CHEMISTRY

FOR IIT JEE ASPIRANTS OF CLASS 12 FOR CHEMISTRY

D - BLOCK ELEMENTS

Example

1. On what ground can you say that scandium $(Z = 21)$ is a transition element but zinc $(Z = 30)$ is not?

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2. Explain the following observations :

(i) Copper atom has completely field d orbitals $\left(3d^{10}\right)$ in its ground state, et it is regarded as a transition element.

(ii) Cr^{2+} is a stronger reducing agent than Fe^{2+} in awueous solutions.

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3. On what ground can you say that scandium $(Z = 21)$ is a transition element but zinc $(Z = 30)$ is not?

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4. Why do the transition elements exhibit higher enthalpies of atomisation?

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5. Why Cr and Cu have abnormally higher 2nd ionisation energy?

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6. Why is enthalpy of atomisation is the lowest for Zn in 3d series of transition elements ?

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7. Why Cu, Ni and Zn generally do not show oxidation state greater than 2?

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8. Calculate the magnetic moment of a divalent ion in aqueous solution if its atomic number is 25.

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9. Explain the blue colour of $CuSO_4.5H_2O$

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10. (a) why is the E^{Θ} value for the Mn^{3+}/Mn^{2+} couple much more positive than that for Cr^{3+}/Cr^{2+} or Fe^{3+}/Fe^{2+}? Explain.

(b) What is meant by 'disproportion' of an oxidation state? Give example.

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11. Why is Cr^{2+} reducing and Mn^{3+} oxidising when both have d^4 configuration ?

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12. The $E^0\left(M^{2+}/M\right)$ value for copper is positive $(+0.34V)$. What is possibly the reason for this?

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13. Which is a stronger reducing agent Cr^{2+} or Fe^{2+} and why?

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14. For the first row transition metals the $E^{\ominus}$ value are:

V	Cr	Mn	Fe	Co	Ni	Cu
-1.18	-0.91	-1.18	-0.44	-0.28	-0.25	$+0.34$

Explain the irregularity in the above values.

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15. Zn form only Zn^{2+} and not Zn^{3+}, why?

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16. Name the transition element which does not exhibit variable oxidation states .

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17. How iron (III) catalyses the reaction between iodide & persulphate ?

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18. Name any two transition metals which exhibit oxidation state of +8 .

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19. The oxidation state of Fe in $Fe(CO)_5$ is

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20. In 3d series , Mn shows highest oxidation state . Why ?

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Evaluate Yourself 1

1. Select the incorrect statement about transition elements.

A. The last electron enters in the d-orbital

B. Their properties are in between s and p-block elements

C. Scandium is the transition element with smallest atomic radii

D. Their common oxidation states are $+2, +3$

Answer: C

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2. Transitional elements exhibit variable valencies because they release electrons from the following orbits

A. ns

B. ns and np

C. (n-1)d and ns

D. (n-1)d

Answer: C

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3. The electronic configuration of chromium (Z=24) is:

A. $[Ne]3s^2 3p^6 3d^4 4s^2$

B. $[Ne]3s^2 3p^6 3d^5 4s^1$

C. $[Ne]3s^2 3p^s 3d^5 4s^2$

D. $[Ne]3s^2 3p^5 3d^6 4s^1$

Answer: B

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Cuq Introduction

1. Element with atomic number 111 might, belong to the following group

A. Chromium

B. Scandium

C. Copper

D. Titanium

Answer: C

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2. The following belongs to d-block but it sis not a transition element

A. Mn

B. Fe

C. Zn

D. Cr

Answer: C

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3. Which of the following set of elements does not belong to transitional element set

A. Fe, Co, Ni

B. Cu, Ag, Au

C. Ti, Zr, Hf

D. Ga, In, Tl

Answer: D

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4. In the transition element the incoming electron occupies $[n-1]$ d sublevel in preference to

A. np

B. ns

C. [n-1]d

D. [n+ 1]s

Answer: A

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5. Transition metals are good electrical conductors because

A. They are metals

B. They are solids

C. They have free electrons in outer energy levels

D. They are hard

Answer: C

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6. The ground state electronic configuration of chromium is against

A. Hund's rule

B. Pauli's principle

C. Auf-bau principle

D. Boyle principle

Answer: C

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7. Which one of the following pairs of ions have the same electronic configuration?

A. Cr^{+3}, Fe^{+3}

B. Fe^{+3}, Mn^{+2}

C. Fe^{+3}, Co^{+3}

D. Sc^{+3}, Cr^{+3}

Answer: B

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8. Which element exhibits highest density in 3d series

A. Sc

B. Cr

C. Zn

D. Cu

Answer: D

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9. The maximum and minimum melting points of first and second transition series respectively are observed with

A. Cr and Zn

B. Cr and Hg

C. Cr and Cd

D. Mo and Cd

Answer: A

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10. The IP of Zr is $674kJ/\text{mole}$. The IP of Hf is

A. 656 kJ

B. 760 kJ

C. 616 kJ

D. 631 kJ

Answer: B

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11. The following does not show variable valency

A. Mn

B. Fe

C. Zn

D. Cr

Answer: C

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12. Maximum oxdiation state exhibited by Osmium is

A. $+8$

B. $+7$

C. $+6$

D. $+5$

Answer: A

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13. Which of the following ion is coloured in its aqueous solution?

A. Cd^{+2}

B. Zn^{+2}

C. Sc^{+3}

D. Ti^{+3}

Answer: D

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14. In which pair, both ions are coloured in aqueous medium

A. Sc^{+3}, Zn^{+2}

B. Cu^{+2}, Ti^{+4}

C. Ti^{+3}, Co^{+3}

D. Cd^{+2}, Mn^{+2}

Answer: C

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15. Name the catalyst and promoter in the Haber's process for the manufacture of ammonia.

A. Mo, V_2O_5

B. V_2O_5, Fe

C. Fe, Mo

D. Mo, Fe

Answer: C

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16. The following metal shows ferromagnetic nature

A. Co

B. Cr^{+3}

C. Ni^{+2}

D. Cu^{+1}

Answer: A

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17. For a paramagnetic substance, the field strength of substance (B) and applied field strength (H) are related as

A. B = H

B. $B < H$

C. $B > H$

D. $B > > > H$

Answer: C

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18. Assertion (A): The "spin only" magnetic moment [in units of Bohr magneton, (μ_B)] of Ni^{2+} in aqueous solution would be (atomic number Ni= 28) 2.84 BM

Reason (R): The metal ion has 2 unpaired electrons

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true and R is not the correct explanation of A

C. A is true but Ris false

D. A is false but R is true

Answer: A

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19. Assertion (A): Magnetic moment of Ni^{+2} ions can be very close to that of Ti^{+2} ions

Reason (R): Both metal ions have equal no. of unpaired electrons

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true and R is not the correct explanation of A

C. A is true but Ris false

D. A is false but R is true

Answer: A

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20. Hydrogen occupies the following holes, C and N occupy the following holes

A. Tetrahedral and octahedral

B. Octahedral and tetrahedral

C. Octahedral and octahedral

D. Tetrahedral and tetrahedral

Answer: A

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21. The alloy used in the reduction of nitrites to ammonia is

A. Gun metal

B. Devarda's alloy

C. Solder metal

D. Bronze

Answer: B

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22. Assertion (A): Zinc-copper couple that can be used as a reducing agent

Reason (R): Zinc copper couple can be obtained from zinc coated from copper

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true and R is not the correct explanation of A

C. A is true but Ris false

D. A is false but R is true

Answer: B

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23. The number of moles of $KMnO_4$ that will be needed to react with one mole of sulphite ion in

acidic solution is

A. $2/5$

B. $3/5$

C. $4/5$

D. 1

Answer: A

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24. Chromyl chloride when dissolves in NaOH solution gives yellow solution. The yellow solution contains

A. $Cr_2O_7^{2-}$

B. Cr_4^{2-}

C. CrO_5

D. $2/3$

Answer: B

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25. Cinnabar is an ore of

A. Hg

B. Cu

C. Pb

D. Zn

Answer: A

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26. Which of the following metals react with chlorine to form their respective chlorides?

A. Cu

B. Ag

C. Au

D. All

Answer: D

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27. Which of the following iron salts exists as a dimer?

A. Ferric chloride

B. Ferrous chloride

C. Ferrous sulphite

D. Mohr's salt

Answer: A

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Exercise 1 Introduction

1. The number of transition series is:

A. 2

B. 3

C. 4

D. 5

Answer: C

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2. The most abundant transition metal in earth crust is :

A. Zn

B. Fe

C. Hg

D. Au

Answer: B

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3. Which of the following metals have both valence shell and penultimate shell partially filled ?

A. Cr

B. Mo

C. V

D. Zn

Answer: A

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4. Of the following outer electronic configurations of atoms, the highest oxidation state is achieved by which one of them ?

A. $(n-1)d^8ns^2$

B. $(n-1)d^5ns^1$

C. $(n-1)d^3ns^2$

D. $(n-1)d^5ns^2$

Answer: D

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5. The atomic number of V, Cr, Mn and Fe are respectively $23, 24, 25$ and 26. Which one of these may be expected to have the highest second ionization enthalpy?

A. Cr

B. Mn

C. Fe

D. V

Answer: A

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6. Which of the following transition metal ions is colourless ?

A. V^{2+}

B. Cr^{+3}

C. Zn^{2+}

D. Ti^{+3}

Answer: C

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7. Which of the following shows an oxidation state of +8?

A. Rh

B. Os

C. Pd

D. Pt

Answer: B

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8. Zn and Hg do not show variable valency like $d-$ block elements because-

A. They are soft

B. Their d-shells are complete

C. They have only two electrons in the outermost shell

D. Their-shell are incomplete

Answer: B

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9. Highest oxidation state of Manganese and Osmium is shown with

A. S

B. H

C. O

D. F

Answer: C

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10. Which of the following compound is not coloured ?

A. $Na_2[CuCl_4]$

B. $Na_2[CdCl_4]$

C. $K_4\left[Fe(CN)_6\right]$

D. None of these

Answer: C

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11. A solution containing Fe^{3+} is titrated against a standard solution of Ti^{3+} using ammonium thiocyanate as indicator. The colour of the solution at end point will be

A. Red

B. Colourless

C. Blue

D. Fe^{3+} is not oxidized by Ti^{3+}

Answer: B

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12. Which of the following compounds are coloured due to charge transfer spectra?

A. $K_2Cr_2O_7$

B. H_2SO_4

C. AgBr

D. $FeSO_4$

Answer: A

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13. Which of the following pairs are not both coloured in aqueous solution?

A. Sc^{3+}, CO^{3+}

B. Ni^{2+}, Cu^{2+}

C. Ni^{2+}, Ti^{3+}

D. Sc^{3+}, Ti^{4+}

Answer: D

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14. $N_2(g) + 3H_2(g) \overset{Fe+Mo}{\Longleftrightarrow} 2NH_3(g)$, Haber's process, Mo is used as:

A. a catalyst

B. a catalytic promoter

C. an oxidixing agent

D. as a catalytic poison

Answer: B

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15. Which one of the following shows highest magnetic moments?

A. V^{3+}

B. Cr^{3+}

C. Fe^{3+}

D. CO^{3+}

Answer: C

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16. Which of the following ion has the maximum magnetic moment?

A. Mn^{2+}

B. Fe^{2+}

C. Ti^{2+}

D. Cr^{2+}

Answer: A

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17. The value of the 'spin only magnetic moment for one of the following configuration is 2.84 BM. The correct one is

A. d^5 (in strong ligand field)

B. d^3 (in weak as well as in strong fields)

C. d^4 (in weak ligand field)

D. d^4 (in strong ligand field)

Answer: D

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18. The "spin-only" magnetic moment [in units of Bohr magneton, (μ_B)] or Ni^{2+} in aqueous solution would be :

(At no. $Ni = 28$).

A. 0

B. 1.73

C. 2.84

D. 4.9

Answer: C

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19. In a transition series, as the atomic number increases, paramagnetism

A. Increases gradually

B. Decreases gradually

C. First increases to a maximum and then decreases

D. First decreases to a minimum and then increases

Answer: C

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20. The magnetic moment of a transition metal ion is 3.87BM. The number of unpaired electrons present in it is

A. 2

B. 3

C. 4

D. 5

Answer: B

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21. Permanent magnets are generally made of alloys of

A. Co

B. Zn

C. Mn

D. Pb

Answer: A

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22. Which of the following group of transition metals is called coinage metals?

A. Cu, Ag, Au

B. Ru, Rh, Pd

C. Fe, Co, Ni

D. Os, Ir, Pt

Answer: A

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23. The product obtained on treating $KMnO_4$ with very strong alkali in absence of any reducing agent is

A. MnO_2

B. Mn_2O_7

C. K_2MnO_4

D. No reaction

Answer: C

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24. The oxidation of manganate ion to permanganate ion can be done by

A. Cl_2

B. H_2

C. SO_2

D. KNO_3

Answer: A

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25. When SO_2 is passed through acidified $K_2Cr_2O_7$ solution

A. The solution becomes blue

B. The solution becomes colourless

C. SO_2 is reduced

D. Green $Cr_2(SO_4)_3$ is formed

Answer: D

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26. Which of the following statement is correct when a mixture of $CaCl_2$ and $K_2Cr_2O_7$ is gently warmed with conc . H_2SO_4 acid ?

A. Deep red vapours are evolved

B. The vapours when passed into NaOH solution given a yellow solution of Na_2CrO_4

C. Chlorine gas is evolved

D. Chromyl chloride is formed

Answer: C

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27. German silver is an alloy of copper and:

A. Zn and Ni

B. Al

C. Zn

D. Sn

Answer: A

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28. Bell metal is an alloy of

A. Cu + Pb

B. Cu + Sn

C. Cu + Zn

D. Cu + Ni

Answer: B

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29. A complex involving dsp^2 hybridisation has

A. Square planar

B. Tetrahedral

C. Triangular planar

D. Pyramidal

Answer: A

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30. A mixture of TiO_2 and $BaSO_4$ is called

A. Titanox

B. Lithopone

C. White pigment

D. None of these

Answer: A

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31. The metal present in vitamin B_{12} is

A. Fe

B. Co

C. Ni

D. Na

Answer: B

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32. The compound containing metal-metal bond is

A. Cu_2Cl_2

B. Al_2Cl_6

C. Hg_2Cl_2

D. Ag_2O_3

Answer: C

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33. Correct statement about FeO at room temperature

A. It is non-stoichiometric and metal deficient

B. It is acidic oxide

C. Its aqueous solution changes to $Fe(OH)_2$ and then to Fe_2O_3.x H_2O by atmospheric oxygen

D. It gives red colour with KCNS

Answer: C

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Exercise 2

1. The atomic numbers of vandium (V). Chromium (Cr), manganese (Mn) and iron (Fe) respectively 23, 24,25 and 26. Which one of these may be expected to have the higher second ionization enthalpy ?

A. V

B. Cr

C. Mn

D. Fe

Answer: B

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2. Among the following, identify the species with an atom in $+6$ oxidation state.

A. MnO_4^-

B. $Cr(CN)_6^{3-}$

C. NiF_6^{2-}

D. CrO_2CI_2

Answer: D

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3. All the following species are strong oxidizing agents. Their strength as oxidizing agents in acidic

solution is such that

A. $S_2O_8^{2-} > Cr_2O_7^{2-} > MnO_4^-$

B. $MnO_4^- > Cr_2O_7^{2-} > S_2O_8^{2-}$

C. $S_2O_8^{2-} > MnO_4^- > Cr_2O_7^{2-}$

D. $Cr_2O_7^{2-} > S_2O_8^{2-} > MnO_4^-$

Answer: C

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4. Which of the following statements (s) is (are) correct with reference to ferrous and ferric ions

A. Fe^{3+} gives brown colour with potassium ferricyanide

B. Fe^{2+} gives blue precipitate with potassium ferricyanide

C. Fe^{3+} gives red colour with potassium thiocyanate

D. Fe^{2+} gives no colour with ammonium thiocyanate

Answer: D

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5. The brown ring complex compound is formulated as $\left[Fe(H_2O)_5NO\right]SO_4$. The oxidation state of Fe is

A. 1

B. 0

C. 2

D. 3

Answer: A

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6. The stability of higher oxidation states on moving down the group in transition elements

A. Decreases

B. Increases

C. Remain same

D. Increases from first series to second and decreases from second to third

Answer: B

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7. In aqueous solutions Eu^{2+} acts as

A. An oxidising agent

B. Areducing agent

C. Can act either of these

D. Disproportionates in solution

Answer: B

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8. Which of the following lanthanoids has highest tendency to form complexes ?

A. Ce^{+3}

B. Pm^{+2}

C. Lu^{+3}

D. Eu^{+2}

Answer: C

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9. Choose the correct statement regarding bonding in

$FeCl_3$

(I) It contains $2c - 2e^-$ bond

(II) It contains $3c - 2e^-$ bond

(III) It contain co-ordinate bond

A. (i),(ii)

B. (i),(iii)

C. (ii),(iii)

D. (i),(ii) & (iii)

Answer: B

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10. Stability of an oxidation state depend on

A. lonisation energy

B. Hydration energy

C. Sublimation energy

D. All of these

Answer: D

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11. 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. 1.40Å

B. 1.06Å

C. 0.85Å

D. 1.60Å

Answer: C

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12. Zr(Z=40) and Hf(Z=72) have similar atomic and ionic radii because of:

A. of diagonal relationship

B. of lanthanide contraction

C. of actinide contraction

D. Both belong to same transition series

Answer: B

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13. A blue colouration is not obtained when

A. Ammonium hyroxide dissolves in copper sulphate

B. Copper sulphate solution reacts with $K_4[Fe(CN)_6]$

C. Ferric chloride reacts with sod. ferrocyanide

D. Anhydrous $CuSO_4$ is dissolved in water

Answer: B

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14. Turnbull's blue is a .....

A. Ferricyanide

B. Ferrous ferrocyanide

C. Ferrous cyanide

D. Ferri-ferrocyanide

Answer: B

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15. The colourless species is

A. VCl_3

B. $VOSO_4$

C. Na_3V0_4

D. $\left[V(H_2O)_6\right]S0_4.\ H_20$

Answer: C

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16. What will the structure of CrO_5 in presence of pyridine ?

A. Butterfly

B. Square pyramidal

C. Pentagonal pyramidal

D. Cannot be predicted

Answer: A

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17. $\left[Ti(H_2O)_6\right]^{3+}$ is purple in colour because it is complimentary colour of

A. Blue

B. Red

C. Green

D. (Greenish) Yellow

Answer: D

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18. Number of electrons transferred in each case when $KMnO_4$ acts as an oxidising agent to give $MnO_2, Mn^2, Mn(OH)_3$ and MnO_4^{2-} are respectively:

A. 3,5, 4 and 1

B. 4, 3, 1 and 5

C. 1,3, 4 and 5

D. 5, 4, 3 and 1

Answer: A

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19. MnO_4^- is of intense pink colour, though Mn is in $(+7)$ oxidation state.It is due to:

A. Oxygen gives colour to it

B. Charge transfer when Mn gives its electron to oxygen

C. Charge transfer when oxygen gives its electrons to Mn making in Mn(+VI) hence coloured

D. None is correct

Answer: C

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20. $KMnO_4$ dissollution in concentration H_2SO_4 results in explosion due to

A. Formation of MnO which explode

B. Formation of Mn_2O_7 which explode

C. Formation of MnO_2 which explode

D. Formation of $MnSO_4$, which explode

Answer: B

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21. When K_2MnO_4 is added in solution of NH_4Cl then

A. Green colour will appear

B. Yellow colour will appear

C. Pink colour will appear

D. Colour will appear

Answer: B

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22. $K_2Cr_2O_7$ is preferred to $Na_2Cr_2O_7$ for use in volumetric analysis as a primary standard because

A. $Na_2Cr_2O_7$ is hygroscopic while $K_2Cr_2O_7$, is not

B. $K_2Cr_2O_7$ is hygroscopic while $Na_2Cr_2O_7$ is not

C. $K_2Cr_2O_7$ is pure while $Na_2Cr_2O_7$ is impure

D. None of these

Answer: A

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23. The blue colour produced on adding H_2O_2 to acidified $K_2Cr_2O_7$ is due to the formation of

A. Cr_2O_3

B. CrO_3

C. CrO_5

D. CrO_4^{2-}

Answer: C

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24. CrO_3 dissolves in aqueous NaOH to give:

A. CrO_4^{2-}

B. $Cr(OH)_2$

C. $Cr_2O_7^{2-}$

D. $Cr(OH)_3$

Answer: A

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25. The n-factor for $K_2Cr_2O_7$ in acidic medium is

A. $+2$

B. $+4$

C. $+6$

D. $+8$

Answer: C

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26. In electrorefining of copper,some gold is deposited as

A. Cathode

B. Cathode mud

C. Anode mud

D. Electrolyte

Answer: C

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

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

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

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

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

Answer: A

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28. Horn silver ore dissolves in excess of sodium cyanide solution forming

A. AgCN

B. $Na\left[Ag(CN)_2\right]$

C. $Na_2\left[Ag(CN)_2\right]$

D. $Na_4\left[Ag(CN)_5\right]$

Answer: B

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29. Using a Ziegler Natta catalyst the polythene formed is

A. High density

B. High melting

C. Straight chain with very little branching

D. All of these

Answer: D

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30. An excellent lubricant amongst these is

A. Molybdenum disulphide

B. Tungsten carbide

C. Ferrocene

D. Chromium Trioxide

Answer: A

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31. The fool's gold is

A. CuS

B. FeS_2

C. $K_2Cr_2O_7$

D. HgI_2

Answer: B

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32. A white solid Y, on heating gives off a gas which turns lime water milky, the residue is yellow when hot, white when cold. The solid Y is probably:

A. $ZnCO_3$

B. $PbCO_3$

C. $ZnSO_4$

D. $Zn(NO_3)_2$

Answer: A

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33. If H_2S gas is passed into a solution of Cu^{2+}, Cd^{2+} having excess of KCN

A. CuS and Cds both are precipitated.

B. Soluble complex $\left[Cu(CN_4\right]^{3-}$ and $\left[Cd(CN)_4\right]^{2-}$ are formed and no effect of passing H_2S gas

C. Soluble complex $[Cu(CN)_4]^{3-}$ and $[Cd(CN)_4]^{2-}$ are formed, of which CdS is precipitated as yellow ppt.

D. Soluble complex $[Cu(CN)_4]^{3-}$ and $[Cd(CN)_4]^{2-}$ are formed of which CuS is precipitated as black ppt.

Answer: C

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34. It is non experimental fact that $Cs_2[CuCl_4]$ is orange coloured but $(NH_4)_2[CuCl_4]$ is yellow. It is

further known that total paramagnetic moment of a unpaired electron is due to spin as well as due to nature of orbital , 'd' orbital contributing more than 's' or 'p'. Thus the total paramgentic moment of orange compound is found to be more than that of yellow compound. Then which of the following is correct?

A. dsp^2 in both

B. dsp^2 and sp^3 respectively

C. sp^3 and dsp^2 respectively

D. sp^3 in both

Answer: B

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35. The correct regarding $CuCl_5^{-3}$ compound is

A. Hybridisation is sp^3d

B. Axial bond length is large than equitorial bond length

C. Equatorial bond length is longer than axial bond length

D. Both (1) & (3)

Answer: D

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36. What will be the hybridisation of $Ni(CN)_5^{-3}$?

A. sp^3d^2

B. sp^3d

C. dsp^3

D. d^2sp^3

Answer: C

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37. Match the following

Column-I (Compounds)	Column-II (Properties)
(A) $KFe[Fe(CN)_6]$	(p) d-d transition is possible in any of atom
(B) $KMnO_4$	(q) Charge transfer from metal to metal
(C) $Cu_2[Fe(CN)_6]$	(r) Paramagnetic
(D) AgBr	(s) Colour due to polarisation
	(t) Charge transfer from ligand to metal

A. A-p, B - s, C-p, q, r ,D-r

B. A-p,q,r, B - t, C-p, q, r, D-s

C. A - p,q,r, B - r, C-p, t,D-q

D. A - p,q,r, B - s, C-t,D-r

Answer: B

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Exercise 3

1. Which of the following ions has the least magnetic moment?

A. Cu^{2+}

B. Ni^{2+}

C. Co^{3+}

D. Fe^{2+}

Answer: A

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2. Assertion : Mercury vapour is shining silvery in appearance.

Reason : Mercury is a metal with shining silvery appearance.

A. Both Assertion and Reason are true and Reason is the correct explanation of Assertion

B. Both Assertion and Reason are true but Reason is not the correct explanation of Assertion

C. Assertion is true but Reason is false

D. Both Assertion and Reason are false

Answer: D

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3. Which of the following ions is the most stable in aqueous solution ?

$(At.\ No.\ Ti = 22, V = 23, Cr = 24, Mn = 25)$

A. Cr^{3+}

B. V^{3+}

C. Ti^{3+}

D. Mn^{3+}

Answer: D

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4. Acidified potassium permanganate soultion is decoloursied by

A. bleaching powder

B. white vitriol

C. Mohr's salt

D. microcosmic salt

Answer: C

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5. 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. 4fand 5f-orbitlas are equally shielded

Answer: D

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6. Which of the following compounds is coloured?

A. $TiCl_3$

B. $FeCl_3$

C. $CoCl_2$

D. All of these

Answer: D

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7. What is the correct roder of spin only magnetic moment (in BM) of Mn^{2+}, Cr^{2+} and Ti^{2+}?

A. $Mn^{2+} > Ti^{2+} > Cr^{2+}$

B. $Ti^{2+} > Cr^{2+} > Mn^{2+}$

C. $Mn^{2+} > Cr^{2+} > Ti^{2+}$

D. $Cr^{2+} > Ti^{2+} > Mn^{2+}$

Answer: C

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8. For which of the following pairs, magnetic moment is same ?

A. $MnCl_2, CuSO_4$

B. $CuCl_2, TiCl_3$

C. $TiO_2, CuSO_4$

D. $TiCl_3, NiCl_2$

Answer: B

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9. Transition metals show paramagnetism

A. high lattice energy

B. variable oxidation statel

C. characteristic configuration

D. unpaired electrons

Answer: D

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10. Among TiF_6^{2-}, CoF_6^{3-}, Cu_2Cl_2 and $NiCl_4^{2-}$ (At. No. $Ti = 22, Co = 27, Cu = 29, Ni = 28$), the colourless species are -

A. TiF_6^{2-} and CoF_6^{3-}

B. Cu_2Cl_2 and $NiCl_4^{2-}$

C. TiF_6^{2-} and Cu_2Cl_2

D. CoF_6^{3-} and $NiCl_4^{2-}$

Answer: C

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11. Which of the following is magnetite ?

A. Fe_2CO_3

B. Fe_2O_3

C. Fe_3O_4

D. $Fe_2O_3.3H_2O$

Answer: C

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12. More number of oxidation states are exhibited by the actinoids than by the lanthanoids. The main reason for this is

A. lesser energy difference between 5f and 6d-orbitals than that between 4f and 5d-orbitals

B. greater metallic character of the lanthanoids than that of the corresponding actinoids

C. more active nature of the actinoids

D. more energy difference between 5f and 6d-orbitals than that between 4f and 5d-orbitals

Answer: A

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13. Which of the following transition metal ion is not coloured?

A. Cu^{+}

B. V^{3+}

C. Co^{2+}

D. Ni^{2+}

Answer: A

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

A. Sc^{3+} (Z=21)

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

C. Ti^{3+} (Z=22)

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

Answer: C

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

A. Zn^{2+}, Hf^{4+}

B. Fe^{2+}, Ni^{2+}

C. Zr^{4+}, Ti^{4+}

D. Zr^{4+}, Hf^{4+}

Answer: D

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16. Acidified $K_2Cr_2O_7$, solution turns green when Na_2SO_3 is added to it. Thus is due to the formation of

A. $CrSO_4$

B. $Cr_2(SO_4)_3$

C. CrO_4^{2-}

D. $Cr_2(SO_3)_3$

Answer: B

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17. For the four successive transition elements (Cr, Mn, Fe, and Co), the stability of $+2$ oxidation state will be there in which of the following order ?

$(At.\ Nos.\ Cr = 24, Mn = 25, Fe = 26, Co = 27)$

A. $Cr > Mn > Co > Fe$

B. $Mn > Fe > Cr > Co$

C. $Fe > Mn > Co > Cr$

D. $Co > Mn > Fe > Cr$

Answer: B

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18. Which of the statements is not trure?

A. $Na_2Cr_2O_7$ is preferred over $K_2Cr_2O_7$, in volumetric analysis

B. $K_2Cr_2O_7$ solution in acidic medium is orange

C. $K_2Cr_2O_7$ solution becomes yellow on increasing the pH beyond 7

D. On passing H_2S trhough acidified $K_2Cr_2O_7$, solution, a milky colour is observed.

Answer: A

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19. Identify the alloy containing a non metal as a constituent in it

A. Steel

B. Bell metal

C. Bronze

D. Invar

Answer: A

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20. Magnetic moment $2.83BM$ is shown by which of the following ions?

A. Mn^{2+}

B. Ti^{3+}

C. Ni^{2+}

D. Cr^{3+}

Answer: C

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21. Magnetic moments $2.84B.$ M is given by :

(At. nos. ni = 28, Ti = 22, Cr = 24, Co = 27).

A. Cr^{2+}

B. Co^{2+}

C. Ni^{2+}

D. Ti^{3+}

Answer: C

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22. The number of d-electrons in Fe^{2+} (Z=26) is not equal to the number of electrons in which one of the following ?

A. d-electrons in Fe(Z=26)

B. p-electrons in Ne(Z=10)

C. s-electrons in Mg(Z=12)

D. p-electrons in Cl(Z=17)

Answer: D

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23. Which one of the following statements is correct when SO_2 is passed through acidified $K_2Cr_2O_7$ solution?

A. Green $Cr_2(SO_4)$ is formed

B. The solution turns blue

C. The solution is decolourized

D. SO_2 is reduced

Answer: A

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Exercise 4

1. Each of these questions contains two statements : Assertion (A) and Reason (R). Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select one of the codes (A), (B), (C), (D) given below

(1) A: Mercury is liquid at room temperature.

R:In mercury, there is no unpaired d-electron and thus, metallic bonding is weakest.

A. (1) Assertion is true, Reason is true, Reason is a correct explanation for Assertion

B. (2) Assertion is true, Reason is true, Reason is not a correct explanation for Assertion.

C. (3) Assertion is true, Reason is false

D. (4) Both assertion and Reason are false.

Answer: A

2. A: Oxalates and carbonates of lanthanides are almost insoluble in water

R: Salts of lanthanides usually contains water of crystallisation

A. (1) Assertion is true, Reason is true, Reason is a correct explanation for Assertion

B. (2) Assertion is true, Reason is true, Reason is not a correct explanation for Assertion.

C. (3) Assertion is true, Reason is false

D. (4) Both assertion and Reason are false.

Answer: A

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3. Assertion : $CuSO_4.5H_2O$ on heating to $250^\circ C$ losses all the five H_2O molecules and becomes anhydrous.

Reason : All five H_2O molecules are coordinated to the central Cu^{2+} ion.

A. (1) Assertion is true, Reason is true, Reason is a correct explanation for Assertion

B. (2) Assertion is true, Reason is true, Reason is not a correct explanation for Assertion.

C. (3) Assertion is true, Reason is false

D. (4) Both assertion and Reason are false.

Answer: C

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4. Assertion: Tungsten has very high melting point.

Reason: Tungsten is a covalent compound.

A. (1) Assertion is true, Reason is true, Reason is a correct explanation for Assertion

B. (2) Assertion is true, Reason is true, Reason is not a correct explanation for Assertion.

C. (3) Assertion is true, Reason is false

D. (4) Both assertion and Reason are false.

Answer: C

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5. Statement-1: Equivalent mass of $KMnO_4$ is equal to one-third of its molecular mass when it acts as an oxidising agent in an alkaline medium.

Statement-2: Oxidation number of Mn is +7 in $KMnO_4$.

A. (1) Assertion is true, Reason is true, Reason is a correct explanation for Assertion

B. (2) Assertion is true, Reason is true, Reason is not a correct explanation for Assertion.

C. (3) Assertion is true, Reason is false

D. (4) Both assertion and Reason are false.

Answer: B

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6. STATEMENT-1 : Oxidation number of Cr in K_3CrO_8 is +5

and

STATEMENT-2: It contains tetraperoxo species , i.e., $\left[Cr(O_2)_4\right]^{3-}$

A. (1) Assertion is true, Reason is true, Reason is a correct explanation for Assertion

B. (2) Assertion is true, Reason is true, Reason is not a correct explanation for Assertion.

C. (3) Assertion is true, Reason is false

D. (4) Both assertion and Reason are false.

Answer: A

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7. A: MnO_4^- is tetrahedral is shape.

R: MnO_4 is purple in colour

A. (1) Assertion is true, Reason is true, Reason is a correct explanation for Assertion

B. (2) Assertion is true, Reason is true, Reason is not a correct explanation for Assertion.

C. (3) Assertion is true, Reason is false

D. (4) Both assertion and Reason are false.

Answer: B

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8. STATEMENT-1 : Chromium atom has electronic configuration $[Ar]3d^5 4s^1$.

and

STATEMENT-2: Atomic number of chromium is 24 .

A. (1) Assertion is true, Reason is true, Reason is a correct explanation for Assertion

B. (2) Assertion is true, Reason is true, Reason is not a correct explanation for Assertion.

C. (3) Assertion is true, Reason is false

D. (4) Both assertion and Reason are false.

Answer: B

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9. Assertion : CrO_3 reacts with HCl to form chromyl chloride gas

Reason : Chromyl chloride (CrO_2Cl_2) has tetrahedral shape.

A. (1) Assertion is true, Reason is true, Reason is a correct explanation for Assertion

B. (2) Assertion is true, Reason is true, Reason is not a correct explanation for Assertion.

C. (3) Assertion is true, Reason is false

D. (4) Both assertion and Reason are false.

Answer: B

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10. STATEMENT-1 : Common oxidation states of iron and +2 and +3 in its compound .

and

STATEMENT-2: Iron can have only +2 and +3 oxidation states in its compounds .

A. (1) Assertion is true, Reason is true, Reason is a correct explanation for Assertion

B. (2) Assertion is true, Reason is true, Reason is not a correct explanation for Assertion.

C. (3) Assertion is true, Reason is false

D. (4) Both assertion and Reason are false.

Answer: C

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11. K_2PtCl_6 is a well known compound whereas corresponding Ni compound is not known. Explain.

A. (1) Assertion is true, Reason is true, Reason is a correct explanation for Assertion

B. (2) Assertion is true, Reason is true, Reason is not a correct explanation for Assertion.

C. (3) Assertion is true, Reason is false

D. (4) Both assertion and Reason are false.

Answer: A

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12. STATEMENT-1 : Zn is not a typical transition metal.

and

STATEMENT-2: Zn is a d-block element .

A. (1) Assertion is true, Reason is true, Reason is a correct explanation for Assertion

B. (2) Assertion is true, Reason is true, Reason is not a correct explanation for Assertion.

C. (3) Assertion is true, Reason is false

D. (4) Both assertion and Reason are false.

Answer: B

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13. STATEMENT-1 : Lanthanoids show less oxidation states than actinoids

and

STATEMENT-2: 4f subshell is dieperseated than 5f .

A. (1) Assertion is true, Reason is true, Reason is a correct explanation for Assertion

B. (2) Assertion is true, Reason is true, Reason is not a correct explanation for Assertion.

C. (3) Assertion is true, Reason is false

D. (4) Both assertion and Reason are false.

Answer: A

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Check Your Grasp

1. Zinc does not show variable valency Because of:

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2. Which of the following ions has the highest magnetic moment ?

$Cr^{3+}, Fe^{2+}., Mn^{2+}, Cu^{2+}, Zn^{2+}$

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3. Densest element of the periodic table is

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4. Which of the following elements are - transition elements Sc, Ti ,Zr ,Hg ,Ag ,Ni`

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5. MnF_7 is not stable while Mn_2O_7 is stable.

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6. What is the hybridisation of Mn in K_2MnO_4 ?

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7. Why is FeI_3 not stable ?

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