

Daily Tutorial Sheet 5

Level – 1

61.(D) Gd (64)



All the electrons of 4f-orbital are unpaired, hence stable. Thus, Gd(64) has EC as $[\text{Xe}]_{54} 4f^7 5d^1 6s^2$

Instead of $[\text{Xe}]_{54} 4f^8 6s^2$.

- 62.(D)** (a) There is a gradual decrease in the radii of the lanthanoids with increasing atomic number-a case of lanthanide contraction, thus true.
- (b) Ionization potential for the formation of Lu^{3+} is comparatively low, hence +3 state is favourable, thus true.
- (c) Due to lanthanide contraction –Zr and Hf ; Nb and Ta, Mo and W have the same size and thus similar properties and thus separation is not easy, thus true.
- (d) Formation of +4 state requires very high energy, thus incorrect.

63.(A) The basic character of hydroxides decreases from $\text{La}(\text{OH})_3$ to $\text{Lu}(\text{OH})_3$. Due to smaller size of Lu, the Lu – OH bond attains more covalent character.

64.(C) The most common oxidation state of lanthanoid is +3. Lanthanoids in +3 oxidation state usually have unpaired electron in f-subshell and impart characteristic colour in solid as well as in solution state due to f – f transition. (Except lanthanum and lutetium)

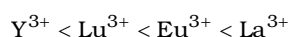
65.(A) Cerium $\text{Ce}_{58} = [\text{Xe}] 4f^1, 5d^1, 6s^2$ Its most stable oxidation state is +3 but +4 is also existing.

66.(D) The general electronic configuration for lanthanides is $[\text{Xe}](n-2)f^{1-14}(n-1)d^1 ns^2$.

∴ After the loss of both of the 6s-electrons and also the solitary d-electrons, the lanthanides gain stable configurations.

∴ (+3) oxidation state is most common among lanthanides.

67.(D) Ionic radii of lanthanide (La^{3+}) decreases with increase in atomic number.



Because Eu and Lu are the members of lanthanide series (so they show lanthanide contraction) and La is the representative element. Y^{3+} ion has lower ionic radii in comparison to La^{3+} because it lies immediately above in the Periodic Table.

68.(D) 4f and 5f-belong to different shell, experience different amount of shielding.

69.(C) Boron (B), aluminium (Al) and gallium, (Ga) are present in IIIA group. They show +3 oxidation state. While cerium (Ce) is a lanthanide. It is present in lanthanide series. It shows +3 and +4 oxidation states.

70.(B) Lanthanide contraction, cancels almost exactly the normal size increase on descending a group of transition elements, thus Nb and Ta, Zr and Hf have same covalent and ionic radii.

71.(B) Lanthanides $[\text{Xe}]4f^{1-14}5d^{0-1}6s^2$ Actinides $[\text{Rn}]4f^{1-14}6d^{0-1}7s^2$

Lanthanides and actinides use core d and f-orbitals also to show higher oxidation state. As actinides have comparatively low energy difference between f and d-orbitals, show more oxidation states.

72.(A) Gadolinium ($Z = 64$) $[\text{Xe}] 4f^7 5d^1 6s^2$

Lutetium ($Z = 71$) $[\text{Xe}] 4f^{14} 5d^1 6s^2$

Lawrencium ($Z = 103$) $[\text{Rn}] 5f^{14} 6d^1 7s^2$

Tantalum ($Z = 73$) $[\text{Xe}] 4f^{14} 5d^3 6s^2$

Hence, gadolinium has got incompletely filled f-subshell.

73.(D) Lanthanides and actinides both are not radioactive. Except promethium, all lanthanides are non-radioactive. While all actinides are radioactive.

74.(D) The actinides (5f-electrons) exhibits more number of oxidation states in general than the lanthanide because 5f-orbitals extend farther from the nucleus than the 4f-orbitals.

75.(B) The fourteen elements which follow actinium from thorium ($Z = 90$) to lawrencium ($Z = 103$) are called actinides.

They involve the filling of 5f-subshell. Californium (Cf) has the $\text{Cf} (Z = 98) : [\text{Rn}] 5f^{10}, 6d^0, 7s^2$.

Hence, it is a member of actinide series.