

$$2) a. [Ar] (3d)^8$$

b. $M_L = +2 \quad +1 \quad 0 \quad -1 \quad -2 \quad M_L M_S \quad M_L = +2 \quad +1 \quad 0 \quad -1 \quad -2 \quad M_L M_S$

1	1	1	1	-	4	0	1	1	1	1	0	0
1	1	1	1	1	3	1	1	1	1	1	0	-1
1	1	1	1	1	3	0	1	1	1	1	-1	0
1	1	1	1	-	2	0	1	1	1	1	-1	-1
1	1	1	1	1	3	0	1	-	1	1	-2	0
1	1	1	1	1	3	-1	1	1	1	1	0	1
1	1	1	1	1	2	1	1	1	1	1	0	0
1	1	1	1	1	1	1	1	1	1	1	-1	1
1	1	1	1	1	2	0	1	1	1	1	-1	0
1	1	1	1	1	1	0	1	1	1	1	-2	1
1	1	1	1	1	2	0	1	1	1	1	-2	0
1	1	1	1	1	1	0	1	1	1	1	-3	1
1	1	1	1	1	2	-1	1	1	1	1	-3	0
1	1	1	1	1	1	-1	1	1	1	1	0	0
1	1	-	1	1	0	0	1	1	1	1	0	-1
1	1	1	1	1	1	1	1	1	1	1	-1	0
1	1	1	1	1	1	0	1	1	1	1	-1	-1
1	1	1	1	1	0	1	1	1	1	1	-2	0
1	1	1	1	1	0	0	1	1	1	1	-2	-1
1	1	1	1	1	-1	1	1	1	1	1	-3	0
1	1	1	1	1	-1	0	1	1	1	1	-3	-1
1	1	1	1	1	1	0	1	1	1	1	-4	0
1	1	1	1	1	1	-1	1	1	1	1		

M_L	M_S	+1	0	-1
4		0	1	0
3		1	2	1
2		1	3	1
1		2	4	2
0		2	5	2
-1		2	4	2
-2		1	3	1
-3		1	2	1
-4		0	1	0

Remove
1G

M_L	M_S	+1	0	-1
4		0	0	0
3		1	1	1
2		1	2	1
1		2	3	2
0		2	4	2
-1		2	3	2
-2		1	2	1
-3		1	1	1
-4		0	0	0

Remove
3F

M_L	M_S	+1	0	-1
3		0	0	0
2		0	1	0
1		1	2	1
0		1	3	1
-1		1	2	1
-2		0	1	0
-3		0	0	0

Remove
1D

M_L	M_S	+1	0	-1
3		0	0	0
2		0	0	0
1		1	1	1
0		1	2	1
-1		1	1	1
-2		0	0	0
-3		0	0	0

Remove
3P

M_L	M_S	+1	0	-1
1		0	0	0
0		0	1	0
-1		0	0	0

→ Last term is 'S'

Five States
'G, 'F, 'D, 'P, 'S

d. Apply Hund's first Rule

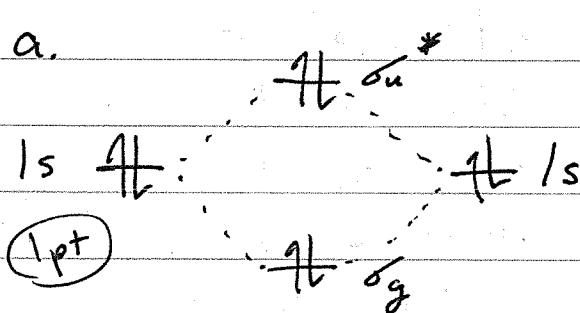
$$^3F, ^3P \ll ^1G, ^1D, ^1S$$

Apply Hund's Second Rule to the Triplet States

$$^3F < ^3P$$

The electronic ground state is 3F

3) a.



Bond order = 0

The σ_u^* orbital is slightly more destabilized than σ_g is stabilized.

Therefore, 2 He are at a ~~higher~~ lower energy than He_2

b. The $f_{5z^3-3zr^2}$ orbital (Also called f_{z^3})

c. The $f_{5xz^2-3xr^2}$ (f_{xz^2}) and $f_{5yz^2-3yr^2}$ (f_{yz^2}) orbitals