$_{23}V^{+3}$: $1S^2$ $2S^2$ $2P^6$ $3S^2$ $3P^6$ $4S^0$ $3d^2$

$S = +1/2 +1/2 = 1$

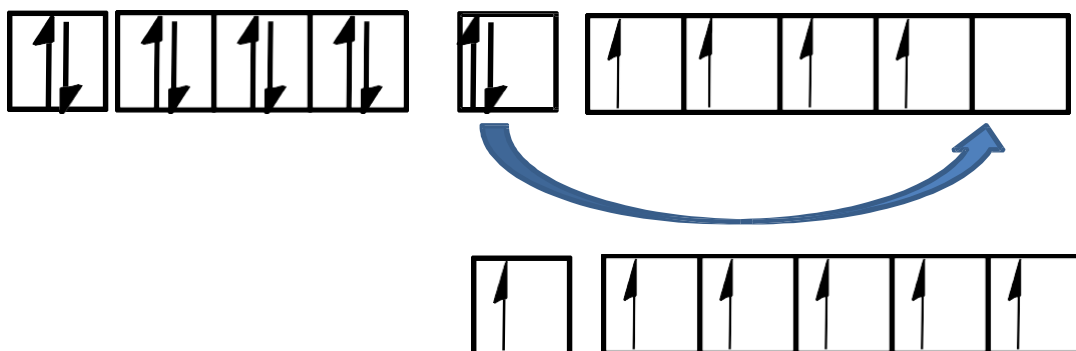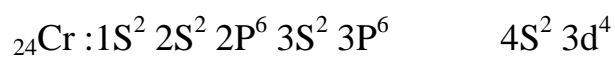$2S+1 = 2\times 1 + 1 = 3$

$L = (+2\times 1) + (+1 \times 1) = 3$

$J = /L+S/ \ldots\ldots/L-S/$

$J = /3+1/ \ldots\ldots/3-1/= 4, 3, 2$

$$^{2S+1}L_J$$

$$^3F_2$$

Example 5/ What is the therm symbol in the stable state of the chromium atom($_{24}Cr$) ?

$_{24}Cr$: $1S^2$ $2S^2$ $2P^6$ $3S^2$ $3P^6$ $4S^2$ $3d^4$

$S = +1/2 +1/2 +1/2 +1/2 +1/2 +1/2 = 3$

$2S+1 = 2\times 3 + 1 = 7$

6

$L = ١ (+2) +١ (+1)+ 0 + ١(-2) +١ (-1) = 0$

$J = /0+3/ ………/0-3/= 3$

$J = /L+S/ ………/L-S/$

$$^{2S+1}L_J$$

$$^7S_3$$

Example 6/ What is the term symbol in the steady state of the iron ion in the compound The atomic number of iron Fe = 26, O = 8?

$_{26}Fe^{+2} : 1S^2\ 2S^2\ 2P^6\ 3S^2\ 3P^6$ $\qquad\qquad 3d^6$
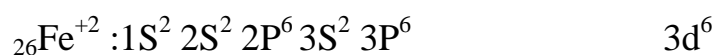
$S = +1/2 +1/2 +1/2 +1/2 = 2$

$2S+1 = 2× 2 + 1= 5$

$L = (+2×2) + (+1×1)+ 0 + (-1×1)+ (-2×1)= 2$

$J = /2+2/ ………/2-2/= 4, 3, 2, 1, 0$

$$^{2S+1}L_J$$

$$^5D_4$$

Question/ Find the term symbols for the stable state of the following atoms: (The solution is in parentheses, prove that it is correct)

1) $_{14}$Si ($^3P_0$)

2) $_{22}$Ti ($^3F_2$)

3) $_{27}$Co ($^4F_{9/2}$)

4) $_{28}$Ni ($^3F_4$)

5) $_{29}$Cu ($^2S_{1/2}$)

Oxidation States:

An oxidation state, or oxidation number, is a number assigned to an element within a compound or molecule to represent how many electrons the element is capable of gaining or losing. Charge and formal charge are similar to the oxidation state, but these are different and separate concepts, even though the values tend to be the same in most cases. The following rules work for most compounds. If there is a conflict between two rules, always pick the rule that comes first.

1. An individual atom that is uncombined with any other element has an oxidation state of 0.

• O_2, N_2, H_2, C, and Ag would all have oxidation states of 0.

• The sum of the oxidation states of all the atoms in a compound must equal the charge.

• The oxidation state of a calcium ion (Ca^{+2}) would be +2.

• Since NaCl doesn't have a charge, the sum of the oxidation state for Na and Cl must be zero, so Na has a oxidation number of +1, while Cl has one of -1.

• In a compound, the oxidation state for Group 1 metals is +1 and Group 2 metals is +2.

• Sodium's oxidation state is +1 since it is a Group 1 metal.

• The oxidation state for F is -1 in a compound.

• The oxidation state for H is +1 in a compound.

 • The oxidation state for O is -2 in a compound.

• In a two-element compound with metals, Group 15 elements will have an oxidation state of -3, Group 16 elements will have one of -2, and Group 17 elements will be -1.
• In HBr, H would have an oxidation state of +1 and Br would have an oxidation number of +1. For most compounds, you can immediately identify almost all of the elements' oxidation states; usually, you're left with one unknown oxidation state. In these cases, you would solve for the remaining oxidation number using Rule 2

H	+2	Oxidation number										+3	+4	-3	-2	-1	He
Li	Be											B	C	N	O	F	Ne
Na	Mg		d-Block elements									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	Ba	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	P-Block elements					

S-Block