CHEMISTRY

FOR IIT JEE ASPIRANTS OF CLASS 11

FOR CHEMISTRY

F-BLOCK ELEMENTS

W E 1

1. Variability in the oxidation states of lanthanides is limited. Why ?

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W E 2

1. Name a member of the lanthanoid series which is well known to exhibit $+4$ oxidation state.

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W E 6

1. On the basis of lanthanoid contraction, explain the following:

(i) Nature of bonding in La_2O_3 and Lu_2O_3.

(ii) Trends in the stability of oxo salts of lanthanoids from La to Lu.

(iii) Stability of the complexes of lanthanoids.

(iv) Radii of 4d and 5d block elements.

(v) Trends in acidic character of lanthanoids oxides.

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CUQ

1. Which sub shell is filled up progressively in actinoids

A. $1.4f$

B. 5f

C. 6d

D. 7s

Answer: B

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2. General valence shell electronic configuration of $f-$ block elements is

A. $(n-2)f^{1-14}(n-1)d^{0-1}ns^2$

B. $(n-2)f^{1-14}(n-1)d^{0-5}ns^{0-2}$

C. $(n-2)f^{1-14}(n-1)d^{0-10}ns^{1-2}$

D. $(n-2)f^{1-14}(n-1)d^{0-2}(n-1)s^2$

Answer: A

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3. The inner transition elements are the elements which the added electrons go to

A. (n-1)d-orbitals

B. (n-2)f-orbitals

C. (n-1)d-orbitals and (n-1)f-orbitals

D. (n-1)d-orbitals and ns orbitals

Answer: B

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4. The expected electronic configuration of cerium is

A. $[Xe]4f^{0}5d^{1}6s^{2}$

B. $[Xe]4f^{1}5d^{1}6s^{2}$

C. $[Xe]4f^{2}5d^{0}6s^{2}$

D. Both 2 and 3

Answer: B

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5. Which of the following is not the configuration of lanthanoid

A. $[Xe]4f^{10}.6s^2$

B. $[Xe]4f^{1}5d^{1}.6s^2$

C. $[Xe]4f^{14}5d^{10}6s^{1}$

D. $[Xe]4f^{7}5d^{1}6s^2$

Answer: C

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6. The element with the electronic configuration $[Xe]^{54}4f^{14}5d^{1}6s^{2}$ is a

A. Representative element

B. Transition element

C. Actinide element

D. Lanthanide element

Answer: D

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7. Lanthanoids are

A. 14 elements in the seventh period (At. No. 90 to 103) that are filling 5f sublevel.

B. 14 elements in the sixth period (At. No. 58 to 71) that are filling 4f sublevel.

C. 14 elements in the seventh period (AT. No. 58 to 71) that are filling 4f sublevel.

D. 14 elements in the sixth period (AT. No. 90 to 103)

Answer: B

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8. Which of the following lanthanoids is radiocative ?

A. Cerium

B. Promethium

C. Thulium

D. Lutetium

Answer: B

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9. Which of the following are all radioactive elements.

A. Transition elements.

B. P block elements

C. Lathanides.

D. Actinides.

Answer: D

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10. The most common lanthanoid is :

A. Lanthanum

B. Cerium

C. Samarium

D. Plutonium

Answer: B

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11. Non-Lanthanoid atom is

A. La

B. Lu

C. Pr

D. Pm

Answer: A

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12. Which of the following is a Lanthanoid

A. Ta

B. Rh

C. Th

D. Lu

Answer: D

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13. Lanthanides are characterized by the filing of the

A. penultimate 4f energy level

B. antepenultimate 4f energy level

C. penultimate 5f energy level

D. antepenultimate 5f energy level

Answer: B

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14. The most common and stable oxidation state of a lanthanide is

A. $+4$

B. $+3$

C. $+6$

D. $+2$

Answer: B

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Level I C W

1. The most common oxidation states of cerium are

A. $+2$ and $+4$

B. $+3$ and $+4$

C. $+3$ and $+5$

D. $+2$ and $+3$

Answer: B

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2. Which of the following ion is paramagnetic

A. $La^{3+}(Z=57)$

B. $Lu^{3+}(Z=71)$

C. $Yb^{2+}(Z=70)$

D. $Sm^{3+}(Z=62)$

Answer: D

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3. The atomic and ionic radii (M^{3+} ions) of Lanthanide elements decrease with increase in atomic number. This effect is called

A. Lanthanoid contraction

B. Lanthanoid expansion

C. Actinoid contraction

D. Actionoid expansion

Answer: A

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4. Lanthanide contraction is caused due to -

A. the 4f electrons, which are gradually added, create a strong shielding effect

B. the 4f orbitals are greater in size than the 3d and 3f orbitals

C. the 5f orbitals strongly penetrate into the 4f orbitals

D. the poor shielding effect of 4f electrons is coupled with increased attraction

between the nucleus and the added electrons.

Answer: D

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5. The lanthanide contraction is responsible for the fact that

A. Zr and Y have about the same radius

B. Zr and Nb have similar oxidation state

C. Zr and Hf have about the same radius

D. Zr and Zn have the same oxidation state

Answer: C

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6. Which elements among the Lanthanides has the smallest atomic radius ?

A. Cerium

B. Lutetium

C. Europium

D. Gadolinium

Answer: B

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7. Lanthanides are separated best by

A. Fractional crystallisation

B. Solvent extraction

C. Complex formation using EDTA

D. Ion exchange resins

Answer: D

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8. The separation of lanthanides by the ion exhange method is based on

A. The solubility of the nitrates

B. Size of the hydrated M^{3+} ions

C. Size of the unhydrated M^{3+} ions

D. Basicity of the hydroxides

Answer: B

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9. Which of the following is the strongest base

A. $Sc(OH)_3$

B. $La(OH)_3$

C. $Lu(OH)_3$

D. $Yb(OH)$

Answer: B

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10. $KMnO_4$ and $K_2Cr_2O_7$ are replaced in volumetric analysis by

A. La(III) salts

B. Ce(III)salts

C. Ce(IV)salt

D. Gd(III)salts

Answer: C

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11. Assertion: Ce^{4+} is used as an oxidising agent in volumetric analysis.

Reason: Ce^{4+} has the tendency to attain $+3$ oxidation state.

A. Statement I is true, Statement II is true, Statement II is a correct explanation of Statement I.

B. Statement I is true, Statement II is true, Statement II is not the correct explanation of statement I

C. Statement I is true, Statement II is false.

D. Statement I is false, Statement II is true.

Answer: A

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12. Statement - I :- Sm^{3+}, Dy^{3+} have same colour (yellow)

Statement - II :- Both ions are having same nupaired electrons

A. Statement I is true, Statement II is true, Statement II is a correct explanation of Statement I.

B. Statement I is true, Statement II is true, Statement II is not the correct explanation of statement I

C. Statement I is true, Statement II is false.

D. Statement I is false, Statement II is true.

Answer: A

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13. Statement - I :- La^{3+}, Lu^{3+} ions are colourless

Statement - II :- They do not contain unpaired electrons

A. Statement I is true, Statement II is true, Statement II is a correct explanation of Statement I.

B. Statement I is true, Statement II is true, Statement II is not the correct explanation of statement I

C. Statement I is true, Statement II is false.

D. Statement I is false, Statement II is true.

Answer: A

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Level Ii C W

1. The stable +2 ions of lanthanides in aqeous solution are

A. Eu^{2+}

B. Ce^{2+}

C. Lu^{3+}

D. Fe^{2+}

Answer: A

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Others

1. SRP values of lanthanides lies between

A. -2.2 to $-2.4V$

B. 4 to 2 V

C. 1 to 5 V

D. 0.1 to $-0.2V$

Answer: A

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2. Ion with maximum number of unpaired electrons

A. Lu^{3+}

B. Yb^{3+}

C. Tm^{3+}

D. Gd^{3+}

Answer: D

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3. What factor make the separation of Lanthanides a formidable task

A. Similarity in ionic size

B. Constant charge of + 3

C. Small charge radius ratio

D. All of these

Answer: D

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4. In the coinage metals (IB) group, the I.E decreases from Cu to Ag and the increases from Ag to Au this is attributed to

A. Increased atomic size

B. Increased ionic radius

C. Increased nuclear density

D. Lanthanuide contraction

Answer: D

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5. Ionic radii of zirconium and hafnium become almost identical because

A. They are 'd' block elements

B. They belongs to the same

C. Of increased nuclear charge

D. Of Lanthanide contraction

Answer: D

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6. Lanthanoids used in glass blower's goggles are

A. Pr and Nd

B. Eu and Gd

C. Tb and Dy

D. Em and Sm

Answer: A

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7. Which lanthanoide compounds is used as a most powerful liquid lasers after dissolving it in selenium oxychloride

A. Cerium oxide

B. Neodymium oxide

C. Promethium sulphate

D. Ceric sulphate

Answer: B

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8. Which one of the following pairs of elements is called chemmical twins because of their very similar chemical properties

A. Mn and W

B. Mo and Tc

C. Fe and Re

D. Hf and Zr

Answer: D

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9. Pair of ions which are having same number of unpaired electrons

A. Eu^{3+}, Tb^{3+}

B. Eu^{3+}, Ce^{3+}

C. Eu^{3+}, Sm^{3+}

D. Eu^{3+}, Pr^{3+}

Answer: A

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10. Pair of ions which are having only one unpair electron

A. Ce^{3+}, Yb^{3+}

B. Eu^{3+}, Tb^{3+}

C. Pm^{3+}, Sm^{3+}

D. Dy^{3+}, Tb^{3+}

Answer: A

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11. Cerium $(Z = 58)$ is an important nember of the lanthanoids . Which of the following statements about cerium is incorrect ?

A. The + 3 oxidation state of cerium is more stable than the + 4 oxidation state.

B. The common oxidation states of cerium are + 3 and + 4

C. Cerium (IV) acts as an oxidizing agent

D. The + 4 oxidation state of cerium is not known in solutios.

Answer: D

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12. In which of the following Lanthanoids oxidation state + 2 is most stable ?

A. Ce

B. Eu

C. Tb

D. Dy

Answer: B

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13. Lanthanoid contraction occurs because

A. the 4f electrons, which are gradually added, create a strong shielding effect

B. the 4f orbitals are greater in size than the 3d and 3f orbitals

C. the 5f orbitals strongly penetrate into the 4f orbitals

D. the poor shielding effect of 4f electrons is coupled with increased attraction

between the nucleus and the added electrons.

Answer: D

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14. The lanthanide contraction is responsible for the fact that

A. Zr and Y have about the same radius

B. Zr and Nb have similar oxidation state

C. Zr and Hf have about the same radius

D. Zr and Zn have the same oxidation state

Answer: C

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15. The correct order of ionic radii Y^{3+} , La^{3+} , Eu^{3+} and Lu^{3+} is

$(AT.\ No: Y = 39, La = 57, Eu = 63, Lu = 71)$

A. $Y^{3+} < La^{3+} < Eu^{3+} < Lu^{3+}$

B. $Y^{3+} < Lu^{3+} < Eu^{3+} < La^{3+}$

C. $Lu^{3+} < Eu^{3+} < La^{3+} < Y^{3+}$

D. $La^{3+} < Eu^{3+} < Lu^{3+} < Y^{3+}$

Answer: C

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16. Arrange Ce^{3+}, La^{3+}, Pm^{3} and Yb^{3+} in increasing order of their size -

A. $Yb^{3+} < \mathrm{Pm}^{3+} < Ce^{3+} < La^{3+}$

B. $Ce^{3+} < Yb^{3+} < \mathrm{Pm}^{3+} < La^{3+}$

C. $Yb^{3+} < \mathrm{Pm}^{3+} < La^{3+} < Ce^{3+}$

D. $\mathrm{Pm}^{3+} < La^{3+} < Ce^{3+} < Yb^{3+}$

Answer: A

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17. Which of the two have almost similar soze

A. $._{22} Ti$ and $._{40} Zr$

B. $._{41} Nb$ and $._{73} Ta$

C. $._{39}Y$ and $._{57}La$

D. $._{20}Ca$ and $._{31}Ir$

Answer: B

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18. Identify the incorrect statement among the following :

A. d-block element show irregular and erratic chemical properties among

themselves

B. La and Lu have partially filled d-orbitals and no therpartially filled orbitals

C. The chemistry of various lanthanoids is very similar

D. 4f - and 5f - orbitals are equally shielded

Answer: D

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19. In context of the lanthanoids, which of the following statements is not correct?

A. There is a gradual decrease in the radii of the members with increasing atomic number in the series

B. All the member exhibit + 3 oxidation state

C. because of milar properties the separation of lanthanoids is not easy

D. Availability of 4f electrons results in the formation of compounds in + 4 state for all the members of the series.

Answer: D

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20. The outer electronic configuration of Gd (At.No. 64) is

A. $4f^3 5d^3 6s^2$

B. $4f^8 5d^0 6s^2$

C. $4f^4 5d^4 6s^2$

D. $4f^7 5d^1 6s^2$

Answer: D

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21. The actinoids exhibit more number of oxidation states in general than the lanthanoids. This is because

A. the 5f orbitals are more buried than the 4f orbitals

B. there is a similarity between 4f and 5f orbitals in their angular part of the wave function

C. actions are more reactive than lanthanoids

D. the 5 f orbitals extend farther from the nucleus than the 4 f orbitals

Answer: D

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22. Larger number of oxidation states are exhibited by the actinoids then those by the lanthanoids, the main reason being

A. the 4f orbitals are more diffused than the 5f orbitals

B. lesser energy difference between 5f and 6d than between 4f and 5d orbitals

C. more energy diference between 5f and 6d than between 4f and 5d orbitals

D. more reactive nature of actinids than that of lanthanoids

Answer: B

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23. Knowing that the chemistry of lanthanoids (Ln) is dominated by its $+3$ oxidation state, which of the following statement is incorrect?

A. because of the large size of Ln (III) ions, the bonding in their compounds is predominatly ionic in character.

B. the ionic size of Ln (III) decreases in general with increasing atomic number

C. Ln (III) compounds are generally colourless

D. Ln (III) hydroxides are mainly basic in character.

Answer: C

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24. In context of the lanthanoids, which of the following statements is not correct?

A. There is a gradual decrease in the radii of the members with increasing atomic number in the series.

B. All the member exhibit + 3 oxidation state

C. because of milar properties the separation of lanthanoids is not easy.

D. Availability of 4f electrons results in the formation of compounds in + 4 state for all the members of the series.

Answer: D

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25. The outer electrons configuration of Lu (Atomic No.,71)` is :

A. $4f^3 5d^5 6s^2$

B. $4f^8 5d^0 6s^2$

C. $4f^4 5d^4 6s^2$

D. $4f^7 5d^1 6s^2$

Answer: D

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26. Match the property given in Column I with the element given in Column II.

	Column I (Property)		Column II (Element)
A.	Lanthanoid which shows +4 oxidation state	1.	Pm
B.	Lanthanoid which can show +2 oxidation state	2.	Ce
C.	Radioactive lanthanoid	3.	Lu
D.	Lanthanoid which has $4f^7$ electronic configuration in +3 oxidation state	4.	Eu
E.	Lanthanoid which has $4f^4$ electronic configuration in +3 oxidation state	5.	Gd
		6.	Dy

A → (2) B → (1) C → (4) D → (5) E → (3)

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