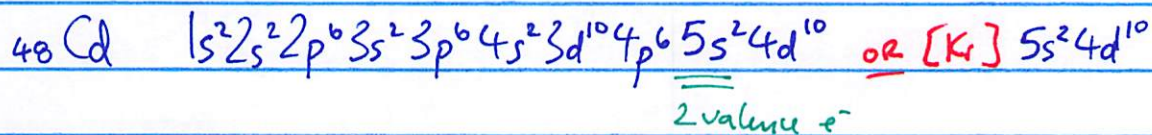


Read  $e^-$  configs from PT

ex  ${}_{12}\text{Mg} \quad 1s^2 2s^2 2p^6 3s^2$  2 valence  $e^-$  or  $[\text{Ne}] 3s^2$



Valence e's: in outermost shell

# Orbital Blocks of the Periodic Table

Groups																		18
1A																		8A
1	2											13	14	15	16	17	2	
1A	2A											3A	4A	5A	6A	7A	8A	
1 <b>H</b> $1s^1$	2 <b>He</b> $1s^2$											5 <b>B</b> $2s^2 2p^1$	6 <b>C</b> $2s^2 2p^2$	7 <b>N</b> $2s^2 2p^3$	8 <b>O</b> $2s^2 2p^4$	9 <b>F</b> $2s^2 2p^5$	10 <b>Ne</b> $2s^2 2p^6$	
3 <b>Li</b> $2s^1$	4 <b>Be</b> $2s^2$											13 <b>Al</b> $3s^2 3p^1$	14 <b>Si</b> $3s^2 3p^2$	15 <b>P</b> $3s^2 3p^3$	16 <b>S</b> $3s^2 3p^4$	17 <b>Cl</b> $3s^2 3p^5$	18 <b>Ar</b> $3s^2 3p^6$	
11 <b>Na</b> $3s^1$	12 <b>Mg</b> $3s^2$	3 <b>B</b>	4 <b>C</b>	5 <b>N</b>	6 <b>O</b>	7 <b>F</b>	8 <b>Ne</b>	9 <b>Na</b>	10 <b>Mg</b>	11 <b>Al</b>	12 <b>Si</b>	13 <b>P</b>	14 <b>S</b>	15 <b>Cl</b>	16 <b>Ar</b>			
19 <b>K</b> $4s^1$	20 <b>Ca</b> $4s^2$	21 <b>Sc</b> $4s^2 3d^1$	22 <b>Ti</b> $4s^2 3d^2$	23 <b>V</b> $4s^2 3d^3$	24 <b>Cr</b> $4s^1 3d^5$	25 <b>Mn</b> $4s^2 3d^5$	26 <b>Fe</b> $4s^2 3d^6$	27 <b>Co</b> $4s^2 3d^7$	28 <b>Ni</b> $4s^2 3d^8$	29 <b>Cu</b> $4s^1 3d^{10}$	30 <b>Zn</b> $4s^2 3d^{10}$	31 <b>Ga</b> $4s^2 4p^1$	32 <b>Ge</b> $4s^2 4p^2$	33 <b>As</b> $4s^2 4p^3$	34 <b>Se</b> $4s^2 4p^4$	35 <b>Br</b> $4s^2 4p^5$	36 <b>Kr</b> $4s^2 4p^6$	
37 <b>Rb</b> $5s^1$	38 <b>Sr</b> $5s^2$	39 <b>Y</b> $5s^2 4d^1$	40 <b>Zr</b> $5s^2 4d^2$	41 <b>Nb</b> $5s^1 4d^4$	42 <b>Mo</b> $5s^2 4d^5$	43 <b>Tc</b> $5s^2 4d^5$	44 <b>Ru</b> $5s^1 4d^7$	45 <b>Rh</b> $5s^1 4d^8$	46 <b>Pd</b> $4d^{10}$	47 <b>Ag</b> $5s^1 4d^{10}$	48 <b>Cd</b> $5s^2 4d^{10}$	49 <b>In</b> $5s^2 5p^1$	50 <b>Sn</b> $5s^2 5p^2$	51 <b>Sb</b> $5s^2 5p^3$	52 <b>Te</b> $5s^2 5p^4$	53 <b>I</b> $5s^2 5p^5$	54 <b>Xe</b> $5s^2 5p^6$	
55 <b>Cs</b> $6s^1$	56 <b>Ba</b> $6s^2$	57 <b>La</b> $6s^2 5d^1$	72 <b>Hf</b> $6s^2 5d^2$	73 <b>Ta</b> $6s^2 5d^3$	74 <b>W</b> $6s^2 5d^4$	75 <b>Re</b> $6s^2 5d^5$	76 <b>Os</b> $6s^2 5d^6$	77 <b>Ir</b> $6s^2 5d^7$	78 <b>Pt</b> $6s^1 5d^9$	79 <b>Au</b> $6s^1 5d^{10}$	80 <b>Hg</b> $6s^2 5d^{10}$	81 <b>Tl</b> $6s^2 6p^1$	82 <b>Pb</b> $6s^2 6p^2$	83 <b>Bi</b> $6s^2 6p^3$	84 <b>Po</b> $6s^2 6p^4$	85 <b>At</b> $6s^2 6p^5$	86 <b>Rn</b> $6s^2 6p^6$	
87 <b>Fr</b> $7s^1$	88 <b>Ra</b> $7s^2$	89 <b>Ac</b> $7s^2 6d^1$	104 <b>Rf</b> $7s^2 6d^2$	105 <b>Db</b> $7s^2 6d^3$	106 <b>Sg</b> $7s^2 6d^4$	107 <b>Bh</b>	108 <b>Hs</b>	109 <b>Mt</b>	110 <b>Ds</b>	111 <b>Rg</b>	112 <b>Cn</b>	113 <b>**</b>	114 <b>Fl</b>	115 <b>**</b>	116 <b>Lv</b>	117 <b>**</b>	118 <b>**</b>	





some exceptions:

often:  $ns^2(n-1)d^4 \rightarrow ns^1(n-1)d^5$

ex:  ${}_{24}\text{Cr}$   ~~$[\text{Ar}] 4s^2 3d^4$~~   $[\text{Ar}] 4s^1 3d^5$

50% filled.

WHY?  $\begin{array}{cc} \boxed{\uparrow\downarrow} & \boxed{\uparrow\downarrow\uparrow\downarrow\uparrow\downarrow} \\ 4s & 3d \end{array} \rightarrow \begin{array}{cc} \boxed{\uparrow} & \boxed{\uparrow\downarrow\uparrow\downarrow\uparrow\downarrow} \\ 4s & 3d \end{array}$

$ns^2(n-1)d^9 \rightarrow ns^1(n-1)d^{10}$

ex:  ${}_{47}\text{Ag}$   ~~$[\text{Kr}] 5s^2 4d^9$~~   $[\text{Kr}] 5s^1 4d^{10}$

100% filled

$[\text{Kr}] \begin{array}{cc} \boxed{\uparrow\downarrow} & \boxed{\uparrow\downarrow\uparrow\downarrow\uparrow\downarrow\uparrow\downarrow} \\ 5s & 4d^9 \end{array} \rightarrow [\text{Kr}] \begin{array}{cc} \boxed{\uparrow} & \boxed{\uparrow\downarrow\uparrow\downarrow\uparrow\downarrow\uparrow\downarrow} \\ 5s & 4d \end{array}$

Valence e's + groups

Notice: gp IA

H

Li

Na

$1s^1$

$1s^2 2s^1$

$1s^2 2s^2 2p^6 3s^1$

1 valence  $e^-$

- all can lose 1 valence  $e^-$  + form inert gas core

ex: gp 7A

F

$1s^2 2s^2 2p^5$

Cl

$1s^2 2s^2 2p^6 3s^2 3p^5$

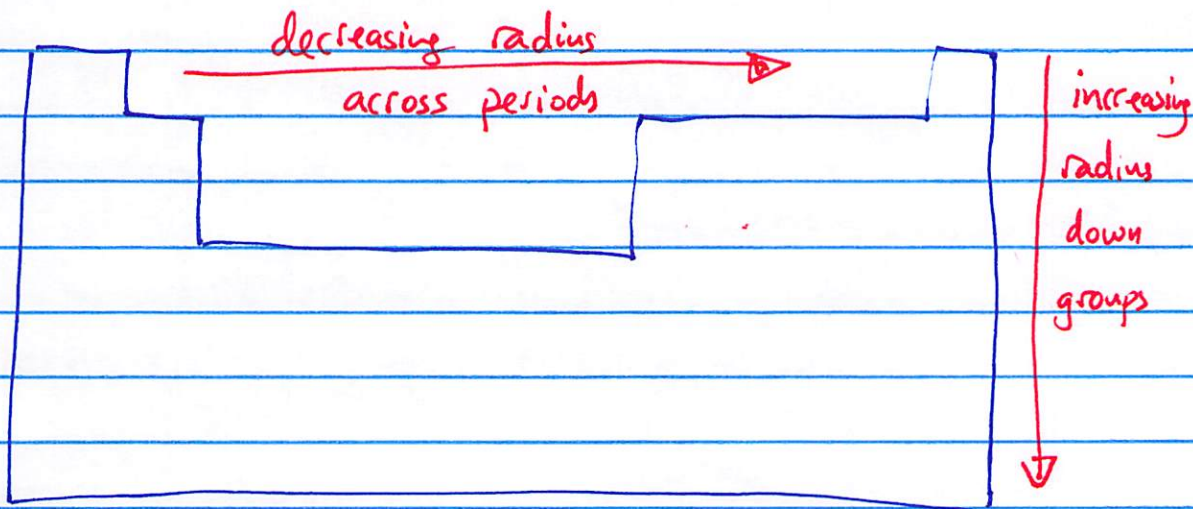
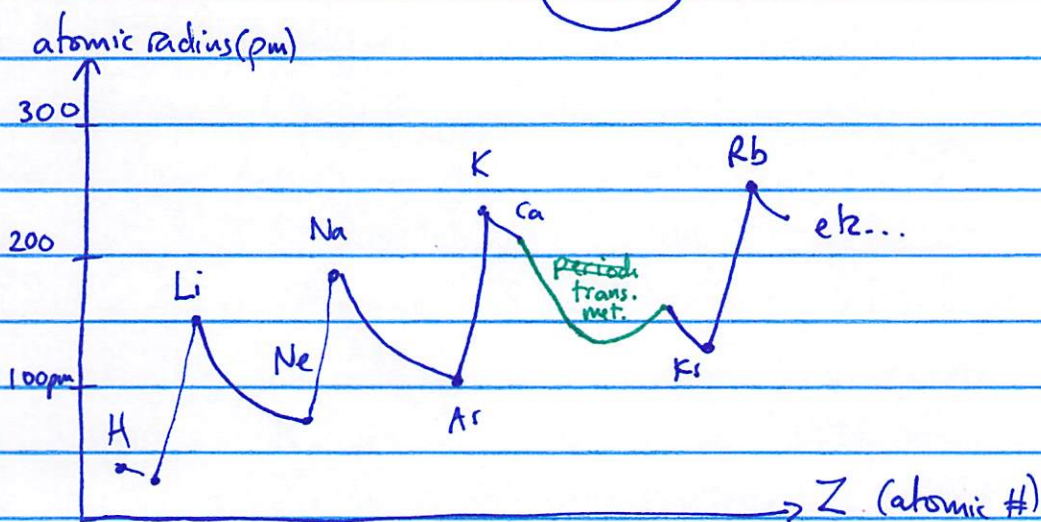
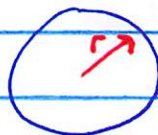
7 valence e's

- all can gain  $1e^-$  + form inert gas core!

$F^-$ ,  $Cl^-$

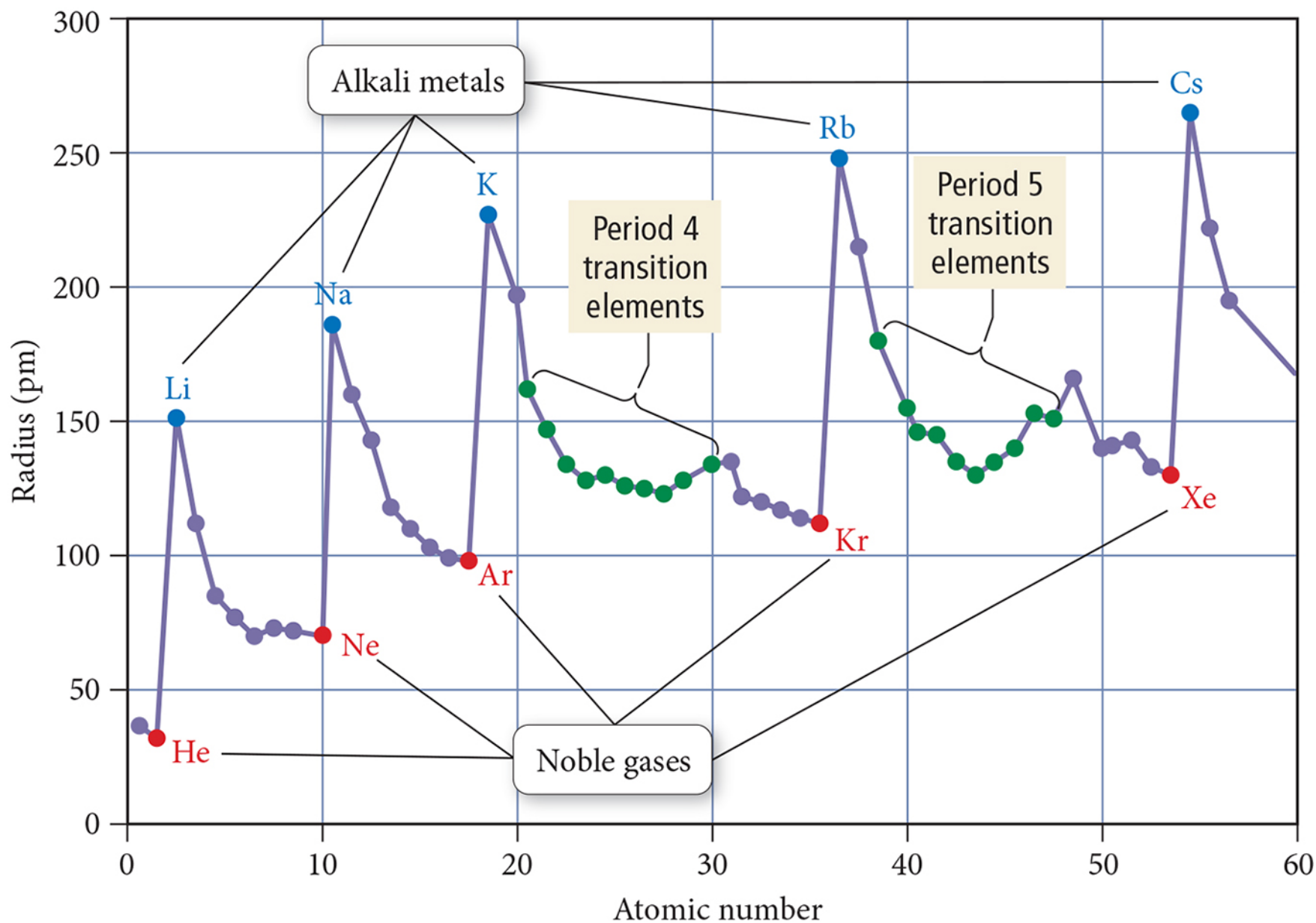
## Periodic trends

ex: atomic radius



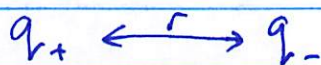


# Atomic Radii



WHY?

Coulomb's law:  $f \propto \frac{q_+ \times q_-}{r^2}$



- the larger the +ve charge, the greater the attraction to the -ve charge!  
( $e^-$ )

The size of atom is determined by outer (valence)  $e^-$ s.

ex:  ${}_{11}\text{Na}$

$11p^+$

$1s^2 2s^2 2p^6 3s^1$

$\uparrow$  valence  $e^-$

${}_{13}\text{Al}$

$13p^+$

$1s^2 2s^2 2p^6 3s^2 3p^1$

$\uparrow$  valence  $e^-$

Outer  $e^-$ s DO NOT feel full nuclear charge,  $Z$ !  
... they feel an effective nuclear charge,  $Z_{\text{eff}}$

where:  $Z_{\text{eff}} = Z - S$

$\hookleftarrow$  screening constant

$\uparrow$  inner shell  $e^-$ s "block"  
or "screen" some of  
the nucleus's charge.