



CHEMISTRY

BOOKS - CENGAGE CHEMISTRY (HINGLISH)

D AND F BLOCK ELEMENTS

Illustration

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

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3. (a) Phosphorous (P_4) and vanadium (V) both exhibit variable oxidation states but due to different reason.

(b) Name the transition metal which does not show variable O.S.

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4. (a). Why IE_1 of Zn , Cd and Hg are very high?

(b). The relative difference in IE of any two consecutive d-block elements is smaller than those of s and p-block elements.

(c). IE_2 is usually very high for Cr and Cu . Why?

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5. IE_2 for Zn is comparatively lower as compared to other transition elements of same series.

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

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7. Give the decreasing order of $E \frac{M^{3+}}{(M^{2+})^{e-}}$ Value for the following:

(a). $Co(Z = 27)$

(b). $Mn(Z = 25)$

(c). $Fe(Z = 26)$

(d). $Cr(Z = 24)$

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8. 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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9. Why is the value for $\frac{Mn^{3+}}{Mn^{2+}}$ couple much more positive than that for $\frac{Cr^{3+}}{Cr^{2+}}$ or $\frac{Fe^{3+}}{Fe^{2+}}$? Explain

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10. How would you account for the increasing oxidising power in the series $VO_2^{\oplus} < Cr_2O_7^{2-} MnO_4^{\ominus}$?

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

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

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13. (a). A strip of Cu dissolved in $FeCl_3$, however Cu cannot displace Fe.

(b). $[CuCl_4]^{2-}$ exists but $[C \text{ --- } (4)]^{2-}$ does not. Why?

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14. (a). Why Mn^{2+} compounds are more stable than Fe^{2+} towards oxidation to their +3 state?

(b). Calculate the magnetic moment of V^{3+} ion.

(c). $[Ti(H_2O)_6]^{3+}$ gives violet coloured aqueous solution but

$[Mg(H_2O)_6]^{2+}$ solution is colourless.

(d). $[Ti(H_2O)_6]^{3+}$ is coloured whereas $[Sc(H_2O)_6]^{3+}$ is colourless.

Why?

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15. Why Sm^{2+} , Eu^{2+} and Yb^{2+} ions in solutions are good reducing agents but an aqueous solution of Ce^{4+} is a good oxidising agent?

(b). Why does $Mn(II)$ show maximum paramagnetic character amongst the bivalent ions of the first transition series?

(c) $La(OH)_3$ is more basic than $Lu(OH)_3$ Explain (Atomic no. of $La = 57$, $Lu = 71$)

(d) Give reason. Why in moist air copper corrodes to produce a green layer on the surface.

(e). Which of the following ions are expected to be coloured and why?
 Fe^{2+} , Mn^{2+} , Cr^{3+} .

(f). Why Zn^{2+} salts are white while Ni^{2+} salts are blue?



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16. A hydrated metallic salt A, light green in colour, gives a white anhydrous residue B after being heated gradually. B is soluble in water

and its aqueous solution reacts with NO to give a dark brown compound

C. B on strong heating gives a brown residue D and a mixture of two gases E and F. The gaseous mixture, when passed through acidified $KMnO_4$ discharges the pink colour, when passed through acidified $BaCl_2$ solution, gives a white precipitate. Identify A, B, C, D, E and F



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17. Which of the following statements is correct?

(a). Nickel is a silver white metal.

(b). Nickel dimethylglyoxime is square planer.

(c). Among complexes of cobalt the most stable are those of Co^{2+} ,

(d). Among simple compounds of cobalt the most stable are those of Co^{2+} .



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

(a). Fe^{3+} gives brown colour with potassium ferricyanide.

(b). Fe^{2+} gives blue precipitate with potassium ferricyanide.

(c). Fe^{2+} gives red colour with potassium thiocyanate.

(d). Fe^{2+} gives brown colour with ammonium thiocyanate.



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19. Hydrazine reduce Fehling's solution to form:

(a). $Cu(OH)$

(b). Cu_2O

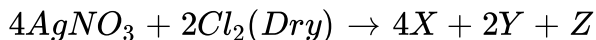
(c). CuO

(d). $Cu + O_2$



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20. In the following reaction Y and Z are respectively:



- (a). $AgCl, O_2$
- (b). NO_2, N_2O_4
- (c). N_2O_5, O_2
- (d). None



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21. Explain the following facts:

- (a). Copper hydroxide is soluble in ammonium hydroxide but not in sodium hydroxide.
- (b). Addition of an alkali to cuprous chloride solution gives a yellow precipitate which gradually changes to a red colour.



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22. Write balanced equations for the reaction of alkaline perbromate with zinc giving tetrahydroxozincate anion.

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23. Excess of dilute sodium hydroxide solution is gradually added with shaking to an aqueous solution of zinc sulphate. What would you observe?

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24. (a). The addition of NaOH solution to a solution of zinc chloride produces a white precipitate which dissolves on further addition of NaOH.

(b). The addition of NH_4OH to $ZnSO_4$ solution produces white precipitate but no precipitate is formed if it contains NH_4Cl .

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25. Identify A, B, C, D and E.

A white substance A reacts with dilute H_2SO_4 to produce a colourless gas B and a colourless solution C. The reaction between B and acidified $K_2Cr_2O_7$ solution produces a green solution and slightly coloured precipitate D. The substance D burns in air to produce a gas E which reacts with B to yield D and a colourless liquid. Anhydrous copper sulphate is turned blue on addition of this colourless liquid. Addition of aqueous NH_3 or $NaOH$ to C produces first a precipitate

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26. Mercurous ion is written as Hg_2^{2+} whereas cuprous ion is written as Cu^+ . Explain.

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27. Give reasons for the following :

Variation in the radii of transition elements are not as pronounced as those of representative elements.

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28. (a). The addition of NaOH solution to a solution of zinc chloride produces a white precipitate which dissolves on further addition of NaOH.

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29. Mercurous chloride black on adding NH_4OH to it. Explain.

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1. Why in any transition series, melting points first increase and then decrease and also they show a dip in the middle?

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2. Atomic radius of Cu is greater than that of Cr but ionic radius of Cr^{2+} is smaller than that of Cu^{2+} . Give suitable explanation.

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3. Why hydrated copper sulphate is blue while anhydrous copper sulphate is white?

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4. Why are the ionisation energies of 5d elements greater than 3d elements?

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5. Explain why cuprous chloride ($CuCl$) is colourless while cupric chloride ($CuCl_2$) is blue? Or $TiCl_3$ is coloured while $TiCl_4$ is colourless?

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6. Describe giving reason which one of the following pairs has the property indicated?

(a). Fe or Cu has higher melting point.

(b). Co^{2+} or Ni^{2+} has lower magnetic moment.

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7. Give reason for the following features of transition metal chemistry:

(i). The lowest oxide of a transition metal (say, chromium, atomic number 24) is basic whereas the highest oxide is usually acidic.

(ii). Transition metals sometimes exhibit very low oxidation states such as +1 and 0.

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8. The 4d and 5d series of transition metals have more frequency metal-metal bonding in their compounds than do the 3d metals. Explain.

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9. (a). K_2PtCl_2 is a well known compound whereas corresponding is not known. State a reason for it.

(b). Most of the transition metals do not displace hydrogen from dilute acids. Why?

(c). Why have the transition elements high enthalpy of hydration?

(d). Chromium is a typical hard metal while mercury is a liquid. Explain why.?

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10. (a). Of the lanthanides, cerium ($Z = 58$) forms a tetrapositive ion, Ce^{4+} in aqueous solution. Why?

(b), The +3 oxidation states of lanthanum ($Z = 57$), gadolinium ($Z = 64$) and lutetium ($Z = 71$) are especially stable. Why?

(c). Why Zr and or Nb and Ta exhibit similar properties ?

(d). Which out of the two $La(OH)_3$ and $Lu(OH)_3$, is more basic and why?

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11. (a). Why second and third transition series elements show similar size?

(b). Why electronic configuration of lanthanoids not known with

certainty?

(c). The electronic configuration of actinide elements are not known with certainty. Explain.

(d). Why there is similarities (horizontal and vertical) in successive members of the transition series?

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12. (a). Chemistry of all the lanthanoids is quite similar.

(b). The actinide contraction differs from lanthanide contraction? Explain

(c). A serious accident occurred in a chemistry laboratory when a student tried to dissolve excess of $KMnO_4$ in conc. H_2SO_4 .

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13. Identify A to E. Pyrolusite on heating with KOH in the presence of air gives a dark green compound (A). The solution of (A) on treatment with H_2SO_4 gives a purple coloured compound (B), which gives the

following reactions:

(a). KI on reaction with alkaline solution of (B) changes into a compound (C).

(b). The colour of the compound (B) disappears on treatment with the acidic solution of $FeSO_4$.

(c). With conc. H_2SO_4 compound (B) gives (D) which can decompose to yield (E) and oxygen.

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14. (a). $CuSO_4 \cdot 5H_2O \xrightarrow{100^\circ} (A) \xrightarrow{230^\circ} (B) \xrightarrow{800^\circ} (C) + (D)$

(b). $AgNO_3 \xrightarrow{redhot} (E) + (F) + O_2$

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15. (a). A powdered substance (A) on treatment with fusion mixture gives a green coloured compound (B).

(b). The solution of (B) in boiling water on acidification with dilute H_2SO_4 gives a pink coloured compound (C).

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16. (a). An ore (A) on roasting with sodium carbonate and lime in the presence of air gives two compounds (B) and (C).

(b). The solution of (B) in conc. HCl on treatment with potassium ferrioxalate gives a blue colour or precipitate of compound (D).

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17. Identify A to C.

(a). An aqueous solution of a compound (A) is acidic towards litmus and (A) is sublimed at about $300^\circ C$.

(b). (A) on treatment with an excess of NH_4CNO gives a red coloured compound (B) and on treatment with a solution of $K_4Fe(CN)_6$ gives a blue coloured compound (C).



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18. How the following conversions are made?

(a). Copper chloride from copper nitrate.

(b). Cuprous oxide from copper sulphate.

(c). Cuprous oxide from copper.

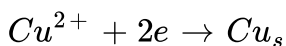


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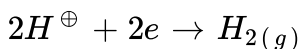
Ex 6.1 Subjective

1. (a). Explain why Mn^{3+} is less stable than Mn^{2+} and M^{4+} ions?

(b). Standard reduction potential of copper is greater than that of hydrogen yet it liberates hydrogen from a concentrated solution of hydrochloric acid. Explain this fact with proper reasoning.



$$E_{\frac{Cu^{2+}}{Cu}}^{\ominus} = 0.34 \text{ volt}$$



$$E_{\frac{H^{\oplus}}{H_2}} = 0.00\text{volt}$$

(c). An aqueous solution of $FeCl_3$ is slightly yellowish in colour.

(d). $Cu(I)$ compounds are not known in aqueous solution.

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2. Write down the names of crystal structures in which the following elements are presents:

Sc,Ti,V,Cr,Mn,Fe,Co,Ni,Cu,Zn(b). Whichism or ebasic? (i). ZrO_2 or

$TiO_2(ii)$. V_2O_5 or $Nb_2O_5(iii)$. OsO_4 or ReO_2

(c). Whichism or e \otimes idi sin ga $\geq ntCr(IV)$ or $Mo^{*+}(VI)$?

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3. Write down the name of catalyst for the following:

(i). In the synthesis of hydrocarbon in fischer-Tropsch process.

(ii). Adams catalyst in reduction.

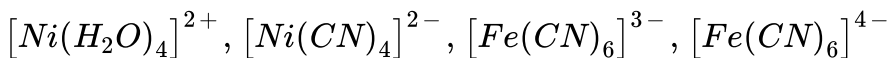
(iii). Deacon's process of making Cl_2 from HCl .

(iv). Reppe synthesis of benzene.

(v). Fenton's reagent in the synthesis of aldehydes from alcohols.

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4. Arrange the following complexes in decreasing order of magnetic moment:



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5. What happen when:

(a). CO_2 gas is passed through aqueous solution of Na_2CrO_4 .

(b). Ammonium dichromate is heated strongly:

(c). Two gases A and B turns acidified $K_2Cr_2O_7$ green,. When these gases are passed through water simultaneously, solution turns turbid yellow. What are the gases A and B?

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6. Explain by giving suitable reason.

(a). Yellow coloured aqueous solution of sodium chromate changes to orange-red when CO_2 under pressure is passed.

(b). Green solution of potassium manganate, K_2MnO_4 , turns purple when CO_2 is circulated.

(c). Hg^{2+} and Hg_2^{2+} salts are colourless.

(d). Cu^{2+} salts are paramagnetic while Cu^{\oplus} salts are diamagnetic in nature.



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7. Explain:

(a). Why is $K - 2Cr_2O_7$ generally preferred to $Na_2Cr_2O_7$ in volumetric analysis?

(b). Which divalent metal ion has maximum paramagnetic character among the first transition metals? Why?

(c). How the colour of $K_2Cr_2O_7$ solution does depend on pH of the solution?

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8. (a). Why do second and third rows of transition elements resemble each other more closely than the first row?

Give reasons:

(b). Most transition metals show paramagnetic behaviours.

(c). Transition metal and their many compounds are coloured.

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9. Acidified $K_2Cr_2O_7$ solution turns green when sodium sulphite is added to it. Explain.

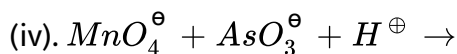
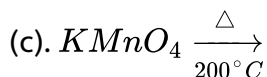
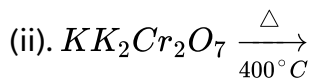
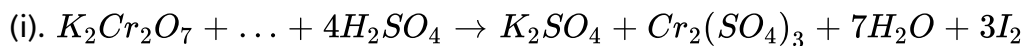
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10. Identify A, B, C, D, and X.

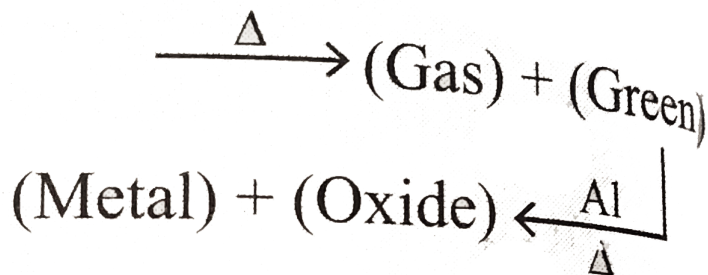
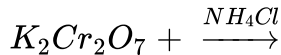
When a white crystalline compound X is heated with $K_2Cr_2O_7$ and concentrated H_2SO_4 , a reddish brown gas A is evolved. On passing A into caustic soda solution a yellow coloured solution of B is obtained. Neutralising the solution of B with acetic acid and on subsequent addition of lead acetate, a yellow precipitate C is obtained. When X is heated with NaOH solution a colourless gas is evolved and on passing this gas into K_2HgI_4 solution a reddish brown precipitate D is formed.

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11. Complete and balance the following equation:



(v).



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12. Explain the following giving suitable reason.

(a). Transition metals of 3d-series do not react readily with dilute acids to liberate hydrogen although they have high negative reduction potential values. Explain.

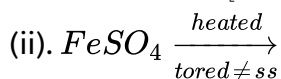
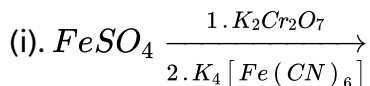
(b). The atomic radii of the elements in a transition series do not vary much while they do vary in the case of s and p-block elements. Explain.

(c). The second and third members in each group of the transition elements group of the transition elements have similar atomic radii. Explain.

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Ex 6.2 Subjective (Compound Of Fe :)

1. Complete and balance the following equation:



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2. Explain the following :

(i). $FeCl_3$ and $FeBr_3$ are well known, but FeI_3 has doubtful existence.

(ii). Anhydrous $FeCl_3$ cannot be obtained by heating hydrated ferric chloride.

(iii). Cast iron is hard but pure iron is soft in nature.

(iv). A ferrous salt decolourises $KMnO_4$ solution.

(v). A ferrous salt turns brown air.



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3. Draw shape of $FeCl_3$ in :

(i). Water

(ii). Ether

(iii). Gaseous state.



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4. What happen when iron is treated with:

(i). Steam

(ii). Dilute HNO_3



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5. Colourless salt (A) decolourise I_2 solution and gives white precipitate (change to black) with $AgNO_3$ solution. (A) also produces pink colour with $FeCl_3$ solution. Identify (A) and explain reactions.



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6. Iron forms iron (II) chloride, $FeCl_2$ and iron (III) chloride $FeCl_3$. One of these chlorides is a dark brown solid melting $306^\circ C$. The other is a white crystalline solid with greenish tint, melts at $674^\circ C$. Which description best fits iron (II) chloride Explain.

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7. Account for the following observation and write balanced chemical equations for them.

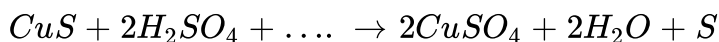
- (i). When ferrous sulphate crystals are exposed to air, it turns brown.
- (ii). A solution of ferric chloride in water gives a brown precipitate on standing.

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1. When copper is exposed to atmosphere for a longer time, a green mass deposits on its surface. Discuss the chemical reaction involved.

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2. Complete and balance the following equations:



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3. Explain the following:

(i). Copper hydroxide is soluble in ammonium hydroxide but not in sodium hydroxide.

(ii). A dark blue precipitate is formed when sodium hydroxide solution is added to copper sulphate solution. The precipitate darkens on heating.

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Ex 6.2 Subjective (Compound Of Zn:)

1. (i). ZnO is used as a white paint inspite of the fact that it has less covering power than white lead.

(ii). Hydrated $ZnCl_2$ cannot be dehydrated on heating?

(iii). Zn is used in galvanisation of Fe.

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Ex 6.2 Subjective (Compound Of Ag:)

1. Preparation of looking mirrors involves the use of ammonical $AgNO_3$ red lead $HCHO$. Explain the function of each.

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2. Give reason for the following:

(i). Silver ornament gets tarnished when exposed to atmosphere for a

long time.

(ii) Silver nitrate solution is kept in dark coloured bottles.

(iii). Why does $AgNO_3$ produce a black stain on the skin.

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Ex 6.2 Subjective (Compound Of Hg:)

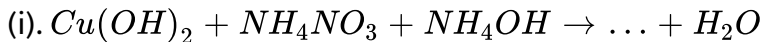
1. An aqueous solution containing one mole of HgI_2 and two moles of NaI is orange in colour. On addition of excess NaI the solution becomes colourless. The orange colour reappears on subsequent addition of $NaOCl$. Explain with equation.

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2. $HgCl_2$ and $SnCl_2$ cannot coexist together in an aqueous solution.

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3. Complete and balance the following equations:



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Exercises Linked Comprehension

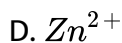
1. The colours of the transition metal are due to d-d excitation. The energy required for d-d electron excitation is available in the visible range.

Transition metal ions have the tendency to absorb certain radiations from the visible region and exhibit the complementary colour.

The transition metal ions which have completely filled d-orbitals are colourless as the excitation of electron or electrons is not possible within d-orbitals. The transition metal ions which have completely empty d-orbitals are also colourless. In $KMnO_4$ and $K_2Cr_2O_7$, there

are no unpaired electrons at the central atom but they are dep in colour. The colour of these compounds is due to charge transfer spectrum. for example in MnO_4 electron is momentarily transferred from O to the metal and thuis oxygen changes from O^{2-} and O^{\ominus} maganese from Mn^{7+} to Mn^{6+} .

Q. Which of the following is paramagnetic as well as coloured ion?



Answer: b



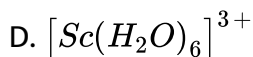
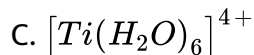
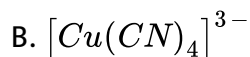
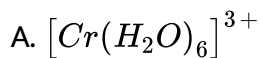
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Q. Which is a coloured ion?



Answer: a



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Q. Select the correct statement:

A. colour of the transition metal ion arises due to d-d transition.

- B. colour of certain oxysalts of transition metals is due to charge transfer.
- C. Both are correct.
- D. None is correct.

Answer: c

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4. The colours of the transition metal are due to d-d excitation. The energy required for d-d electron excitation is available in the visible range.

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Q. Which of the following compounds is (are) coloured due to charge transfer spectra and not due to d-d transition?

A. $KMnO_4$

B. K_2CrO_4

C. CrO_3

D. all of these

Answer: d

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5. The colours of the transition metal are due to d-d excitation. The energy required for d-d electron excitation is available in the visible

range.

Transition metal ions have the tendency to absorb certain radiations from the visible region and exhibit the complementary colour.

The transition metal ions which have completely filled d-orbitals are colourless as the excitation of electron or electrons is not possible within d-orbitals. The transition metal ions which have completely empty d-orbitals are also colourless. In $KMnO_4$ and $K_2Cr_2O_7$, there are no unpaired electrons at the central atom but they are deep in colour.

The colour of these compounds is due to charge transfer spectrum. For example in MnO_4^- electron is momentarily transferred from O to the metal and thus oxygen changes from O^{2-} and O^{\ominus} manganese from Mn^{7+} to Mn^{6+} .

Q. $K_2Cr_2O_7$ gives coloured solution in water. The colour is due to

- A. d-d transition in Cr-atoms
- B. Presence of unpaired electron in d-orbital of oxygen
- C. charge transfer from O to Cr
- D. none of the above

Answer: c

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6. $KMnO_4$ is prepared from the mineral pyrolusite, MnO_2 (deep purple colour). It acts as an oxidising agent in the neutral, alkaline as well as acidic medium in acidic medium it is used in volumetric analysis for estimation of Fe^{2+} , $Cr_2O_4^{2-}$ salts etc. The titrations are carried out in presence of H_2SO_4 . However, before using it as a titrant, it is first standardised with standard oxalic acid solution or Mohr's salt solution . In one of the experiments on titration 26.8g of dry pure sodium oxalate ($Mw = 123g\text{mol}^{-1}$) was dissolved in 1L of distilled water and then 100 mL of $2MH_2SO_4$ were added. The solution was cooled. Now to this solution $0.1MKMnO_4$ solution was added till a very faint pink colour persisted.

Q. The purple colour of $KMnO_4$ is due to

A. incomplete d-subshell

B. ionic nature of $KMnO_4$

C. Charge transfer

D. Resonance in MnO_4^\ominus ion

Answer: c

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7. $KMnO_4$ is prepared from the mineral pyrolusite, MnO_2 (deep purple colour). It acts as an oxidising agent in the neutral, alkaline as well as acidic medium in acidic medium it is used in volumetric analysis for estimation of Fe^{2+} , $Cr_2O_4^{2-}$ salts etc. The titrations are carried out in presence of H_2SO_4 . However, before using it as a titrant, it is first standardised with standard oxalic acid solution or Mohr's salt solution . In one of the experiments on titration 26.8g of dry pure sodium oxalate ($Mw = 123gmol^{-1}$) was dissolved in 1L of distilled water and then 100 mL of $2MH_2SO_4$ were added. The solution was cooled. Now to this solution $0.1MKMnO_4$ solution was added till a very faint pink colour

persisted.

Q. Mohr's salt, $FeSO_4(NH_4)_2SO_4 \cdot 6H_2O$, is preferred over $FeSO_4 \cdot 7H_2O$ for standardisation of $KMnO_4$ solution because.

- A. Mohr's salt is a double salt while ferrous sulphate is a single salt.
- B. Mohr's salt is not hygroscopic but $FeSO_4 \cdot 7H_2O$ is hygroscopic.
- C. Mohr's salt contains only ferrous ions whereas ferrous sulphate contains some ferric ions.
- D. Mohr's salt solution can be titrated even in the absence of H_2SO_4 .

Answer: c



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8. $KMnO_4$ is prepared from the mineral pyrolusite, MnO_2 (deep purple colour). It acts as an oxidising agent in the neutral, alkaline as well as acidic medium in acidic medium it is used in volumetric analysis for estimation of Fe^{2+} , $Cr_2O_4^{2-}$ salts etc. The titrations are carried out in

presence of H_2SO_4 . However, before using it as a titrant, it is first standardised with standard oxalic acid solution or Mohr's salt solution . In one of the experiments on titration 26.8g of dry pure sodium oxalate ($Mw = 123gmol^{-1}$) was dissolved in 1L of distilled water and then 100 mL of $2MH_2SO_4$ were added. The solution was cooled. Now to this solution $0.1MKMnO_4$ solution was added till a very faint pink colour persisted.

Q. When pyrolusite is fused with KOH and $KClO_3$, we get

- A. $KMnO_4$
- B. K_2MnO_4
- C. both $KMnO_4$ and K_2MnO_4
- D. None of these

Answer: b



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9. $KMnO_4$ is prepared from the mineral pyrolusite, MnO_2 (deep purple colour). It acts as an oxidising agent in the neutral, alkaline as well as acidic medium in acidic medium it is used in volumetric analysis for estimation of Fe^{2+} , $Cr_2O_4^{2-}$ salts etc. The titrations are carried out in presence of H_2SO_4 . However, before using it as a titrant, it is first standardised with standard oxalic acid solution or Mohr's salt solution . In one of the experiments on titration 26.8g of dry pure sodium oxalate ($Mw = 123g\text{mol}^{-1}$) was dissolved in 1L of distilled water and then 100 mL of $2MH_2SO_4$ were added. The solution was cooled. Now to this solution $0.1MKMnO_4$ solution was added till a very faint pink colour persisted.

Q. If $0.1MK_2Cr_2O_7$ solution were used in place of $0.1 MKMnO_4$ solution used would be

- A. 200 mL
- B. 400 mL
- C. 333.3 mL
- D. 666.6 mL

Answer: d



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10. If instead of H_2SO_4 , HCl or HNO_3 of suitable concentration were used, the volume of $KMnO_4$ solution used would have been

- A. less in case of HCl but more in case of HNO_3
- B. More in case of HCl but less in case of HNO_3
- C. more in both cases
- D. Less in both cases

Answer: b



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11. $KMnO_4$ is prepared from the mineral pyrolusite, MnO_2 (deep purple colour). It acts as an oxidising agent in the neutral, alkaline as well as

acidic medium in acidic medium it is used in volumetric analysis for estimation of Fe^{2+} , $Cr_2O_4^{2-}$ salts etc. The titrations are carried out in presence of H_2SO_4 . However, before using it as a titrant, it is first standardised with standard oxalic acid solution or Mohr's salt solution . In one of the experiments on titration 26.8g of dry pure sodium oxalate ($M_w = 123\text{gmol}^{-1}$) was dissolved in 1L of distilled water and then 100 mL of $2MH_2SO_4$ were added. The solution was cooled. Now to this solution $0.1MKMnO_4$ solution was added till a very faint pink colour persisted.

Q. The volume of $KMnO_4$ solution that must have been added to obtain the faint pink colour at the end point must be

- A. 100 mL
- B. 200 mL
- C. 400 mL
- D. 800 mL

Answer: d



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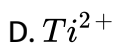
12. Transition metals and many of their compounds show paramagnetic behaviour where there are unpaired electron or electrons. The magnetic moment arises from the spin and orbital motions in ions or molecule.

Magnetic moment of n unpaired electrons is given as

$$\mu = \sqrt{n(n + 2)} \text{ Bohr magneton}$$

Magnetic moment increases as the number of unpaired electrons increases.

Q. Which among the following ions has maximum value of magnetic moment



Answer: b



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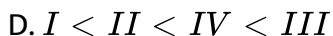
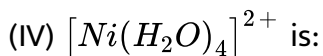
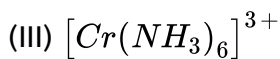
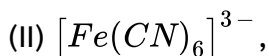
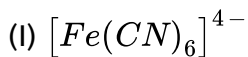
13. Transition metals and many of their compounds show paramagnetic behaviour where there are unpaired electron or electrons. The magnetic moment arises from the spin and orbital motions in ions or molecule.

Magnetic moment of n unpaired electrons is given as

$$\mu = \sqrt{n(n + 2)} \text{ Bohr magneton}$$

Magnetic moment increases as the number of unpaired electrons increases.

Q. Increasing value of magnetic moment of



Answer: d

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14. Transition metals and many of their compounds show paramagnetic behaviour where there are unpaired electron or electrons. The magnetic moment arises from the spin and orbital motions in ions or molecule.

Magnetic moment of n unpaired electrons is given as

$$\mu = \sqrt{n(n + 2)} \text{ Bohr magneton}$$

Magnetic moment increases as the number of unpaired electrons increases.

Q. In 3d series the maximum magnetic moment is shown by

A. Sc

B. V

C. Cr

D. Fe

Answer: c

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15. Transition metals and many of their compounds show paramagnetic behaviour where there are unpaired electron or electrons. The magnetic moment arises from the spin and orbital motions in ions or molecule.

Magnetic moment of n unpaired electrons is given as

$$\mu = \sqrt{n(n + 2)} \text{ Bohr magneton}$$

Magnetic moment increases as the number of unpaired electrons increases.

Q. Magnetic moments of $Cr(Z = 24)$, $Mn^{\oplus}(Z = 35)$ and $Fe^{2+}(Z = 36)$ are x, y and z respectively. Which of the following order is correct?

A. $x < y < z$

B. $x = y < z$

C. $z < x = y$

$$D. x = y = z$$

Answer: c

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16. Transition metals and many of their compounds show paramagnetic behaviour where there are unpaired electron or electrons. The magnetic moment arises from the spin and orbital motions in ions or molecule.

Magnetic moment of n unpaired electrons is given as

$$\mu = \sqrt{n(n + 2)} \text{ Bohr magneton}$$

Magnetic moment increases as the number of unpaired electrons increases.

Q. There are three unpaired electrons in $[Co(H_2O)_6]^{2+}$ and calculated value of magnetic moment on the basis of $\sqrt{n(n + 2)}$ formula is 3.87 BM. which is lower than the experimental value of 4.40 BM. The reason for this difference is due to

A. increase in number of unpaired electrons during determination

- B. Some contribution of the orbital motion of the electrons to the magnetic moment
- C. d-d transition
- D. Experimental error

Answer: b

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17. Transition metals and many of their compounds show paramagnetic behaviour where there are unpaired electron or electrons. The magnetic moment arises from the spin and orbital motions in ions or molecule.

Magnetic moment of n unpaired electrons is given as

$$\mu = \sqrt{n(n + 2)} \text{ Bohr magneton}$$

Magnetic moment increases as the number of unpaired electrons increases.

Q. Magnetic moment of $[Ni(CN)_4]^{2-}$ is zero but that of $[Ni(H_2O)_4]^{2+}$ is $2.83BM$. is because of:

A. CN^\ominus is a strong ligand making two unpaired electrons in Ni^{2+} to pair up, while in $[Ni(H_2O)_4]^{2+}$ two electrons remain unpaired as H_2O is a weak ligand.

B. Different oxidation state of Ni in two complexes

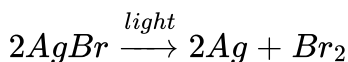
C. Both (a) and (b)

D. none of the above

Answer: a

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18. Photography is based on the nature of silver halides. Except AgF , the silver halides are photosensitive. These undergo decomposition in light and turn black due to formation of free silver.



The photography films are prepared by adding 20% aqueous solution of $AgNO_3$ to NH_4Br solution containing gelatin. When such a film is

exposed, emulsion gets affected and a latent image is formed on the film.

When this exposed film or plate is dipped in a developer which contains a reducing agent, the part affected most during exposure are reduced to the maximum. The image becomes visible. It is called a negative. The remaining sensitive emulsion on the negative is removed by dissolving it in hypo solution (fixer). Finally, a positive of the negative already prepared is made on silver bromide paper.

Q. The compound formed on the unexposed photographic film or plate is

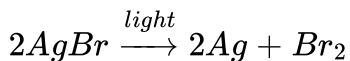
- A. silver nitrate
- B. ammonium bromide
- C. diammine silver bromide
- D. silver bromide

Answer: d



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19. Photography is based on the nature of silver halides. Except AgF, the silver halides are photosensitive. These undergo decomposition in light and turn black due to formation of free silver.



The photography films are prepared by adding 20 % aqueous solution of $AgNO_3$ to NH_4Br solution containing gelatin. When such a film is exposed, emulsion gets affected and a latent image is formed on the film.

When this exposed film or plate is dipped in a developer which contains a reducing agent, the part affected most during exposure are reduced to the maximum. The image becomes visible. It is called a negative. The remaining sensitive emulsion on the negative is removed by dissolving it in hypo solution (fixer). Finally, a positive of the negative already prepared is made on silver bromide paper.

Q. The exposed part of the film or plate after developing contains

A. Silver metal

B. Silver oxide

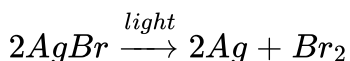
C. Silver bromide

D. Silver nitrate

Answer: a

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20. Photography is based on the nature of silver halides. Except AgF, the silver halides are photosensitive. These undergo decomposition in light and turn black due to formation of free silver.



The photography films are prepared by adding 20% aqueous solution of $AgNO_3$ to NH_4Br solution containing gelatin. When such a film is exposed, emulsion gets affected and a latent image is formed on the film.

When this exposed film or plate is dipped in a developer which contains a reducing agent, the part affected most during exposure are reduced to the maximum. The image becomes visible. It is called a negative. The

remaining sensitive emulsion on the negative is removed by dissolving it in hypo solution (fixer). Finally, a positive of the negative already prepared is made on silver bromide paper.

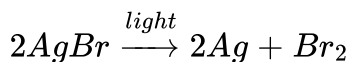
Q. Silver halides are used in photography because these compounds

- A. are insoluble in water
- B. are affected by light
- C. are soluble in ammonia solution
- D. easily stick on the surface of photographic plate or film

Answer: b

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21. Photography is based on the nature of silver halides. Except AgF, the silver halides are photosensitive. These undergo decomposition in light and turn black due to formation of free silver.



The photography films are prepared by adding 20% aqueous solution

of $AgNO_3$ to NH_4Br solution containing gelatin. When such a film is exposed, emulsion gets affected and a latent image is formed on the film.

When this exposed film or plate is dipped in a developer which contains a reducing agent, the part affected most during exposure are reduced to the maximum. The image becomes visible. It is called a negative. The remaining sensitive emulsion on the negative is removed by dissolving it in hypo solution (fixer). Finally, a positive of the negative already prepared is made on silver bromide paper.

Q. The solution of the developer consists of

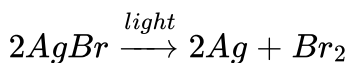
- A. Alkaline solution of pyrogallol
- B. Alkaline solution of quinil
- C. Either (a) or (b)
- D. Neither (a) nor (b)

Answer: c



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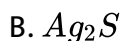
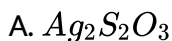
22. Photography is based on the nature of silver halides. Except AgF, the silver halides are photosensitive. These undergo decomposition in light and turn black due to formation of free silver.

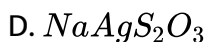
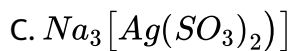


The photography films are prepared by adding 20% aqueous solution of $AgNO_3$ to NH_4Br solution containing gelatin. When such a film is exposed, emulsion gets affected and a latent image is formed on the film.

When this exposed film or plate is dipped in a developer which contains a reducing agent, the part affected most during exposure is reduced to the maximum. The image becomes visible. It is called a negative. The remaining sensitive emulsion on the negative is removed by dissolving it in hypo solution (fixer). Finally, a positive of the negative already prepared is made on silver bromide paper.

Q. Silver bromide dissolves in hypo solution forming:





Answer: c



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23. In any transition series, from left to right, the d-orbitals are progressively filled and their properties vary accordingly.

Q. In the second transition series, the largest number of oxidation states are shown by

A. Tc

B. Ru

C. Rh

D. Pd

Answer: c

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24. In any transition series, from left to right, the d-orbitals are progressively filled and their properties vary accordingly.

Q. Which element do you expect to have the smallest atomic radius?

A. La

B. Zn

C. Sc

D. Hg

Answer: b

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25. In any transition series, from left to right, the d-orbitals are progressively filled and their properties vary accordingly.

Q. Which element do you expect to have the highest melting point?

A. La

B. W

C. Pt

D. Os

Answer: b

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26. In any transition series, from left to right, the d-orbitals are progressively filled and their properties vary accordingly.

Q. Which of the following pair of compounds is expected to exhibit same colour in aqueous solution?

A. $FeCl_2$, $CuCl_2$

B. $VOCl_2$, $CuCl_2$

C. $VOCl_2$, $FeCl_2$

D. $FeCl_2$, $MnCl_2$

Answer: b

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27. In any transition series, from left to right, the d-orbitals are progressively filled and their properties vary accordingly.

Q. Which of the following is the correct order of second ionisation energy ?

A. $V > Cr > Mn$

B. $V < Cr < Mn$

C. $V < Cr > Mn$

D. $V > Cr < Mn$

Answer: c

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28. $KMnO_4$ reacts with $Na_2S_2O_3$ in acidic, strongly basic and aqueous (neutral) media. 100mL of $LMnO_4$ reacts with 100 mL of $0.1\text{ M } Na_2S_2O_3$ in acidic, basic and neutral media.

Q. The molarity (M) of $KMnO_4$ solution in the acidic medium is

A. 0.2 M

B. 0.02M

C. 0.4 M

D. 0.04 M

Answer: b



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29. $KMnO_4$ reacts with $Na_2S_2O_3$ in acidic, strongly basic and aqueous (neutral) media. 100mL of $LMnO_4$ reacts with 100 mL of $0.1\text{ M } Na_2S_2O_3$ in acidic, basic and neutral media.

Q. The molarity (M) of $KMnO_4$ solution in basic medium is:

- A. 0.8 M
- B. 0.08 M
- C. 0.26 M
- D. 0.026M

Answer: a

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30. $KMnO_4$ reacts with $Na_2S_2O_3$ in acidic, strongly basic and aqueous (neutral) media. 100mL of $LMnO_4$ reacts with 100 mL of $0.1\text{ M } Na_2S_2O_3$ in acidic, basic and neutral media.

Q. The molarity (M) of $KMnO_4$ in aqueous medium is

- A. 0.8M
- B. 0.08M
- C. 0.26M
- D. 0.026M

Answer: c



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31. $KMnO_4$ reacts with $Na_2S_2O_3$ in acidic, strongly basic and aqueous (neutral) media. 100 mL of $LMnO_4$ reacts with 100 mL of $0.1\text{ M } Na_2S_2O_3$ in acidic, basic and neutral media.

Q. The molality (m) of $KMnO_4$ in the acidic medium is (Density of $KMnO_4$) solution = $1.58^{-1}\text{ Mw}(KMnO_4) = 158\text{ gmol}^{-1}$)

A. 0.025

B. 0.25

C. 0.12

D. 0.012

Answer: d



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1. dz^2 orbital is involved in which of the following hybridisation?

A. sp^3d

B. dsp^3

C. sp^3d^2

D. d^2sp^3

Answer: a,b

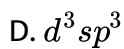
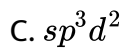


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2. d_{xy} , d_{yz} and d_{xz} orbitals is involved in which of the following hybridisation?

A. dsp^2

B. sp^3d

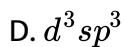
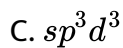
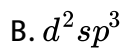
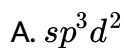


Answer: c,d



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3. $d_{x^2-y^2}$ and d_{z^2} orbitals is involved in which of the foollowing hybridisation?



Answer: a,b



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4. $d_{x^2 - y^2}$ orbital is involved in which of the following hybridisation ?

A. sp^3d

B. sp^3d^2

C. sp^3d^3

D. None of these

Answer: b,c



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5. Which of following is/are correctly matched ?

A. d-block element: Electronic configuration is $ns^{0-2}(n-1)d^{1-10}$

B. p-block element: electronic configuration is $ns^{1-2}np^{1-6}$

C. s-block element: electronic configuration is ns^{1-2}

D. Ce: f-block's first member

Answer: a,c,d

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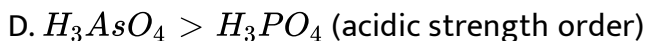
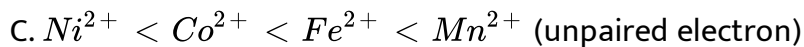
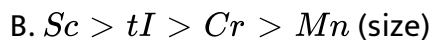
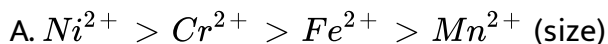
6. Which of the following is False?

- A. Cr_g^{2+} ion has greater magnetic moment as compared to Co_g^{3+} .
- B. The magnitude of ionisation potential of iron anion (monoanion) would be equal to electron gain enthalpy of iron.
- C. Lanthanoids contraction is cause of lower IE of Pb than Sn.
- D. If successive ionisation energy are 332,738,849,4080,4958 (in $\frac{kJ}{mol}$).
- Then this element can be of 15th group.

Answer: a,c,d

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7. Which of the following represents the incorrect order of the properties indicated?



Answer: a,d



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8. What will be the correct representation of quantum numbers of the last electron entered into Ce?

A. $n = 1, l = 3, m = -3, s = \frac{-1}{2}$

B. $n = 4, l = 3, m = 0, s = \frac{-1}{2}$

C. $n = 4, l = 2, m = -3, s = \frac{+1}{2}$

$$D. n = 4, l = 3, m = +2, s = \frac{-1}{2}$$

Answer: a,b,d



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9. Which is true statement about $KMnO_4$?

- A. Its solution is unstable in acidic medium.
- B. It has purple colour.
- C. MnO_4^\ominus changes to Mn^{2+} in basic solution.
- D. It is self indicator in Fe^{2+} or $C_2O_4^{2-}$ titration.

Answer: a,b,d



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10. Out of $[Fe(CN)_6]^{4-}$, $[Ni(CN)_4]^{2-}$, and $[Ni(CO)_4]$: select the incorrect Statement(s):

A. All have identical geometry

B. All are paramagnetic

C. all are diamagnetic

D. $[Fe(CN)_6]^{4-}$ is diamagnetic but $[Ni(CN)_4]^{2-}$ and $[Ni(CO)_4]$ are paramagnetic

Answer: a,b,d



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11. The ability of d-block elements to form complexes is due to:

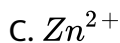
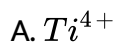
A. Small and highly charged ions

- B. Vacant low energy orbitals to accept lone pair of electrons from ligands
- C. Low polarising power of cation
- D. None is correct

Answer: a,b

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12. Which one of the following ionic species will not impart colour to an aqueous solution?



Answer: a,b,c



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13. A transition element X has a configuration $3d^4$ in its +3 oxidation state. Its atomic number is not

A. 25

B. 26

C. 22

D. 19

Answer: b,c,d



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14. The transition metals which do not form amalgams are

A. Zn

B. Fe

C. Cd

D. Pt

Answer: b,c



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15. The colour of the transition metal ions is due to

A. d-d transition

B. Charge transfer

C. Change in the geometry

D. None

Answer: a,b



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16. Transition elements have greater tendency to form complexes because

- A. They have vacant d-orbitals
- B. They have large size
- C. They show variable oxidation state
- D. They have two electrons in their outermost shells.

Answer: a,c,d



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17. Which out of the following belong to 3d-series?

- A. Copper
- B. Cobalt
- C. Gold

D. Silver

Answer: a,b



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18. The elements which exist in the liquid state at room temperature are.

A. Na

B. Br_2

C. Hg

D. Ga

Answer: b,c,d



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19. Which of the following statements (s) is (are) correct with reference to the 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 brown colour with ammonium thiocyanate.

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 brown colour with ammonium thiocyanate.

Answer: a,b,c



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20. Which of the following represents the correct order of the properties indicated?

A. $Ni^{2+} > Cr^{2+} > Fe^{2+} > Mn^{2+}$ (size)

B. $Sc > Ti > Cr > Mn$ (size)

C. $Ni^{2+} < Co^{2+} < Fe^{2+} < Mn^{2+}$ (unpaired electron)

D. $Cr^{3+} > Cr^{2+}$ (magnetic moment)

Answer: b,c

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21. The correct statement for d-block element is

A. it shows magnetic property

B. It has variable valency

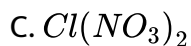
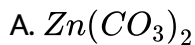
C. It has tendency of formation of coloured ions.

D. it has complete d-orbitals.

Answer: a,b,c

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22. The aqueous solution of the salt will be coloured in the case of



Answer: c,d



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23. Potassium manganate (K_2MnO_4) is formed when

A. Chlorine is passed through aqueous $KMnO_4$ solution

B. Manganese dioxide is fused with potassium hydroxide in air

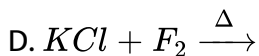
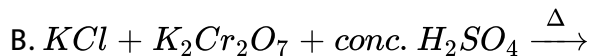
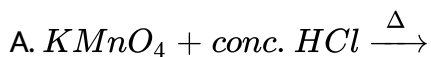
C. Formaldehyde reacts with potassium

D. Potassium permanganate reacts with H_2SO_4

Answer: b,c

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24. Cl_2 gas is obtained by various reactions select the reactions from the following (s):



Answer: a,c,d

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25. Which is /are true statement?

- A. Ions of d-block elements are coloured due to d-d transition.
- B. Ions of f-block elements are coloured due to f-f transition.
- C. $[Sc(H_2O)_6]^{3+}$, $[Ti(H_2O)_6]^{4+}$, are coloured complexes.
- D. Cu^{\oplus} is colourless ion.

Answer: a,b,d



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26. In $[Fe(CN)_5(NO)]^{2-}$, Fe has +2 state. It cannot be decided by

- A. Magnetic measurement
- B. Colligative property
- C. Colour Hybridisation
- D.

Answer: b,c,d

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27. Which one of the following statement is/are correct?

A. Zinc dissolves in sodium hydroxide solution.

B. Carbon monoxide reduces iron (III) oxide to iron.

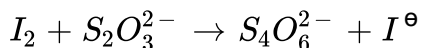
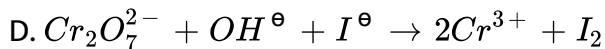
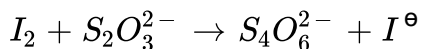
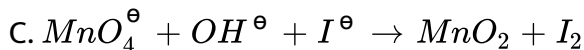
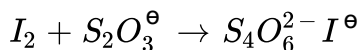
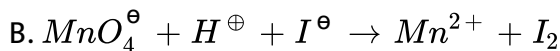
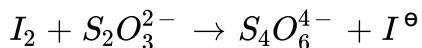
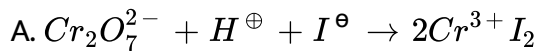
C. Mercury (II) iodide dissolves in excess of potassium iodide solution

D. Tin (IV) chloride is made by dissolving tin solution in concentrated hydrochloric acid.

Answer: a,b,c

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28. In the iodometric estimation in the laboratory which process is involved?



Answer: a,b



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1. In general the melting and boiling points of transition metals

- A. increases gradually across the period from left to right
- B. decreases gradually across the period from left to right
- C. first increases till the middle of the period and then decreases towards the end
- D. First decreases regularly till the middle of the period and then increases towards the end.

Answer: c



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2. Which metal has the highest melting point?

A. Pt

B. W

C. Pd

D. Au

Answer: b

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3. Which metal has the lowest melting point?

A. Cs

B. Na

C. Hg

D. Sn

Answer: c

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4. Which of the following electronic structures refers to transition elements?

A. 2, 8, 18, 5

B. 2, 8, 14, 2

C. 2, 8, 18, 32, 18, 8, 1

D. 2, 8, 5

Answer: b



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5. 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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6. The electronic configuration of actinides Cannot be assigned with degree of certainty because of

A. Small energy difference between 5f and 6d levels

B. overlapping of inner orbitals

C. Free movement of electrons over all the orbitals

D. None of above

Answer: a

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7. The second series of transition element start with

- A. Ytterium
- B. Yttrium
- C. Scandium
- D. Rhodium

Answer: a



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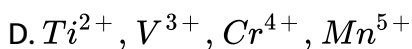
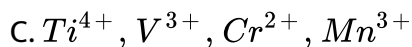
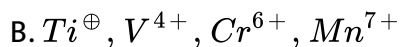
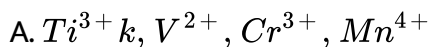
8. Which of the following does not belong to 3d series of transition elements?

- A. Titanium
- B. Iron
- C. Palladium
- D. Vanadium

Answer: c

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9. Among the following series of transition metal ions the one where all metal ions have $3d^2$ electronic configuration is



Answer: d

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10. The first ionisation energies of the elements of the first transition series ($Ti \rightarrow Cu$)

- A. Increases as the atomic number increases
- B. Decreases as the atomic number increases
- C. Do not show any change as the addition of electrons takes place in the inner $(n - i)$ d-orbitals.
- D. Increases from Ti to Mn and then decreases from Mn to Cu.

Answer: a



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11. Which has the largest radius?



Answer: d



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12. 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 ionisation enthalpy?

A. V

B. Cr

C. Mn

D. Fe

Answer: b



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13. The first ionisation energies of the elements of the transition series.

A. Increases as the atomic number increases

- B. Decreases as the atomic number increases
- C. Do not show any change as the addition of electrons takes place in the inner $(n - 1)$ d-orbitals.
- D. None of these

Answer: a

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14. Among 3d transition series the IE

- A. Increases regularly in moving from left to right
- B. Decrease regularly in moving from left to right
- C. Remains constant within the period
- D. increases gradually within the period but the relativ increase is not sharp.

Answer: d



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15. Which of the following is the most suitable description of transition elements?

- A. Low melting points
- B. No catalytic activity
- C. Show variable oxidation states
- D. Exhibit inert pair effect

Answer: c



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Exercises Single Correct D-Block Elements (Colour)

1. The tendency of the transition elements to form coloured compounds is attributed to

- A. Transition of electrons from one atom to the other
- B. Transition of electrons from s-orbitals of then outer shells to p-orbitals.
- C. d-d-transition in last but one shell.
- D. None of the reason is correct.

Answer: c



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2. Which of the following compound is not cooured?

- A. Copper (II) sulphat
- B. Zinc(II) chloride

C. Chromium(II) sulphate

D. Manganese(II) oxalate

Answer: b

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3. Anhydrous cobalt(II) chloride is blue in blue in colour but on dissolving in water it changes to pink in colour because

A. its oxidation state changes

B. Its magnetic character changes

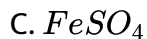
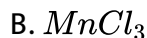
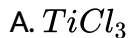
C. its coordination number changes

D. in water it shows fluorescence

Answer: c

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1. Which of the following contains the maximum number of unpaired electrons?

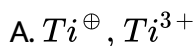


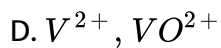
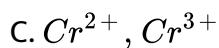
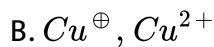
Answer: b



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2. Among the following pairs of ions the lower oxidation state in aqueous solution is more stable than the other in





Answer: d

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3. In general, the Transition elements exhibit their highest oxidation states in their compounds with elements like:

A. C

B. S

C. S and P

D. F and O

Answer: d

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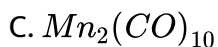
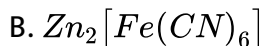
4. Within each transition series, the oxidation states

- A. decreases regularly in moving from left to right
- B. first increase till the middle of period and then decreases
- C. first decreases till the middle of period and then
- D. None of the trend is correct.

Answer: b

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5. In which of the following complexes the metal ion is in zero oxidation state?





Answer: c



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6. The maximum oxidation state shown by

$V(Z = 23)$, $Cr(Z = 24)$, $Co(Z = 27)$, $Sc(Z = 21)$, are respectively

A. +5, +6, +2, +3

B. +3, +4, +5, +2

C. +3, +4, +5, +2

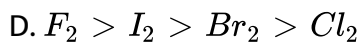
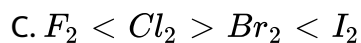
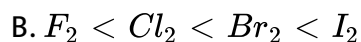
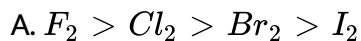
D. +4, in each case

Answer: a



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1. In general the order of reactivity of halogens with transition metals is



Answer: a

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2. Which of the following cannot reduce the acidified solution of permanganate?



B. H_2

C. Nascent hydrogen

D. Fe^{2+} ions

Answer: b

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3. Which of the following can be employed for the conversion of potassium manganate to potassium permanganate?

A. O_3

B. Cl_2

C. Electrolysis

D. All

Answer: d

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

- A. CrO_5
- B. Cr_2O_3
- C. CrO_4
- D. CrO_3

Answer: a

 [Watch Video Solution](#)

5. The equilibrium $Cr_2O_7^{2-} \rightleftharpoons 2CrO_4^{2-}$

- A. exist in acidic maximum
- B. exists in basic medium
- C. Exists in neutral medium

D. It does not exist

Answer: b

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6. Which of the following compounds is used as the starting material for the preparation of potassium dichromate?

A. $K_2SO_4 \cdot Cr_2(SO_4)$

B. $PbCrO_4$ (chrome yellow)

C. $FeCr_2O_4$ (chromite)

D. $PbCrO_4 - 4PbO$ (chrome red)

Answer: c

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7. The image on an exposed and developed photographic film is due to

A. $AgBr$

B. $[Ag(C_2O_3)_2]^{3+}$

C. Ag

D. Ag_2O

Answer: c



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8. During titration H_2SO_4 is preferably used over HCl and HNO_3 to make the solution acidic because

A. H_2SO_4 is a strong oxidising agent and it reacts with $KMnO_4$ during titration

B. Some $KMnO_4$ is consumed during the reaction with H_2SO_4

C. H_2SO_4 does not react with $KMnO_4$ or the reducing agent used

D. H_2SO_4 can turn colourless $KMnO_4$ to pink at the end point

Answer: c

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9. When $KMnO_4$ is added to oxalic acid, the decolourisation is slow in the beginning but becomes instantaneous after sometime because

A. Mn^{2+} acts as autocatalyst

B. CO_2 is formed as the oproduct

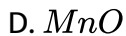
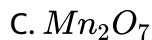
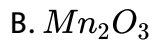
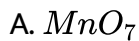
C. Reaction is exothermic

D. MnO_4^\ominus catalyses the reaction.

Answer: a

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10. Which of the following of manganese is amphoteric?



Answer: a



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11. Number of moles of $K_2Cr_2O_7$ reduced by one mole of Sn^{2+} ion is

A. $\frac{1}{3}$

B. 3

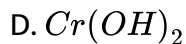
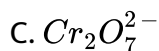
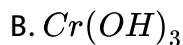
C. $\frac{1}{6}$

D. 6

Answer: a

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12. CrO_3 dissolves in aqueous NaOH to give

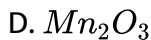
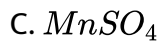
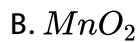
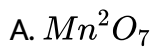


Answer: a

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13. An explosion takes place when conc. H_2SO_4 is added to $KMnO_4$.

Which of the following is formed?



Answer: a

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14. Formation of interstitial compound makes the transition metal

A. More soft

B. More ductile

C. More metallic

D. More hard

Answer: d

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15. The lanthanide contraction relates to

- A. Atomic radii
- B. Atomic as well as M^{3+} radii
- C. Valence electrons
- D. Oxidation states



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16. The properties of Zr and Hf are similar because

- A. Both belong to d-block
- B. Both belong to same group of the periodic table
- C. both have similar radii
- D. both have same number of electrons

Answer: c

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17. Cerium shows oxidation state of +4 because

- A. It resembles alkali metals
- B. It has very low IE
- C. it has tendency to attain noble gas configuration
- D. It has tendency to attain f^0 configuration

Answer: d

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18. Which of the two have almost similar size

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

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

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

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

Answer: b

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19. Which of the following statement is not correct?

A. $\text{La}(\text{OH})_3$ is less basic than $\text{Lu}(\text{OH})_3$

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

- A. 4f-subshell-half filled
- B. 4f subshell-completely filled
- C. Possesses the general electronic configuration of noble gases
- D. 4f-subshell empty.

Answer: a



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21. Arrange (I) Cr^{3+} , (II) La^{3+} , (III) Pm^{3+} and (IV) Yb^{3+} in increasing order of their ionic radii.

- A. $IV < III < I < II$
- B. $I < IV < III < II$

C. $IV < III < II < I$

D. $III < II < I < IV$

Answer: a

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22. 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. 160 pm

B. 140 pm

C. 106 pm

D. 85 pm

Answer: d

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23. Lanthanides and actinides resemble in

- A. Electron configuration
- B. Oxidation state
- C. Ionisation energy
- D. Formation Complexes

Answer: d



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24. Misch metal is

- A. An alloy of aluminium
- B. A mixture of chromium and lead chromate
- C. An alloy of lanthanoid metals
- D. An alloy of copper

Answer: c

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

- A. An oxidising agent
- B. A reducing agent
- C. Can act either of these
- D. Can act as redox agent

Answer: b

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26. Which transition metal has lowest density?

- A. Sc

B. Ti

C. Zn

D. La

Answer: a

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27. Among the transition elements the element with lowest melting point belongs to

A. Group 3

B. group 11

C. group 6

D. group 12

Answer: d

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28. The stability of particular oxidation state of a metal in aqueous solution is determined by

- A. Enthalpy of sublimation of the metal
- B. Ionisation energy
- C. Enthalpy of hydration of the metal ion
- D. All of these

Answer: d

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29. Which of the following is not a condition for complex formation?

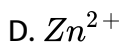
- A. Small atomic size
- B. High nuclear charge
- C. Variable oxidation states

D. Availability of vacant d orbitals

Answer: c

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30. Which is not amphoteric?



Answer: c

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31. Both acid and base may react with which of the following oxides?

A. CaO

B. Na_2O_2

C. ZnO

D. Mn_3O_4

Answer: c

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32. Coinage metals show the properties of

A. Typical elements

B. Normal elements

C. Transitional elements

D. Inert elements

Answer: c

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33. When $(NH_4)_2CrO_2O_7$ is heated, the gas evolved is

A. N_2

B. NO_2

C. O_2

D. Na_2O

Answer: a



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34. Which of the following oxides of Cr is amphoteric.

A. CrO_2

B. Cr_2O_3

C. CrO_5

D. CrO_3

Answer: a



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Exercises Single Correct Compounds Of Transition Elements (Iron)

1. Important ore of iron is

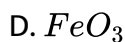
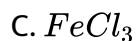
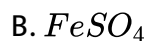
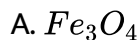
- A. Garnierite
- B. Pentlandite
- C. Haematite
- D. Smaltite

Answer: c



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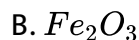
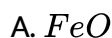
2. A compound of iron exists as a dimer in vapour state. It is hygroscopic in nature and dissolves in water giving brown acidic solution. The compound is



Answer: c

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3. Which among FeO and Fe_2O_3 is more basic?



C. both have same basic length

D. None of them is basic

Answer: a

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4. The colour of FeF_3 is

A. Brown

B. Red Brown

C. Light green

D. White

Answer: d

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5. Iron is obtained on a large scale from Fe_2O_3 by

- A. Reduction with Al
- B. Smelting with carbon
- C. Calcination
- D. Water gas

Answer: b

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6. The deep red colour of $Fe(SCN)_3$ and $Fe(SCN)_4^\ominus$ is destroyed by addition of :

- A. F^\ominus
- B. CN^\ominus
- C. SCN^\ominus
- D. Fe^\ominus

Answer: a



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Exercises Single Correct Compounds Of Transition Elements (Copper)

1. On heating copper nitrate strongly the compound obtained is

- A. Copper
- B. Copper oxide
- C. Copper nitrite
- D. Copper nitride

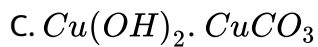
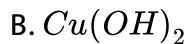
Answer: b



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2. Which of the following is fool's gold?

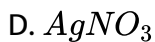
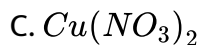
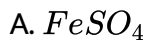
- A. $CuFeS_2$



Answer: a

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3. Bordeaux mixture consists of lime and



Answer: b

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4. In vapour state $Cu(NO_3)_2$ and $Cu_2(CH_3COO)_4 \cdot 2H_2O$ exist as

- A. Dimer, monomer
- B. monomer, dimer
- C. monomer, monomer
- D. dimer, dimer

Answer: b



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Exercises Single Correct Compounds Of Transition Elements (Silver)

1. Which of the following is known as WORM SILVER?

A. $AgCl$

B. A specific horn, type article made of silver

C. Ag_2S

D. PbS containing traces of Ag_2S

Answer: a

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2. It is always advisable not to cover egg yolk or mustard with silver cutlery because

A. Silver reacts with water of egg yolk to form $AgOH$

B. Silver reacts with sulphur of egg yolk forming black Ag_2S

C. silver reacts with egg yolk forming Ag_2SO_4 which is a poisonous substance.

D. Silver attracts UV light of the atmosphere, thereby spoiling the food.

Answer: b



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3. Silver halides are used in photography because they are

- A. Photosensitive
- B. Soluble in hyposolution
- C. Soluble in NH_4OH
- D. Insoluble in acids

Answer: a



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4. Which of the following false?

- A. molten lead and zinc are miscible
- B. silver is more soluble in molten zinc than lead

C. zinc-silver alloy is volatile

D. zinc-silver alloy is heavier and gets solidified later than lead

Answer: d

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5. $AgNO_3$ gives red ppt. with.

A. NaI

B. KCl

C. $NaNO_3$

D. Na_2CrO_4

Answer: d

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1. percentage of gold in 21.6 carat gold is

- A. 21.8 %
- B. 90 %
- C. 10 %
- D. 70 %

Answer: b

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2. Gold dissolves in aqua regia forming

- A. $Au(NO_3)_2$
- B. $H[AuCl_4]$
- C. $AuCl$

D. $AuNO_3$

Answer: b

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3. The process of extraction of Au and Ag ores is based on their solubility in

A. NH_3

B. HCl

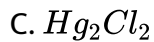
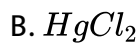
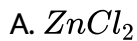
C. HNO_3

D. KCN

Answer: d

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1. Which of the following is used as purgative in medicine?

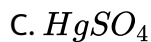
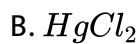
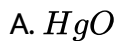


Answer: c



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2. The roasting of HgS in air produces



Answer: d



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3. Which of the following is used as a white pigment?

A. ZnO

B. Na_2ZnO_2

C. ZnS

D. $ZnCO_3$

Answer: a



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4. Mercury (I) chloride sublimes when this compound is heated and the vapours it gives off are called the substance collected consists of

- A. Mercury (II) chloride
- B. Mercury (I) and mercury (II) chlorides
- C. Mercury (II) chloride and mercury
- D. mercury

Answer: d

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Exercises Single Correct Compounds Of Transition Elements (Zinc)

1. White vitriol is

- A. $CuSO_{4.5}H_2O$
- B. $FeSO_{4.7}H_2O$
- C. $ZnSO_{4.7}H_2O$
- D. $NiSO_{4.5}H_2O$

Answer: c

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2. When zinc reacts with very dilute nitric acid it produces

A. NO

B. NH_4, NO_3

C. NO_2

D. H_2

Answer: b

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3. Lithapone is a mixture of

A. $ZnSO_4, BaSO_4$

B. ZnS , $BaSO_4$

C. $ZnCO_3$, $BaSO_3$

D. ZnS , HNO_3

Answer: b



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Exercises Single Correct Compounds Of Transition Elements (Miscellaneous Compounds)

1. Iron is rendered passive by treatment with

A. H_2SO_4 is a strong oxidising agent and it reacts with $KMnO_4$

during titration

B. H_3PO_4

C. HCl

D. conc. HNO_3

Answer: d



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2. Nitriding is a process of hardening steel by treating it in an atmosphere of

A. NH_3

B. O_3

C. N_2

D. H_2O

Answer: a



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3. Which of the following is used for joining the broken pieces of glass and stones?

A. Heamatite

B. Sindoor

C. Massicot

D. German silver

Answer: c



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4. Which method is based on distribution principle?

A. Mond's process

B. Plattner's principle

C. Glower's process

D. Parke's process

Answer: d



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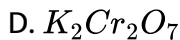
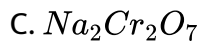
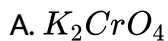
5. Which of the following statement is wrong?

- A. An acidified solution of $K_2Cr_2O_7$ liberated iodine from iodides
- B. In acidic solution dichromate ions are converted to chromate ions
- C. Ammonium dichromate on heating undergo exothermic decomposition to give Cr_2O_3
- D.

Answer: b

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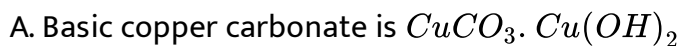
6. When H_2S has is passed through an orange red solution (X), the solution turns milky. When an alkali is added to this orange red solution it turns yellow and on acidifying this yellow solution again turns orange red. X is



Answer: d

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7. Which of the following statement is incorrect?



B. On strong heating potassium dichromate decomposes with evolution of oxygen

C. CuS is white in colour

D. $KMnO_4$ exists as dark purple black prismatic crystals

Answer: c



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8. A man made white silvery metal,radioactive innature has a strong tendency to form oxocations and complexes. It is used as nuclear fuel in atomic reactors. The metal is a

- A. Lanthanide
- B. Actinide
- C. Transition metal representative element
- D. S block element

Answer: b



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9. From a solution of $CuSO_4$ the metal used to recover copper is

- A. Na

B. *Ag*

C. *Hg*

D. *Fe*

Answer: d

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10. Iron, once dipped in concentrated H_2SO_4 , does not displace copper from copper sulphate solution, because

A. It is less reactive than copper

B. A layer of sulphate is deposited on it

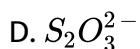
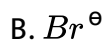
C. An inert layer of iron oxides is deposited on it

D. All valence electrons of iron are consumed

Answer: c

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11. Which of the following ions will finally give a black precipitate with Ag^{\oplus} ion?



Answer: d



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12. The compound which gives oxygen on moderate heating is

A. Zinc oxide

B. Mercuric oxide

C. Aluminium oxide

D. Ferric oxide

Answer: b

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13. Identify the statement which is not correct regarding $CuSO_4$?

A. It reacts with KI to give iodine

B. It reacts with KCl to give Cu_2Cl_2

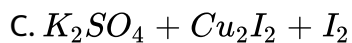
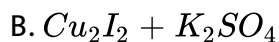
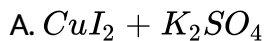
C. It reacts with $NaOH$ and glucose to give Cu_2O

D. It gives CuO on strong heating in air

Answer: b

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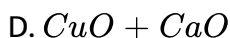
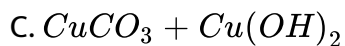
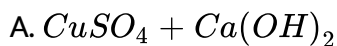
14. KI and $CuSO_4$ solutions when mixed give



Answer: c

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15. Bordeaux used a fungicide is a mixture of



Answer: a

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16. Mercury is the only metal which is liquid at $0^{\circ}C$ this is due to its

- A. Very high ionisation energy and weakly metallic bond
- B. Low ionisation potential
- C. High atomic weight
- D. High vapour pressure

Answer: a



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17. Which of the following is false for Hg ?

- A. It can evolve hydrogen from H_2S
- B. It is metal
- C. It has high specific heat

D. It is less reactive than hydrogen

Answer: a



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18. Which compound is volatile on heating?

A. $MgCl_2$

B. $HgCl_2$

C. $ZnCl_2$

D. None of these

Answer: b



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19. Which one of the following pairs of substances on reaction will not evolve H_2 gas?

- A. Iron and H_2SO_4
- B. Iron and steam
- C. Copper and HCl
- D. Sodium and ethyl alcohol

Answer: c



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20. Which of the following is not the characteristic of zinc?

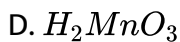
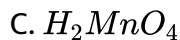
- A. It is volatile metal
- B. It dissolves in alkali forming sodium zincate
- C. It is brittle at very high temperature

D. Zinc dust is used as a reducing agent

Answer: c

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21. The correct formula of permanganic acid is



Answer: a

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1. Assertion: The second ionisation energies of V, Cr and Mn are in the order $V < Cr < Mn$.

Reason: Ionisation energies show a regular increase along a period with increase of atomic number.

- A. If both (A) and (R) are correct and (R) is the correct explanation of (A).
- B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).
- C. If (A) is correct, but (R) is incorrect.
- D. If (A) is incorrect but (R) is correct.

Answer: d

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2. Assertion: The metals of 4d and 5d greater enthalpies of atomisation than the corresponding elements of the 3d series.

Reason: The metal-metal bond in 4d and 5d series are stronger than those in the 3d series.

- A. If both (A) and (R) are correct and (R) is the correct explanation of (A).
- B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).
- C. If (A) is correct, but (R) is incorrect.
- D. If (A) is incorrect but (R) is correct.

Answer: a



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3. Assertion: Mercury is not considered as a transition element.

Reason: Mercury is liquid.

- A. If both (A) and (R) are correct and (R) is the correct explanation of (A).
- B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).
- C. If (A) is correct, but (R) is incorrect.
- D. If (A) is incorrect but (R) is correct.

Answer: b

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4. Assertion: Ti^{3+} salts are coloured whereas Ti^{4+} salts are white.

Reason: Ti^{3+} is less stable than Ti^{4+}

- A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect but (R) is correct.

Answer: b

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5. Assertion: Cu, Ag and Au lie in Group 11 of the periodic table. Hence their atomic radii are in the order $Cu < Ag < Au$

Reason: In any group of the transition elements, the atomic radii increase as we move down the group.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect but (R) is correct.

Answer: d

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6. Assertion: $K_2Cr_2O_7$ is used as primary standard in volumetric analysis.

Reason: It has a good solubility in water.

A. If both (A) and (R) are correct and (R) is the correct explanation of

(A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation

of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect but (R) is correct.

Answer: c



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7. Assertion: Tungsten has very high melting point.

Reason: Tungsten is a covalent compound.

- A. If both (A) and (R) are correct and (R) is the correct explanation of (A).
- B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).
- C. If (A) is correct, but (R) is incorrect.
- D. If (A) is incorrect but (R) is correct.

Answer: c



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8. Assertion: Manganese shows a number of oxidation states.

Reason: The difference of energy between 3d and 4s subshells is large.

- A. If both (A) and (R) are correct and (R) is the correct explanation of (A).
- B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).
- C. If (A) is correct, but (R) is incorrect.
- D. If (A) is incorrect but (R) is correct.

Answer: c



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9. Assertion: Equivalent mass of $KMnO_4$ is same in the neutral as well as alkaline medium.

Reason: The product formed in both cases in MnO_2

- A. If both (A) and (R) are correct and (R) is the correct explanation of (A).
- B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).
- C. If (A) is correct, but (R) is incorrect.
- D. If (A) is incorrect but (R) is correct.

Answer: a

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10. Assertion: In $Cr_2O_7^{2-}$ ion, all the $Cr - O$ bond lengths are equal.

Reason: In $Cr_2O_7^{2-}$ ion all the $O - Cr - O$ bond angles are equal.

- A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect but (R) is incorrect.

Answer: d

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11. Assertion: In any transition series the magnetic moment of M^{2+} ions first decreases

Reason: In a transition series, the number of unpaired electrons first increases and then decreases.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect but (R) is correct.

Answer: a



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12. Assertion: MnO is basic whereas Mn_2O_7 is acidic.

Reason: Higher the oxidation state of a transition metal in its oxide, greater is the acidic character.

A. If both (A) and (R) are correct and (R) is the correct explanation of

(A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation

of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect but (R) is correct.

Answer: a

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

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

- A. If both (A) and (R) are correct and (R) is the correct explanation of (A).
- B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).
- C. If (A) is correct, but (R) is incorrect.
- D. If (A) is incorrect but (R) is correct.

Answer: a

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14. Assertion: Mn atom loses ns electrons first during ionisation as compared to $(n - 1)d$ electrons

Reason: The effective nuclear charge experienced by $(n - 1)d$ electrons is greater than that by ns electrons.

- A. If both (A) and (R) are correct and (R) is the correct explanation of (A).
- B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).
- C. If (A) is correct, but (R) is incorrect.
- D. If (A) is incorrect but (R) is correct.

Answer: a



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15. Assertion: Actinoids show greater number of oxidation states than lanthanoids. Reason: Actinoids are radioactive.

- A. If both (A) and (R) are correct and (R) is the correct explanation of (A).
- B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).
- C. If (A) is correct, but (R) is incorrect.
- D. If (A) is incorrect but (R) is correct.

Answer: b

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16. Assertion: E^\ominus for $\frac{Mn^{3+}}{Mn^{2+}}$ is more positive than for $\frac{Cr^{3+}}{Cr^{2+}}$.

Reason: The third ionisation energy of Mn is larger than that of Cr.

- A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect but (R) is correct.

Answer: a

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17. Assertion: The spin only magnetic moment of Sc^{3+} is 1.73 BM.

Reason: The spin only magnetic momentum in (BM) is equal to $\sqrt{n(n+2)}$.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect but (R) is correct.

Answer: d

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18. Assertion: An aqueous solution of $FeCl_3$ is acidic.

Reason: It is due to cationic hydrolysis of Fe^{3+} ion to give $Fe(OH)_3$ and H^{\oplus} ions.

A. If both (A) and (R) are correct and (R) is the correct explanation of

(A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation

of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect but (R) is correct.

Answer: a



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19. Assertion: La should be the f-block element according to Aufbau principle.

- A. If both (A) and (R) are correct and (R) is the correct explanation of (A).
- B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).
- C. If (A) is correct, but (R) is incorrect.
- D. If (A) is incorrect but (R) is correct.

Answer: b



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20. Assertion: Mercurous compounds are diamagnetic.

Reason: Two Hg^{\oplus} species which have $6s^1$ configuration are bonded together using s-electrons.

- A. If both (A) and (R) are correct and (R) is the correct explanation of (A).
- B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).
- C. If (A) is correct, but (R) is incorrect.
- D. If (A) is incorrect but (R) is correct.

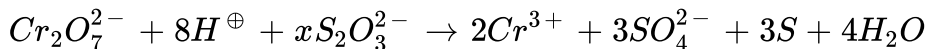
Answer: a



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Exercises Integer

1. What is the value of x in the following equation.

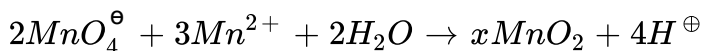


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2. What is the oxidation states of Cr in butterfly structure.

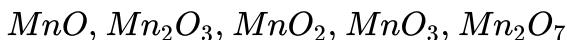
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3. What is the value of x in the following equation:



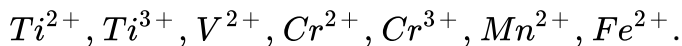
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4. Out of the following how many oxides are acidic.



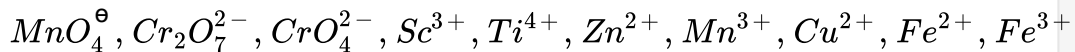
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5. Out of the following how many of them have magnetic moment value $\sqrt{24}BM$.



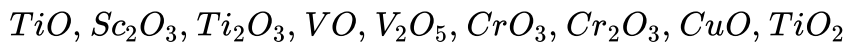
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6. Out of the following how many of them are coloured compounds.



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7. Out of the following how many oxides are basic:



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8. What is the value of x in the Wilkinson's catalyst in the hydrogenation of alkene.

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9. How many of the transition elements are called coinage metals.

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10. How many of the transition elements are called Platinum metals.

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Exercises Fill In The Blanks

1. The highest oxidation state exhibited by a transition elements is _____.



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2. _____ ion show maximum paramagnetic character among the bivalent ions of first transition series.



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3. Transition elements exhibit ____ oxidation states.



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4. The chromate ion in acidic medium changes to _____



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5. Lithapone is a mixture of $BaSO_4$ and _____.



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6. The transition metal present in the alloy gun metal is _____.

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7. $AgNO_3$ on heating forms _____, _____ and _____.

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8. Iron is _____ copper in the electrochemical series and hence displaces _____ from a solution of copper sulphate.

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9. When a solution of iron (II) salt is added to potassium ferricyanide solution, a _____ coloured product known as _____ is formed.

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10. Red form of HgS is used as a pigment under the name of _____.



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Exercises True False

1. Mn_2O_7 is a basic oxide.



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2. Fe_2O_4 is a mixed oxide of FeO and Fe_2O_3 .



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3. The orange colour of dichromate solution changes of blue on heating with alkalies due to the formation of chromate ions.



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4. Transition metal ions containing $(n - 1)d^0$ or $(n - 1)d^{10}$ configuration are only coloured.



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5. The transition elements are those elements which have partially filled penultimate d-subshells in their elementary form or in their commonly occurring oxidation states.



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6. Steel contains more carbon than wrought iron



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7. When iron is heated in oxygen, it forms ferrous ferric oxide (Fe_3O_4).

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8. Ferric chloride gives dark blue colour with ammonium thiocyanate solution.

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9. Blister copper is 98 % copper.

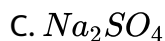
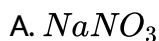
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10. silver nature is used for making inks and hair dyes.

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1. p-Amino-N,N-dimethylaniline is added to a strongly acidic solution of X. The resulting solution is treated with a few drops of aqueous solution of Y to yield blue colouration due to the formation of methylene blue. Treatment of aqueous solution of Y with reagent potassium hexacyanoferrate (II) leads to the formation of an intense blue precipitate. The precipitate dissolves on excess addition of the reagent. Similarly, the treatment of the solution of Y with the solution of potassium hexacyanoferrate (III) leads to a brown colouration due to the formation of Z.

Q. Compound X is

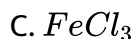
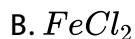
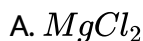


Answer: D

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2. p-Amino-N,N-dimethylaniline is added to a strongly acidic solution of X. The resulting solution is treated with a few drops of aqueous solution of Y to yield blue colouration due to the formation of methylene blue. Treatment of aqueous solution of Y with reagent potassium hexacyanoferrate (II) leads to the formation of an intense blue precipitate. The precipitate dissolves on excess addition of the reagent. Similarly, the treatment of the solution of Y with the solution of potassium hexacyanoferrate (III) leads to a brown colouration due to the formation of Z.

Q. Compound Y is



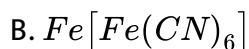
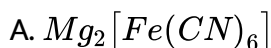
D. $ZnCl_2$

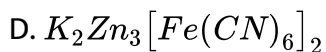
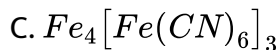
Answer: C

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3. p-Amino-N,N-dimethylaniline is added to a strongly acidic solution of X. The resulting solution is treated with a few drops of aqueous solution of Y to yield blue colouration due to the formation of methylene blue. Treatment of aqueous solution of Y with reagent potassium hexacyanoferrate (II) leads to the formation of an intense blue precipitate. The precipitate dissolves on excess addition of the reagent. Similarly, the treatment of the solution of Y with the solution of potassium hexacyanoferrate (III) leads to a brown colouration due to the formation of Z.

Q. Compound Z is





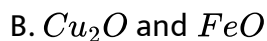
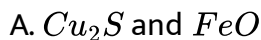
Answer: B



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4. Copper is the most noble of the first row transition elements it occurs in small deposits in several countries. Ores of Copper include chalcantite ($CuSO_{4.5}H_2O$), atacamite [$Cu_2Cl(OH)_3$], cuprite (Cu_2O), copper glance (Cu_2S), and malachite [$Cu_2(OH)_2CO_3$]. However, 80 % of the world copper production comes from the ore chalcopyrite ($CuFeS_2$). Extraction of copper from chalcopyrite includes roasting, iron removal, and self-reduction.

Q. Partial roasting of chalcopyrite produces



C. CuS and Fe_2O_3

D. Cu_2O and Fe_2O_3

Answer: A

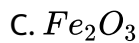
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5. Copper is the most noble of the first row transition elements it occurs in small deposits in several countries. Ores of Copper include chalcantite ($CuSO_{4.5}H_2O$), atacamite [$Cu_2Cl(OH)_3$], cuprite (Cu_2O), copper glance (Cu_2S), and malachite [$Cu_2(OH)_2CO_3$]. However, 80 % of the world copper production comes from the ore chalcopyrite ($CuFeS_2$). Extraction of copper from chalcopyrite includes roasting, iron removal, and self-reduction.

Q. Iron is removed from chalcopyrite as

A. FeO

B. FeS

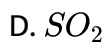
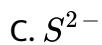
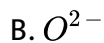


Answer: D



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6. In self-reduction, the reducing species is



Answer: C



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7. When a metal rod M is dipped into an aqueous colourless concentrated solution of compound N, the solution turns light blue. Addition of aqueous NaCl to the blue solution gives a white precipitate O. Addition of aqueous NH_3 dissolves O and gives an intense blue solution.

Q. The metal rod M is

A. Fe

B. Cu

C. Ni

D. Co

Answer: B

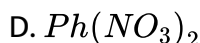
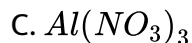
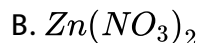
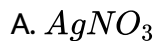


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8. When a metal rod M is dipped into an aqueous colourless concentrated solution of compound N, the solution turns light blue. Addition of aqueous NaCl to the blue solution gives a white precipitate O. Addition

of aqueous NH_3 dissolves O and gives an intense blue solution.

Q. The compound N is



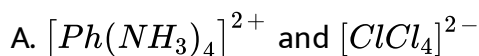
Answer: A

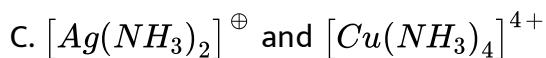
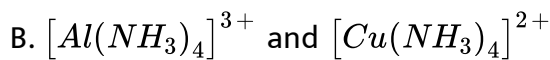


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9. When a metal rod M is dipped into an aqueous colourless concentrated solution of compound N, the solution turns light blue. Addition of aqueous NaCl to the blue solution gives a white precipitate O. Addition of aqueous NH_3 dissolves O and gives an intense blue solution.

Q. The final solution contains.





Answer: C

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Archives Multiple Correct

1. Potassium manganate (K_2MnO_4) is formed when

A. Chlorine is passed through aqueous $KMnO_4$ solution

B. Manganese dioxide is fused with potassium hydroxide in air.

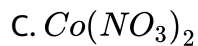
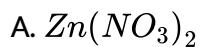
C. Formaldehyde reacts with potassium permanganate in the presence of a strong alkali.

D. Potassium permanganate reacts with concentrated sulphuric acid.

Answer: B::C

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2. The aqueous solution of the following salts will be coloured in the case of



Answer: C::D

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3. Which of the following alloys contain (s) Cu and Zn?

A. Bronze

B. Brass

C. Gun metal

D. Type metal

Answer: A::B::C

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4. Which of the following statements is/are correct, when a mixture of $NaCl$ and $K_2Cr_2O_7$ is gently warmed with concentrated H_2SO_4 ?

A. Deep red vapours are evolved.

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

C. Chlorine gas is evolved.

D. Chromyl chloride is formed.

Answer: A::B::D

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5. The addition of high proportions of manganese makes steel useful in making rails or railroads because manganese is useful in making rails or railroads because manganese

- A. Gives hardness to steel
- B. Helps in the formation of oxides of iron
- C. Can remove oxygen and sulphur
- D. Can show the highest oxidation state of +7

Answer: A::C

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6. Reduction of the metal centre in aqueous permanganate ion involves

- A. 3 electrons in neutral medium
- B. 5 electrons in neutral medium
- C. 3 electrons in alkaline medium
- D. 5 electrons in acidic medium

Answer: A::D

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7. The equilibrium $2CuI \rightleftharpoons Cu + Cu^{II}$

In aqueous medium at $25^\circ C$ shifts towards the left in the presence of

- A. NO^\ominus
- B. Cl^\ominus
- C. SCN^\ominus
- D. CN^\ominus

Answer: B::C::D



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8. Which one of the following arrangements does not represent the correct order of the property stated against it?

A. $Ni^{2+} < Co^{2+} < Fe^{2+} < Mn^{2+}$: ionic size

B. $Co^{3+} < Fe^{3+} < Cr^{3+} < Sc^{3+}$: Stability in aqueous solution.

C. $Sc < Ti < Cr < Mn$: number of oxidation states.

D. $V^{2+} < Cr^{2+} < Mn^{2+} < Fe^{2+}$: paramagnetic behaviour

Answer: B::D



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Archives Single Correct

1. One of the constituents of German silver is

A. *Ag*

B. *Cu*

C. *Mg*

D. *Al*

Answer: B

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2. Which of the following dissolves in hot concentrated NaOH solution?

A. Fe

B. Zn

C. Cu

D. Ag

Answer: B

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3. How many unpaired electrons are present in Ni^{2+} ?

A. 0

B. 2

C. 4

D. 4

Answer: B



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4. In the metallurgy of iron, when limestone is added to the blast furnace, the calcium ions end up in

A. Slag

B. Gangue

C. Metallic calcium

D. Calcium carbonate

Answer: A



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5. Iron is rendered passive by treatment with concentrated

A. H_2SO_4

B. H_3PO_4

C. HCl

D. HNO_3

Answer: D



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6. The types of bonds present in $CuSO_{4.5}H_2O$ are only

- A. Electrovalent and covalent
- B. Electrovalent and coordinate covalent
- C. Electrovalent, covalent, and coordinate covalent
- D. Covalent and coordinate covalent.

Answer: C



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7. Zinc-copper couple that can be used as a reducing agent is obtained by

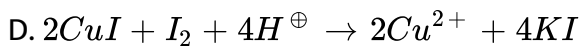
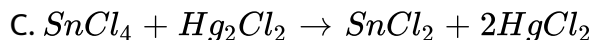
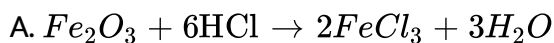
- A. Mixing zinc dust and copper gauze
- B. Zinc coated with copper
- C. Copper coated with zinc

D. Zinc and copper wires welded together.

Answer: B

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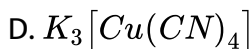
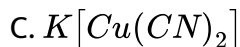
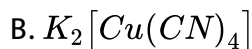
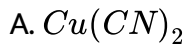
8. The reaction which proceeds in the forward direction is



Answer: A

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9. Which of the following is formed when excess of KCN is added to an aqueous solution of copper sulphate?



Answer: D



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10. An aqueous solution of $FeSO_4$, $Al_2(SO_4)_3$ and chrome alum is heated with excess of Na_2O_2 and filtered. The materials obtained are

A. A colourless filtrate and a green residue

B. A yellow filtrate and a green residue

C. A yellow filtrate and a brown residue

D. A green filtrate and a brown residue

Answer: C



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11. Which compound does not dissolve in hot diluted HNO_3 ?

A. HgS

B. PbS

C. CuS

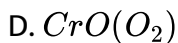
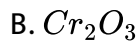
D. CdS

Answer: A



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12. Ammonium dichromate is used in some fireworks. The green-coloured powder blown in the air is

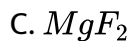
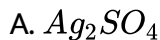


Answer: B



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13. Which of the following compounds is expected to be coloured?



D. $CuCl$

Answer: B

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14. Which of the following is an organometallic compound?

- A. Lithium methoxide
- B. Lithium acetate
- C. Lithium dimethylamide
- D. methyl lithium

Answer: D

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15. In the dichromate dianion,

- A. Four $Cr - O$ bonds are equivalent
- B. six $Cr - O$ bonds are equivalent
- C. All $Cr - O$ bonds are equivalent
- D. All $Cr - O$ bonds are non-equivalent.

Answer: B

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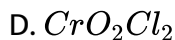
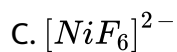
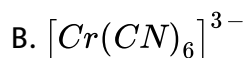
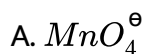
16. On heating ammonium dichromate, the gas evolved is

- A. Oxygen
- B. Ammonia
- C. Nitrous oxide
- D. Nitrogen

Answer: D

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



Answer: D



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18. Anhydrous ferric chloride is prepared by

A. Heating hydrated ferric chloride at a high temperature in a stream of air.

B. Heating metallic iron in a stream of dry chlorine gas

C. Reaction of ferric oxide with HCl

D. Reaction of metallic iron with HCl

Answer: B

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19. When MnO_2 is fused with KOH , a coloured compound is formed, the product and its colour are

A. K_2MnO_4 , purple

B. $KMnO_4$, purple

C. Mn_2O_3 , brown

D. Mn_3O_4 , black

Answer: A

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20. $(NH_4)_2Cr_2O_7$ on heating gives a gas which is also given by

A. heating NH_4NO_2

B. Heating NH_4NO_3

C. $Mg_3N_2 + H_2O$

D. $Na + H_2O_2$

Answer: A



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21. Which pair of compounds is expected to show similar colour in aqueous medium?

A. $FeCl_3$ and $CuCl_2$

B. $VOCl_2$ and $CuCl_2$

C. $VOCl_2$ and $FeCl_2$

D. $FeCl_2$ and $MnCl_2$

Answer: B



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22. A solution of a metal ion when treated with KI gives a red precipitate which dissolves in excess KI to give a colourless solution. Moreover, the solution of metal ion on treatment with a solution of cobalt (II) thiocyanate gives rise to a deep-blue crystalline precipitate. The metal ion is

A. Pb^{2+}

B. Hg^{2+}

C. Cu^{2+}

D. CO^{2+}

Answer: B



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23. The colour of light absorbed by an aqueous solution of $CuSO_4$ is

- A. Orange red
- B. Blue green
- C. Yellow
- D. Violet

Answer: A



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24. In the cyanide extraction process of silver from argentite, the oxidizing and reduction agents used are

- A. O_2 and CO_2
- B. O_2 and Zn dust

C. HNO_3 and CO

D. HNO_3 and Zn dust

Answer: B

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25. Four successive members of the first series of transition metals are listed below. For which one of the of standard potential $\left(E_{M^{2+}/M}^\circ\right)$ value has a positive sign ?

A. $Mn(Z = 25)$

B. $Fe(Z = 26)$

C. $Co(Z = 27)$

D. $Cr(Z = 24)$

Answer: C

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26. Which of the following statements about the interstitial compounds is incorrect?

- A. They are much harder than the pure metal.
- B. They have higher melting points than the pure metal.
- C. They retain metallic conductivity
- D. They are chemically reactive.

Answer: D



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27. $KMnO_4$ can be prepared from K_2MnO_4 as per the reaction: 

The reaction can go to completion by removing OH^- ions by adding.

- A. CO_2
- B. SO_2

C. HCl

D. KOH

Answer: A



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28. A magnetic moment of 1.73 B.M. will be shown by one among the following:

A. $TiCl_4$

B. $[CoCl_6]^{4-}$

C. $[Cu(NH_3)_4]^{2+}$

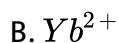
D. $[Ni(CN)_4]^{2-}$

Answer: C



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29. Which of the following lanthanoid ions is diamagnetic? (Atomic number of $Ce = 58$, $Sm = 62$, $Eu = 63$, $Yb = 70$]



Answer: B



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Archives Assertion Reasoning

1. (a). Assertion (A) is true, Reason (R) is also true, Reason (R) is the correct explanation for assertion (A).

(b). Assertion (A) is true, Reason (R) is true, Reason (R) is not the correct explanation for Assertion (A).

(c). Assertion (A) is true, Reason (R) is false.

(d). Assertion (A) is false, Reason (R) is true.

Q. Assertion (A): to a solution of potassium chromate, if a strong acid is added, it changes its colour from yellow to orange.

Reason (R): The colour change is due to the change in oxidation state of potassium chromate.

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2. (a). Assertion (A) is true, Reason (R) is also true, Reason (R) is the correct explanation for assertion (A).

(b). Assertion (A) is true, Reason (R) is true, Reason (R) is not the correct explanation for Assertion (A).

(c). Assertion (A) is true, Reason (R) is false.

(d). Assertion (A) is false, Reason (R) is true.

Q. Assertion (A): Zn^{2+} is diamagnetic.

Reason (R): The electrons are lost from 4s-orbital to form Zn^{2+} .

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3. (a). Assertion (A) is true, Reason (R) is also true, Reason (R) is the correct explanation for assertion (A).

(b). Assertion (A) is true, Reason (R) is true, Reason (R) is not the correct explanation for Assertion (A).

(c). Assertion (A) is true, Reason (R) is false.

(d). Assertion (A) is false, Reason (R) is true.

Q. Assertion (A): $[Fe(H_2O)_5NO]SO_4$ paramagnetic.

Reason (R): The Fe in $[Fe(H_2O)_5NO]SO_4$ has three unpaired electrons.



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Archives Integer

1. The oxidation number of Mn in the product of alkaline oxidative fusion of MnO_2 is



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2. The number of water molecule(s) directly bonded to the metal centre in $CuSO_{4.5}H_2O$ is

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Archives Fill In The Blanks

1. Mn^{2+} can be oxidised to $MnO_4(\ominus)$ by SnO_2, PbO_2, BaO_2 .

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2. Galvanisation of iron denotes coating with _____

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3. Silver chloride is sparingly soluble in water because its lattice energy is greater than _____



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4. The salts _____ and _____
($FeSO_{4.7}H_2O$, $CuSO_{4.5}H_2O$, $MnSO_{4.4}H_2O$, $ZnSO_{4.7}H_2O$) are
isostructural.



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5. Fehling solution A consist of an aqueous solution of copper sulphate
while Fehling solution B consists of an alkaline solution of _____.



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6. The outermost electronic configuration of Cr is _____



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7. The compound $Yb_aCu_3O_7$ which shows super conductivity has copper in oxidation state _____. Assume that the rare earth element yttrium is in its usual +3 oxidation state.

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8. Silver jewellery items tarnish slowly in air due to their reaction with _____.

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Archives True & False

1. Copper metal reduces Fe^{2+} in an acid medium.

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2. Silver fluoride is fairly soluble in water.

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3. The electron density in the xy-plane in $3d_{x^2 - y^2}$ orbital is zero.

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4. Deposition of zinc exhibits paramagnetism due to loss of two electrons from 3d-orbitals of neutral atom.

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Archives Subjective

1. What happens when SO_2 gas is bubbled through an aqueous solution of copper sulphate in the presence of potassium thiocyanate?



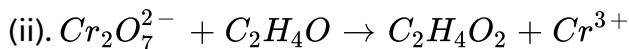
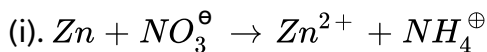
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2. Given reasons for the following in one or two sentences: silver bromide is used in photography?



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3. Complete and balance the following reactions:



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4. State the conditions under which the following preparations are carried out. Give the necessary equations which need not be balanced.

Potassium permanganate from manganese dioxide.



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5. Show with balanced equations what happens when the following are mixed.

(i). Aqueous solution of potassium manganate and acid.

(ii). Aqueous solution of potassium chromate and acid.

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6. Write the balanced equations for the reactions when

(i). Potassium permanganate interacts with manganese dioxide in the presence of potassium hydroxide.

(ii). Potassium ferrocyanide is heated with concentrated sulphuric acid.

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7. Mention the products formed in the following

(i) Zinc oxide is treated with excess of sodium hydroxide solution

(ii). Iodine is added to a solution of stannous chloride.



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8. Write the balanced equations for the reaction occurring when gold is dissolved in aqua regia.



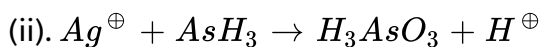
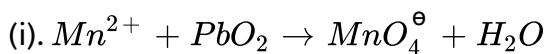
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9. Write the balanced equation for the following "potassium permanganate is reacted with warm solution of oxalic acid in the presence of sulphuric acid"



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10. Complete and balance the following reactions:



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11. Answer the following questions briefly:

(i). What is the actual reducing agent of haematite in blast furnace?

(ii). Zinc, not copper is used for the recovery of metallic silver from the complex $[Ag(CN)_2]^\ominus$, explain.

(iii). Why is chalcocite roasted and not calcinated during the recovery of copper?



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12. Write the balanced equations for extraction of silver from glance by cyanide process.



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13. Write the balanced chemical equation for the following:

(i). Silver chloride is treated with aqueous sodium cyanide and the

product thus formed is allowed to react with zinc in an alkaline medium.

(ii). Cobalt (II) solution reacts with KNO_2 in acetic acid medium.

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14. Write balanced equations for "the extraction of copper from pyrites by self-reduction".

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15. Write the balanced chemical equations for the following reactions:

(i). A mixture of potassium dichromate and sodium chloride is heated with concentrated H_2SO_4 .

(ii). Potassium permanganate is added to a hot solution of manganous sulphate.

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16. A light bluish-green crystalline compound responds to the following tests:

(i). Its aqueous solution gives a brown precipitate on reaction with alkaline $K_2[HgI_4]$ solution.

(ii). Its aqueous solution gives a blue colour with $K_3[Fe(CN)_6]$ solution.

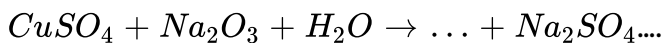
(iii). Its solution in hydrochloric acid gives a white precipitate with $BaCl_2$ solution. Identify the ions present and suggest the formula of the compound.



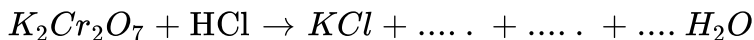
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17. Complete and balance the following chemical reaction:

(i). Na_2CO_3 is added to a solution of copper sulphate.

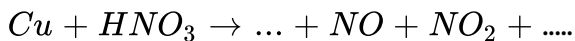


(ii). Potassium dichromate and concentrated HCl are heated together.



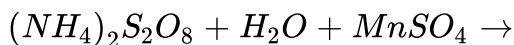
(iii). Copper reacts with HNO_3 to give NO and NO_2 in molar ratio of

2:1



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18. Complete and balance the following:

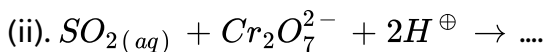
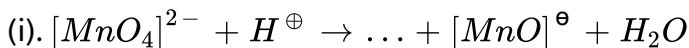


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19. The composition of a sample of wustite is $Fe_{0.93}O_{1.00}$. What percentage of iron is present in the form of $Fe(III)$?

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20. Complete and balance the following reaction:





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21. Write a balanced equation for the reaction of agentite with KCN and name the products in solution.



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22. Write a balanced equation for the following:

"Reaction of zinc with dilute nitric acid"



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23. Thionyl chloride can be synthesised by chlorinating SO_2 using PCl_5 .

Thionyl chloride is used to prepare anhydrous ferric chloride starting from its hexahydrated salt. Alternatively, the anhydrous ferric chloride can also be prepared from its hexahydrated salt by treating with 2,2-dimethoxypropane. Discuss all this using balanced chemical equations.

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24. When the ore haematite is burnt in air with coke around 2000 K along with lime, the process not only produces steel but also produces a silicate slag that is useful in making building materials such as cement. Discuss the same and show through balanced chemical equations.

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25. Work out the following using chemical equation.

In moist air, copper corrodes to produce a green layer on the surface?

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26. Give reasons for following in one or two sentences:

CrO_3 is an acid anhydride?

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27. An aqueous blue-coloured solution of a transition metal sulphate reacts with H_2S in acidic medium to give a black precipitate A which is insoluble in warm aqueous solution of KOH. The blue solution on treatment with KI in weakly acidic medium turns yellow and produces a white precipitate B. Identify the transition metal ion. Write the chemical reactions involved in the formation of A and B.

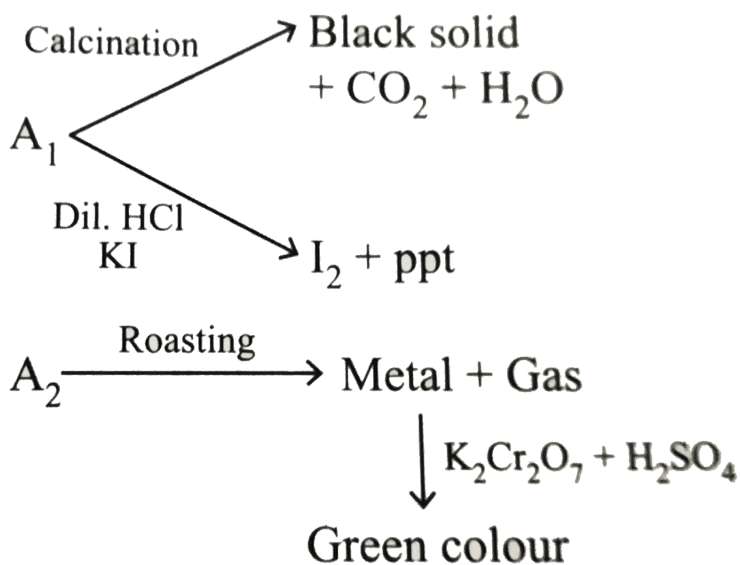


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28. When a white crystalline compound X is heated with $K_2Cr_2O_7$ and concentrated H_2SO_4 a reddish-brown gas A is evolved. On passing A into caustic soda solution, a yellow-coloured solution B is obtained. Neutralising the solution of lead acetate, a yellow precipitate C is obtained. When X is heated with $NaOH$ solution a colourless gas is evolved and on passing this gas into K_2HgI_4 solution a reddish-brown precipitate D is formed. Identify A, B, C, D, and X. Write the equations of the reactions involved.



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29.

A_1 and A_2 are two ores of metal M . A_1 on calcination gives black precipitate, CO_2 and water. Identify A_1 and A_2 .

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