> 26.981
$1s^2 2s^2 2p^3$ + 3e <sup>-</sup>	$1s^2 2s^2 2p^4$ + 2e <sup>-</sup>	$1s^2 2s^2 2p^5$ + 1e <sup>-</sup>	$1s^2 2s^2 2p^6 3s^1$ - 1e <sup>-</sup>	$1s^2 2s^2 2p^6 3s^2$ - 2e <sup>-</sup>	$1s^2 2s^2 2p^6 3s^2 3p^1$ - 3e <sup>-</sup>
<b>N<sup>3-</sup></b>	<b>O<sup>2-</sup></b>	<b>F<sup>1-</sup></b>	<b>Na<sup>1+</sup></b>	<b>Mg<sup>2+</sup></b>	<b>Al<sup>3+</sup></b>
$1s^2 2s^2 2p^6$	$1s^2 2s^2 2p^6$	$1s^2 2s^2 2p^6$	$1s^2 2s^2 2p^6$	$1s^2 2s^2 2p^6$	$1s^2 2s^2 2p^6$



# Magnetism:

**Diamagnetic:** Not attracted by magnetic fields



↑  
no unpaired electrons

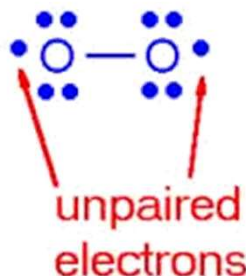


<http://www.chem.uiuc.edu/clcwebsite>



*...contains NO unpaired electrons*

**Paramagnetic:** Attracted by magnetic fields



<http://www.chem.uiuc.edu/clcwebsite>



*...contains unpaired electrons*



# Metals, Non-metals and Metalloids

Periodic Table

1A 1 H 1.008	2A 4 He 4.003											3A 5 B 10.81	4A 6 C 12.01	5A 7 N 14.01	6A 8 O 16.00	7A 9 F 19.00	8A 10 Ne 20.18		
11 Na 23.00	12 Mg 24.31	3B 21 Sc 44.96	4B 22 Ti 47.90	5B 23 V 50.94	6B 24 Cr 52.00	7B 25 Mn 54.94	8B 26 Fe 55.85			1B 27 Co 58.93	2B 28 Ni 58.70	3B 29 Cu 63.55	4B 30 Zn 65.38	5B 31 Ga 69.72	6A 32 Ge 72.59	7A 33 As 74.92	8A 34 Se 78.96	9A 35 Br 79.90	10A 36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	(98) 43 Tc 101.1	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3		
55 Cs 132.9	56 Ba 137.3	57 La 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209	84 Po (209)	85 At (210)	86 Rn (222)		
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (261)	105 Ha (262)	106 Unh (263)	107 Uns (262)	109 Uue (267)												

Metals →

← Nonmetals

Metalloids

Low Ionization Energies  
(easy to remove e<sup>-</sup>)

High Electron Affinities  
(additional e<sup>-</sup> not welcome)

High Ionization Energies  
(Difficult to remove e<sup>-</sup>)

Low Electron Affinities  
(additional e<sup>-</sup> VERY welcome)



# Why Are There Multiple Charge States?

*Finally, an answer to this “pesky” question.*

**Question: What are the common ions for lead (Pb)?**

**Answer:  $\text{Pb}^{2+}$      $\text{Pb}^{4+}$**

**Why?**

