GENERAL CHEMISTRY

DO YOUR SELF – 2

K L M N O P

1. How many subshells are possible in P-shell : $n = 1$ 2 3 4 5 6

(A) 3 (B) 6 (C) 7 (D) 1

2. For an electron magnetic quantum number $= -2$, the electron may be present in

(A) $3\,d$ – orbital (B) $2p$ – orbital

(C) $4p$ - orbital (D) $5\,s$ - orbital

d

$-2 \quad -1 \quad 0 \quad +1 \quad +2$

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3. Number of Valence shell electron in Fe is?

(A) 8 (B) 6 (C) 14 (D) 12

4. Hund's rule deals with the distribution of electrons in

(A) outer shell only (B) a subshell only

(C) an orbital (D) degenerate orbital

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5. The number of possible orientation of $\boxed{\text{d-orbitals}}$ in space is:

(A) 2 (B) 3 (C) 4 (D) 5

6. Maximum number of electrons in $\boxed{3p \text{ - orbital?}}$

(A) 2 (B) 10 (C) 6 (D) 3

d_{xy} d_{yz} d_{zx} $d_{x^2-y^2}$ d_{z^2}

Note ⇒ each orbital maximum two e^-

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7. In which pair both the orbitals have same shape, same orientation, but different energy?

(A) $3\,d_{xy}$, $4\,d_{xy}$ (B) $5p_x$, $5p_y$ (C) $3p_x$, $3\,d_{xy}$ (D) $4\,s$, $4p_x$

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RULES FOR FILLING ELECTRONS

1. Pauli's exclusion principle :

(i) 'No two electrons in an atom can have same values of all the four quantum numbers.

(ii) An orbital accommodates two electron with opposite spin. These two electrons have same values of principal, azimuthal and magnetic quantum number but the fourth, i.e. spin quantum number will be different. i.e.

For $He = 1s^2$ K, shell $(n = 1), l = 0,\ m = 0$

For 1^{st} Electron $n = 1, l = 0,\ m = 0,\ s = +\frac{1}{2}$

For 2^{nd} Electron $n = 1, l = 0,\ m = 0,\ s = -\frac{1}{2}$

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$$\boxed{He = 1s^2}$$

$$\boxed{1L}$$

$$m = -l \quad 0 \quad +l$$
$$= -0 \quad 0 \quad +0$$
$$= \underline{0}$$

	1	L
$n =$	1	1
$l =$	0	0
$m =$	0	0
$s =$	$+1/2$	$-1/2$

Hund's Rule

d^5

↑↓	↑↓	↑		

↑↓	↑	↑	↑	

↑	↓	↑	↓	↑

↑	↑	↑↓		↑

d^5

↑	↑	↑	↑	↑

d^6

↑↓	↑	↑	↑	↑

d^7

↑↓	↑↓	↑	↑	↑

electronic conf.

nl^x

$n \rightarrow$ Principle Q.N

$l =$ Azimuthal Q.N

$x =$ no. of e^-

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d^1

d^2

d^3

d^4

d^5

d^6

d^7

d^8

d^9

d^{10}

$\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}$

maximum e^-

s = subshell = 2

d = subshell = 10

p = subshell = 6

f = subshell = 14

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$$\frac{n\ell^{x}}{e^{-}\ \text{Conf.}}$$

$x =$ no of e^{-}

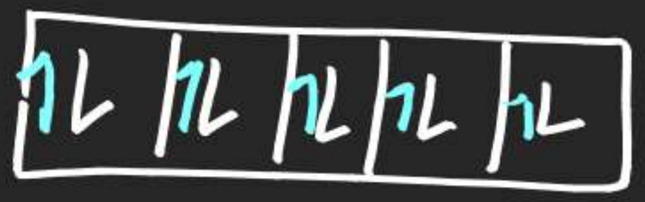
$3s^2$ $\boxed{\uparrow\downarrow}$

$3p^6$ $\boxed{\uparrow\downarrow \mid \uparrow\downarrow \mid \uparrow\downarrow}$

$3d^{10}$ $\boxed{\uparrow\downarrow \mid \uparrow\downarrow \mid \uparrow\downarrow \mid \uparrow\downarrow \mid \uparrow\downarrow}$

$4f^{14}$ $\boxed{\uparrow\downarrow \mid \uparrow\downarrow \mid \uparrow\downarrow \mid \uparrow\downarrow \mid \uparrow\downarrow \mid \uparrow\downarrow \mid \uparrow\downarrow}$

d^5



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$s = \pm 1/2$

1

$2 \times \left(\frac{1}{2}\right) + 1$

2

Hund's multiplicity $= 2|S| + 1$

d^5

$S =$ total spin

$\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow}\boxed{\quad}\boxed{\uparrow}$

$\uparrow\downarrow \quad \uparrow\downarrow$

$1\frac{1}{2}$

$\cancel{2} \times \frac{1}{\cancel{2}} + 1$

2

$\boxed{\uparrow}\boxed{\uparrow}\boxed{\uparrow}\boxed{\uparrow}\boxed{\uparrow}$

$\cancel{2} \times \frac{5}{\cancel{2}} + 1$

$\underline{6}$

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$2|S|+1$

S = total spin

$\uparrow$ $s = \pm 1/2$

$\downarrow$ $s = \pm 1/2$

$\uparrow$	$\downarrow$	$\uparrow$	$\downarrow$	$\uparrow$

$+1/2$ $-1/2$ $+1/2$ $-1/2$

$\cancel{2} \times \frac{1}{\cancel{2}} + 1$

2

$\uparrow$	$\uparrow$	$\uparrow$	$\uparrow$	$\uparrow$

$\cancel{2} \times \frac{5}{\cancel{2}} + 1$

6

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$(n+l)$ Rule [Aufbau Principle) (German word Building up)

if $(n+l)$ value ↑ then energy of orbital Higher

but if $(n+l)$ value same then energy of orbital decided by $\underline{n}$, n ↑ energy ↑

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l

$s = 0$

$p = 1$

$d = 2$

$f = 3$

energy

$3s > 2s$

$n = 3 \quad n = 2$

$l = 0 \quad l = 0$

$(n+l) = 3+0 \quad 2+0$

$= 3 \quad 2$

$3d < 4f$

$n = 3 \quad 4$

$l = 2 \quad 3$

$(n+l) = 3+2 \quad 4+3$

$= 5 \quad 7$

$3s > 2p$

$3+0 \quad 2+1$

$3 \quad \cancel{3}$

$3d < 4p$

$3+2 \quad 4+1$

$5 \quad 5$

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$_2He$ $_3Li$ $H^{\ominus}$

Multielectronic syst. = (n + l) Rule

(H) but for single electronic syst. energy dec. by Shell

n ↑ energy ↑

$1s < 2s = 2p < 3s = 3p = 3d < 4s = 4p = 4d = 4f$

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electronic conf.

	Maximum e^-
s	2
p	6
d	10
f	14

1s 2s 2p 3s 3p 4s 3d 4p 5s 4d 5p 6s 4f 5d 6p 7s 5f 6d 7p

$_1H = 1s^1$

$_2He = 1s^2$

$_3Li = 1s^2 2s^1$

$_4Be = 1s^2 2s^2$

$_5B = 1s^2 2s^2 2p^1$

$_6C = 1s^2 2s^2 2p^2$

$_7N = 1s^2 2s^2 2p^3$

$_8O = 1s^2 2s^2 2p^4$

$_9F = 1s^2 2s^2 2p^5$

$_{10}Ne = 1s^2 2s^2 2p^6$

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$_{11}Na = 1s^2 2s^2 2p^6 3s^1$

$_{81}Tl$

$1s^2\ 2s^2 2p^6\ 3s^2 3p^6\ 4s^2 3d^{10} 4p^6\ 5s^2 4d^{10} 5p^6\ 6s^2 4f^{14} 5d^{10} 6p^1\ 7s\, 5f\, 6d\, 7p$

$_{50}Sn = 1s^2\ 2s^2 2p^6\ 3s^2 3p^6\ 4s^2 3d^{10} 4p^6\ 5s^2 4d^{10} 5p^2$

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Noble gas

$_{2}He = 1s^2$

$_{10}Ne = 1s^2 \boxed{2s^2 2p^6}$

$_{18}Ar = 1s^2 2s^2 2p^6 3s^2 3p^6$

$_{36}Kr = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6$

$_{54}Xe = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6$

$N = 1s^2 2s^2 2p^3$

$N = [He] 2s^2 2p^3$

$_{81}Tl = [Xe] 4f^{14} 5d^{10} 6s^2 6p^1$

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$$_{28}Ni = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^8$$

$$= \underline{1s^2 2s^2 2p^6 3s^2 3p^6} 3d^8 4s^2$$

$$_{28}Ni = \underline{[Ar] 3d^8 4s^2}$$

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$$_{23}V = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^3$$

$$= 1s^2 2s^2 2p^6 3s^2 3p^6 3d^3 4s^2$$

$$_{23}V = [Ar] \; 3d^3 4s^2$$

$$N = 1s^2 2s^2 2p^3$$

$$= 1s^2 2s^2 2p_x^1 2p_y^1 2p_z^1$$

$$= \boxed{\uparrow\downarrow}\ \boxed{\uparrow\downarrow}\ \boxed{\uparrow \,|\, \uparrow \,|\, \uparrow}$$

$${}_6C = 1s^2 2s^2 2p^2$$

$$= 1s^2 2s^1 2p^3$$ [excitation state]