



CHEMISTRY ONLINE
— **TUITION** —

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CHEMISTRY

PHYSICAL CHEMISTRY

Level & Board	CIE (A-LEVEL)
TOPIC:	ATOMIC STRUCTURE
PAPER TYPE:	SOLUTION - 1
TOTAL QUESTIONS	2
TOTAL MARKS	15

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Atomic Structure

Solution 1

(a)

	1s	2s	2p	3s	3p	3d	4s	4p	4d
Ca	2	2	6						
Sr ²⁺	2	2	6						

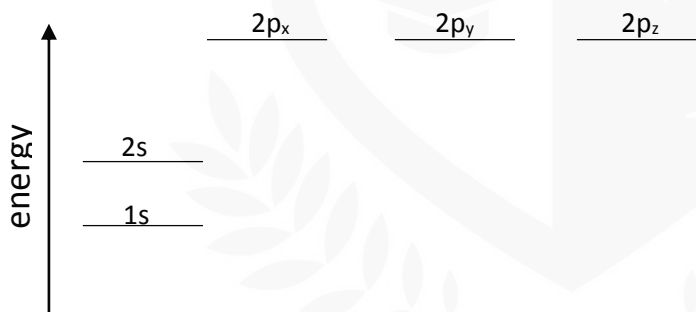
(b) (i) Number of energy levels increase down the group, therefore, atomic size increases.

(ii) Outermost shells increase and valence electrons are further away from nucleus. The shielding effect increases and effective nuclear charge decreases causing decrease in first ionization energies.

(b) (ii) Greater nuclear charge attract remaining electrons more strongly, therefore reducing its size.

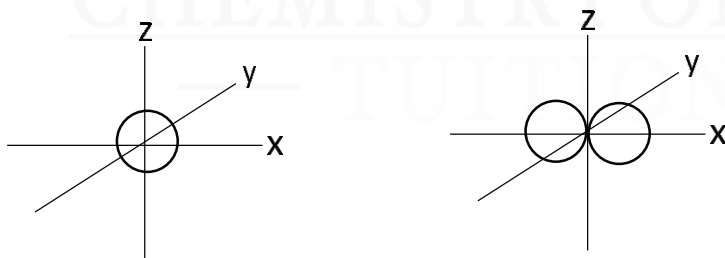
Solution 2

(b) (i)



(b) (i) All P orbitals of same quantum shell are of equal energy.

(ii)

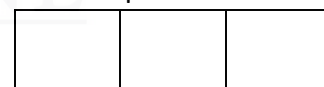


S – orbital is spherical in shape

P – orbital is bilobed or dumb – bell shaped

(ii) p_x, p_y, p_z, similar in shape but their alignment in space is different. They are in different directions w.r.t. each other.

(iii) In nitrogen atom 7e⁻ – s are arranged as 1s²2s² 2p³



P_x p_y p_z
half filled p – orbital.

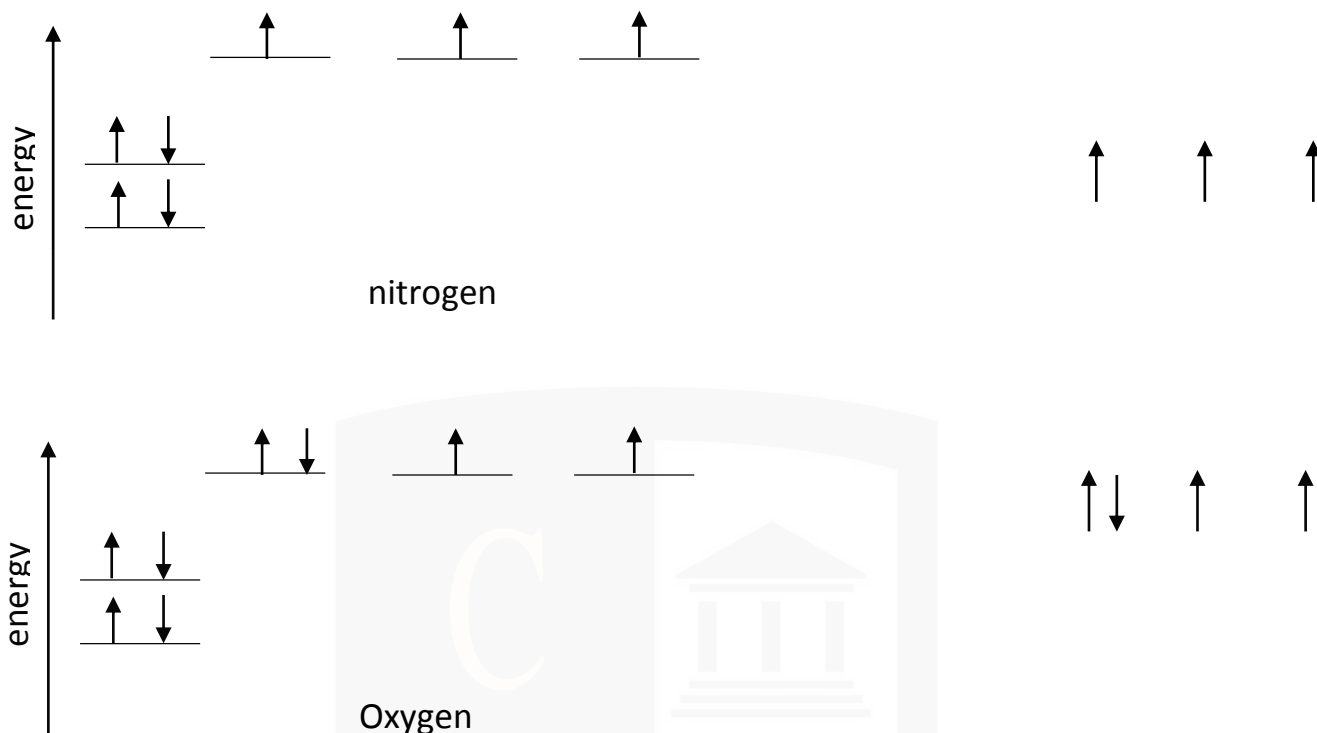
In oxygen atom 8e⁻ s are arranged as 1s² 2s² 3p⁴



2p_x 2p_y 2p_z

Hence one of p – orbital is paired.

(iii)



(b) (i) Nitrogen: 1400 kJ mol^{-1} Oxygen: 1310 kJ mol^{-1}

(ii) In nitrogen each p – orbital is half filled which is relatively stable configuration as compared to p^4 configuration in oxygen. In case of oxygen pairing starts in p – orbitals as a result interelectronic repulsions are dominant and it is easier to remove electrons hence oxygen has less 1st ionization energy than nitrogen.

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I am Sorry !!!!!



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- Founder & CEO of Chemistry Online Tuition Ltd.
- Completed Medicine (M.B.B.S) in 2007
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