



CHEMISTRY

BOOKS - GRB CHEMISTRY (HINGLISH)

F-BLOCK ELEMENTS

Straight Objective Type

1. 5f-subshell is filled by electron (s) :

A. in actinides

B. after filling of 7s-subshell

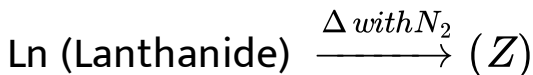
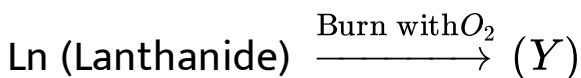
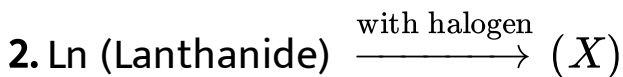
C. before filling of electron in 6d series

D. all are correct

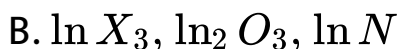
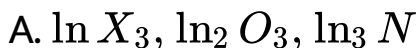
Answer: D



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X, Y and Z respectively:



C. $\ln X_2, \ln O, \ln N$

D. $\ln X_2, \ln_2 O_3, \ln_3 N$

Answer: B



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3. Last element of lanthanide series is:

A. Lawrencium

B. Lutetium

C. Thulium

D. Hafnium

Answer: B



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4. The lanthanide contraction is responsible for the fact that

A. Size of $Zr > HF$

B. Size of $Zr < HF$

C. Size of $Zr \approx HF$

D. Size of $Zr > Zr^{4+}$

Answer: C



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5. Select ion which is larger than Ce^{3+} :



Answer: D



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6. Select reducing agent out of given options :



Answer: B

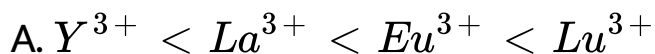


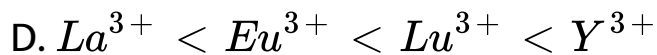
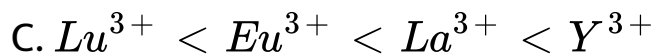
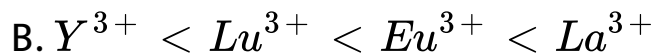
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7. The correct order of ionic radii Y^{3+} , La^{3+} , Eu^{3+}

and Lu^{3+} is

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





Answer: B



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8. Which of the following statements is not correct ?



B. In lanthanide series, ionic radius of Ln^{3+} ions
decreases

C. La is actually an element of transition series rather than lanthanide series

D. Atomic radii of Zr and Hf are same because of lanthanide contraction

Answer: A

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9. Across the lanthanide series, the basicity of the lanthanoid hydroxides:

A. increases

B. decreases

C. first increases and then decreases

D. first decreases and then increases

Answer: B



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10. The reason for the stability of Gd^{3+} ion is

A. 4f subshell - half filled

B. 4f subshell-complete filled possesses the
general electronic configuration of noble gases

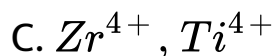
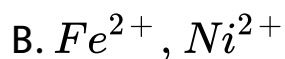
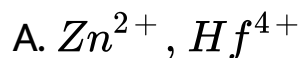
C. possesses the general electronic configuration
of noble gases

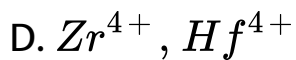
D. 4f subshell empty

Answer: A

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11. Which of the following pairs has the same size ?



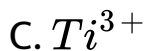


Answer: D



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12. Which of the following ions will exhibit colour in aqueous solution ?



Answer: C



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13. Which of the following exhibits only +3 oxidation state?

A. Ac

B. Pa

C. U

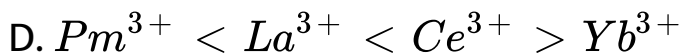
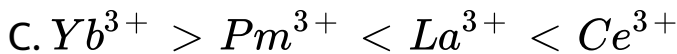
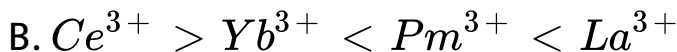
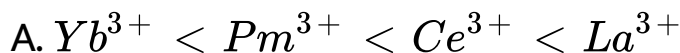
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Answer: A



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



Answer: A



15. The most common oxidation states of cerium are

A. +2, +4

B. +3, +4

C. +3, +5

D. +2, +3

Answer: B



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16. A reduction in atomic size the increases in atomic number is a charactersitic of elements of:

A. f-block

B. radioactive series

C. high atomic masses

D. d-block

Answer: A



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17. The radius of La^{3+} ($Z = 57$) is 106 pm. Which one of the following given values will be closest to the radius of Lu^{3+} ($Z = 71$)?

A. 1.6\AA

B. 1.4\AA

C. 1.06\AA

D. 0.85\AA

Answer: D



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

A. Cerium (IV) acts as an oxidising agent

B. The +3 oxidation state of Cerium is more known than the +4 oxidation state

C. The +4 oxidation state of Cerium is not known in solutions

D. The common oxidation states of Cerium are +3 and +4

Answer: C



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19. 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 similar oxidation state

Answer: C

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20. Lanthanoid contraction is caused due to:

- A. the same effective nuclear charge from Ce to Lu

- B. the imperfect shielding on outer electrons by 4f electrons from the nuclear charge
- C. the appreciable shielding on outer electrons by 4f electrons from the nuclear charge
- D. the appreciable shielding on outer electrons by 5d electrons from the nuclear charge

Answer: B



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21. Identify the incorrect statement among the following :

- A. d-block elements show irregular and erratic chemical properties among themselves
- B. La and Lu have partially filled d-orbitals and no other partially 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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22. 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 in their angular part of the wave function

C. the actinoids are more reactive than the lanthanoids

D. the 5f-orbitals extend further from the nucleus than the 4f-orbitals

Answer: D



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

A. 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 difference between 5f and 6d than between 4f and 5d orbitals.

D. more reactive nature of the actinides than the lanthanides.

Answer: B

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

A. Ln(III) compounds are generally colourless

- B. Ln(III) hydroxides are mainly basic in character
- C. Because of the large size of the Ln(III) ions the bonding in its compounds is predominantly ionic in character
- D. The ionic sizes of Ln(III) decrease in general with increasing atomic number

Answer: A



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

- A. Because of similar properties the separation of lanthanoids is not easy
- B. Availability of 4f electrons results in the formation of compounds in +4 state for all the members of the series
- C. There is a gradual decrease in the radii of the members with increasing atomic number in the series
- D. All the members exhibit +3 oxidation state

Answer: B



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26. Which of the following forms stable +4 oxidation state ?

A. La ($Z = 57$)

B. Eu ($Z = 63$)

C. Gd ($Z = 64$)

D. Ce ($Z = 58$)

Answer: D



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27. The number of unpaired electrons in gadolinium (Z=64) is :

A. 2

B. 6

C. 8

D. 3

Answer: C



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28. The incorrect statement for lanthanides among the following statements is :

A. 4f and 5d orbitals are so close in energy that it is very difficult to locate the exact position of electrons in lanthanides

B. Most common stable oxidation state is +3

C. Tripositive lanthanide ions have characteristic colour depending on nature of group with which they combine to form compounds

D. Some lanthanides ions absorb colour either in infrared or ultraviolet region of

electromagnetic spectrum

Answer: D



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29. Wood or cattle dung ash is used for cleaning cooking utensils in many parts of India. The statement that is not true for this ash is :

A. it largely consists of metal oxides and silicates because non-metals are removed as gaseous compounds during burning of the wood/dung cakes

- B. when added to water, it forms alkaline solution with $pH \sim 8$ and above, which helps to remove oily substances from the utensils
- C. several chemical components of ash remain undissolved as solids in water and these solids help in cleaning by providing scrubbing action
- D. if left moist for a few hours in air, it slowly turns acidic because of oxidative decomposition

Answer: D



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30. In the general electronic configuration :

$(n - 2)f^{1-14}(n - 1)d^{0-1}ns^2$, if the value of $n = 7$,

then the configuration will be of :

- A. lanthanides
- B. actinides
- C. transition elements
- D. none of these

Answer: B



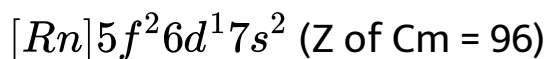
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31. Consider the following statements (s) which of the following is false ?

A. Eu^{+2} is a strong reducing agent (Z of Eu = 63)

B. Ce^{4+} is a strong oxidising agent (Z of Ce = 58)

C. Curium has electronic configuration:



D. Yb^{+2} is an oxidising agent (Z of Yb = 70)

Answer: D



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32. Most common oxidation states of La and Ln respectively are :

A. +2, +2

B. +3, +3

C. +2, +3

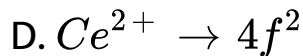
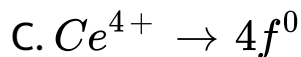
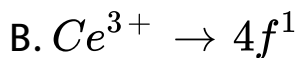
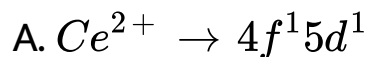
D. +2, +4

Answer: C



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33. If outermost E.C. of Ce is $4f^1 5d^1 6s^2$, then select the incorrectly matched outermost E.C. of its various ions in ground state:

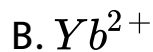


Answer: A



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34. Identify the only paramagnetic species:



Answer: D



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35. Best single use of lanthanide is :

- A. industrial manufacture of high voltage batteries
- B. productions of alloy steels for plates and pipes
- C. productions of bullets, shell and lighter flint
- D. Ln oxides are used as phosphor in television screens and similar fluorescing surfaces.

Answer: B



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36. Mischmetal' alloy does not contain :

A. lanthanoids metal (~95 %)

B. iron (~5 %)

C. S, c, Ca and Al traces

D. Mg traces

Answer: D



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37. Select the correct statements (s) for the comparison of lanthanoids with actinoids.

- A. Actinoids contraction is greater from element to element due to poor shielding by 5 f electrons
- B. Magnetic properties of actinoids are more complex, with corresponding lanthanides having higher values
- C. Lanthanoids have higher I.E.
- D. All of the above

Answer: D



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38. Crystal field stabilization is important for :

A. d-block elements

B. f-block elements

C. p-block elements

D. both (a) and (b)

Answer: A



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39. Whether f-orbitals are filled or empty has little effect on :

A. chemical properties (common)

B. colour of ions

C. magnetic properties of lanthanide ions

D. all of the above

Answer: A



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40. The colour of the transition metal ions is/are due to:

A. f-f transitions

B. crystal field splitting

C. full f-orbitals

D. partially filled d-subshell

Answer: A



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41. Strong yellow colour of Ce^{4+} solutions and blood red colour of Sm^{2+} solution arises due to :

A. charge transfer from M to L

B. charge transfer from L to M

C. f-f spectra

D. absorption in UV region

Answer: B



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42. UO_2^{2+} is expected to have which shape?

A. Angular, unstable

B. Linear, stable

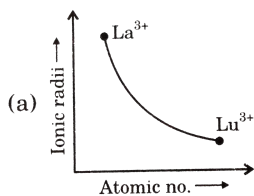
C. Angular, stable

D. Linear, unstable

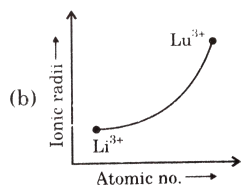
Answer: B

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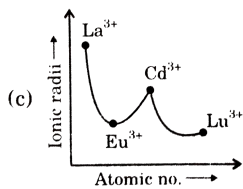
43. Select the correct graphical representation :



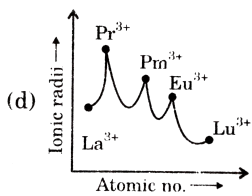
A.



B.



C.



D.

Answer: A

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Reasoning Type

1. Statement-1 : Occasionally +2 and +4 oxidation states of lanthanides are obtained.

Statement-2: Empty, half-filled or filled f-subshell are extra stable.

A. Statement-1 is True, Statement-2 is True,
Statement-2 is a correct explanation for
Statement-1.

B. Statement-1 is True, Statement-2 is True,
Statement-2 is not a correct explanation for
Statement-1.

C. Statement-1 is True, Statement-2 is false

D. Statement-1 is False and Statement-2 is True.

Answer: A



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2. Statement-1 : Ce^{4+} is more stable than Ce^{3+} .

Statement-2 : Ce^{4+} has noble gas configuration.

A. Statement-1 is True, Statement-2 is True,

Statement-2 is a correct explanation for

Statement-1.

B. Statement-1 is True, Statement-2 is True,

Statement-2 is not a correct explanation for

Statement-1.

C. Statement-1 is True, Statement-2 is false

D. Statement-1 is False and Statement-2 is True.

Answer: D

3. Statement-1 : Ce^{4+} can oxidise water.

statement-2 : Ce^{4+} is a good analytical reagent.

A. Statement-1 is True, Statement-2 is True,

Statement-2 is a correct explanation for

Statement-1.

B. Statement-1 is True, Statement-2 is True,

Statement-2 is not a correct explanation for

Statement-1.

C. Statement-1 is True, Statement-2 is false

D. Statement-1 is False and Statement-2 is True.

Answer: B

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4. Statement-1 : The third ionisation enthalpy of La, Gd and Lu are abnormally low.

Statement-2 : Empty, half-filled and completely filled orbitals of f-level are extra stable.

A. Statement-1 is True, Statement-2 is True,
Statement-2 is a correct explanation for
Statement-1.

B. Statement-1 is True, Statement-2 is True,
Statement-2 is not a correct explanation for
Statement-1.

C. Statement-1 is True, Statement-2 is false

D. Statement-1 is False and Statement-2 is True.

Answer: A



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5. Statement -1 : Actinoids are very difficult to study.

Statement-2 : Actinoids are radioactive elements

having very short half lives especially of later members of actinides.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is not a correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is false

D. Statement-1 is False and Statement-2 is True.

Answer: A

6. Statement-1 : 5f orbitals resemble the 4f orbitals in their angular part of the wave-function.

Statement-2 : 5f orbitals are not as buried as 4f orbitals and hence 5f electrons can participate in bonding to a far greater extent.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is not a correct explanation for

Statement-1.

C. Statement-1 is True, Statement-2 is false

D. Statement-1 is False and Statement-2 is True.

Answer: B



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7. Statement-1 : Lanthanoid contraction is more important than actinoid contraction is more important than actinoid contraction.

Statement-2 : Chemistry of elements surrounding the actinoids are much less known at the present time.

A. Statement-1 is True, Statement-2 is True,
Statement-2 is a correct explanation for
Statement-1.

B. Statement-1 is True, Statement-2 is True,
Statement-2 is not a correct explanation for
Statement-1.

C. Statement-1 is True, Statement-2 is false

D. Statement-1 is False and Statement-2 is True.

Answer: A



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8. Statement-1 : Colour of lanthanide ions are pale in nature.

Statement-2 : In the f-f transition change in subsidiary quantum number is zero.

A. Statement-1 is True, Statement-2 is True,

Statement-2 is a correct explanation for

Statement-1.

B. Statement-1 is True, Statement-2 is True,

Statement-2 is not a correct explanation for

Statement-1.

C. Statement-1 is True, Statement-2 is false

D. Statement-1 is False and Statement-2 is True.

Answer: A



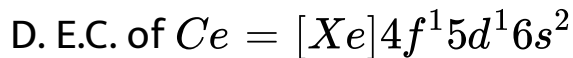
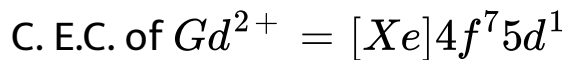
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Multiple Objective Type

1. Choose the correct statement (s) about electronic configuration of lanthanides:

A. all the tripositive ions of the series are of the form $4f^n$ (n=1 to 14 with increasing atomic number)

B. E.C. of Gd = $[Xe]4f^75d^16s^2$



Answer: A::B::C::D



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2. Which lanthanide among the following can exhibit +4 oxidation state but only in oxides (MO_2) ?

A. Pr

B. Nd

C. Tb

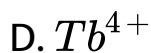
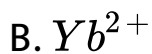
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Answer: A::B::C::D



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3. Select the species which is an oxidant?



Answer: C::D



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4. Choose the correct statement(s) regarding characteristics of lanthanides :

- A. They are silvery white soft metals and tarnish rapidly in air
- B. Hardness increases with increasing atomic number, samarium being steel hard
- C. They have typical metallic structure and are good conductors of heat and electricity

D. Their M.P. range between 1000 to 1200 K but samarium melts at 1623 K

Answer: A::B::C::D



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5. Choose the correct statement(s) about colour of lanthanoids:

A. Colour of the ions may be attributed to the presence of f-electrons.

B. Lu^{3+} , Yb^{2+} , La^{3+} , Ce^{3+} are colourless.

C. Absorption bands are narrow, probably because of excitation within f-level.

D. Elements with (n) f electrons have a similar colour to those with (14-n)f electrons.

Answer: A::B::C::D



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6. Select the correct statement(s) about chemical behavior of lanthanoids:

A. II^{nd} I.E. are comparable with those of calcium.

B. Earlier members of the series are quite reactive, similar of calcium.

C. With increasing atomic number, they behave more like aluminium.

D. The metals combine with hydrogen when gently heated in the gas.

Answer: A::B::C::D



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7. Select the correct statement(s) regarding chemical reactions of Ln:

A. The carbides In_3C , In_2C_3 and InC_2 are formed when the metals are heated with carbon.

B. They liberate hydrogen from dilute acids and burn in halogens to form halides.

C. They form oxides M_2O_3 and hydroxides $\text{M}(\text{OH})_3$.

D. The hydroxides are just hydrated oxides and not definite compounds.

Answer: A::B::C



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8. Select the correct chemical characteristics of actinoids.

A. They do not react with alkalies

B. They are only slightly affected by nitric acid
owing to the formation of protective oxide layer

C. The action of boiling water on them gives a
mixture of oxide and hydride

D. They are highly reactive metals.

Answer: A::B::C::D



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9. Choose the correct statement for actinides.

A. Pa, U, Np, Pu and Cm have very sharp lines in the absorption spectra.

B. Spectral lines are ten times as intense as those from the lanthanides.

C. Am^{2+} exists only in the solid as the fluoride.

D. Cf^{2+} , Es^{2+} , Fm^{2+} , Md^{2+} and No^{2+} exist as ions in solution.

Answer: A::B::C::D

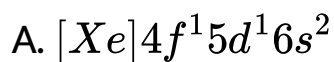


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Comprehension

1. Ce is the first element of lanthanide series.

What is the most suitable E.C. of Ce^{3+} ?



Answer: C



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2. Ce is the first element of lanthanide series.

What will be the 'spin only' magnetic moment of

Ce^{3+} ? [Assume $\mu = \sqrt{n(n+1)}$ B.M.]

A. 0 B.M.

B. $\sqrt{3}$ B.M.

C. $2\sqrt{2}$ B.M.

D. $\sqrt{15}$ B.M.

Answer: B



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Match The Column Type

1. Match the outermost E.C. of the species :

List I (Species)		List II (Outermost E.C.)	
(a)	Ce	(p)	$4f^1 5d^1 6s^2$
(b)	Pr^{3+}	(q)	$4f^3$
(c)	Nd^{2+}	(r)	$4f^4$
(d)	Pm^{3+}	(s)	$4f^2$



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2. Match the outermost E.C. of various actinoids :

List I (Species)		List II (Outermost E.C.)	
(a)	Th	(p)	$5f^{14} 6d^1 7s^2$
(b)	Pu	(q)	$5f^7 6d^1 7s^2$
(c)	Cm	(r)	$6d^2 7s^2$
(d)	Lr	(s)	$5f^6 7s^2$



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3. Match the following lists :

List I (Highest-possible oxidation state)		List II (Actinoid)	
(a)	+4	(p)	Th
(b)	+5	(q)	Pa
(c)	+6	(r)	U
(d)	+7	(s)	Np



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4. Match the following lists:

List I (Compound/element)		List II (Uses)	
(a)	TiO	(p)	Dry battery cells
(b)	MnO ₂	(q)	Ziegler catalyst
(c)	TiCl ₄	(r)	Wacker's process catalyst
(d)	PdCl ₂	(s)	Pigment industry



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Subjective Type

1. The first f-block organometallic compound $[ThH(OR)(C_5Me_5)_2]$ was prepared in late 1970s.

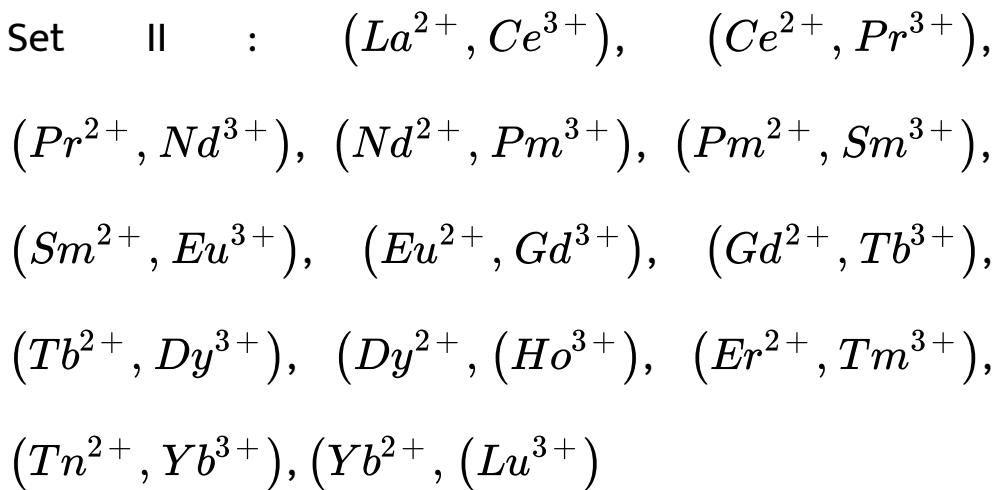
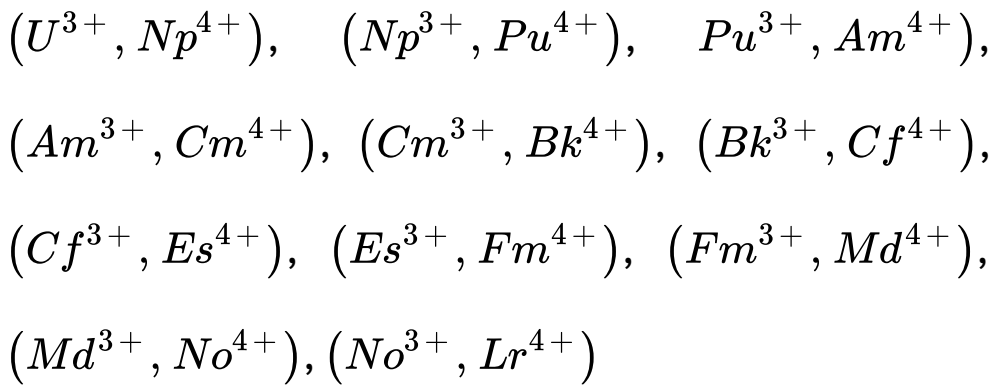
Find the oxidation state of central metal atom/cation.



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2. Find the number pair of ions which have same outermost E.C.

Set I : $(Ac^{3+}, Th^{4+}), (Th^{3+}, Pa^{4+}), Pa^{3+}, U^{4+})$,



If the value of set I is 'x' and set II is 'y', then find

$$|x - y|.$$



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3. Most common oxidation state of actinoids is



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4. Find the number of inner transition elements among those having following atomic numbers :

29, 59, 74, 95, 102, 104, 89, 57, 72.



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5. Among the species:

Ce^{4+} , Eu^{2+} , Tb^{4+} , Yb^{2+} , Sm^{2+} , Tm^{2+} , Pr^{4+} , Nd^{4+}

, find the number of ions which have sufficient stability to be studied in aqueous chemistry.

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6. The number of unpaired electrons in Gd^{3+} is

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7. The number of O-U-O linkages in Uranyl nitrate dihydrate $UO_2(NO_3)_2 \cdot 2H_2O$ is

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