

Adsorption.

(1)

Rate of physisorption increases with

- a) decrease in temperature
- b) increase in temperature
- c) decrease in pressure
- d) decrease in surface area

IIT 2003

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During the adsorption of a gas on the surface of a solid, which of the following is true?

- a) $\Delta G < 0$, $\Delta H > 0$, $\Delta S < 0$
- b) $\Delta G > 0$, $\Delta H < 0$, $\Delta S < 0$
- c) $\Delta G < 0$, $\Delta H < 0$, $\Delta S < 0$
- d) $\Delta G < 0$, $\Delta H < 0$, $\Delta S > 0$

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Ans: (c) Adsorption is exothermic $\therefore \Delta H = -ve$

Freedom of movement of particles become restricted $\therefore \Delta S = -ve$

Since the process of adsorption is spontaneous, $\Delta G = -ve$

$$\begin{aligned}\Delta G &= \Delta H - T\Delta S \\ &= -\Delta H - T(-\Delta S) \\ &= -\Delta H + T\Delta S\end{aligned}$$

$$\Delta H > T\Delta S$$

Spontaneous

② Which of the following statements is ^② incorrect regarding physisorption? AIEEE 09

- a) It occurs because of Van der Waals forces
- b) More easily liquefiable gases are adsorbed readily.
- c) Under high pressure it results into multimolecular layer on adsorbent surface.
- d) ~~Enthalpy of adsorption is low & positive.~~

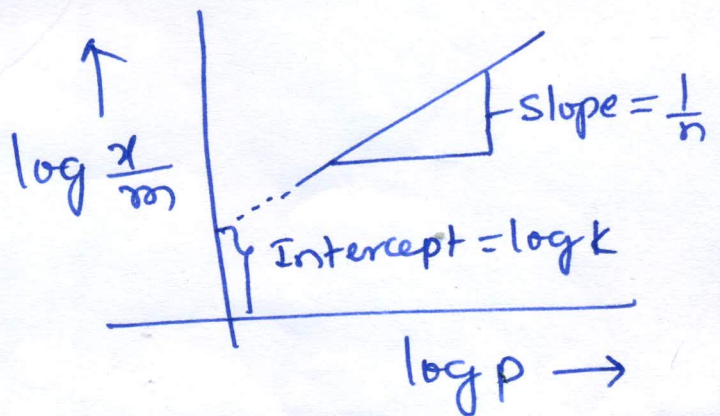
④ A plot of $\log \frac{x}{m}$ vs $\log p$ for the adsorption of a gas on a solid gives a straight line with slope equal to

a) n ~~b) $\frac{1}{n}$~~ c) $\log k$ d) $-\log k$

$$\frac{x}{m} \propto p^{1/n}$$

$$\frac{x}{m} = k p^{1/n}$$

$$\log \frac{x}{m} = \log k + \frac{1}{n} \log p$$



(3)

- 5) Stability of lyophilic colloids is due to
- a) Same charge on all the colloidal particles
 - b) Solvation of the colloidal particles
 - c) both (a) & (b)
 - d) the fact that they are organic substances

- 6) Gold numbers of protective colloids A, B, C & D are 0.50, 0.01, 0.10 and 0.005 respectively. The correct order of their protective power is
- a) $A < C < B < D$
 - b) $B < D < A < C$
 - c) $D < A < C < B$
 - d) $C < B < D < A$

Smaller the gold number, greater is the protective power. Thus, protective powers of A, B, C and D are in the order:

$$D (0.005) > B (0.01) > C (0.05) > A (0.50)$$

or $A < C < B < D$

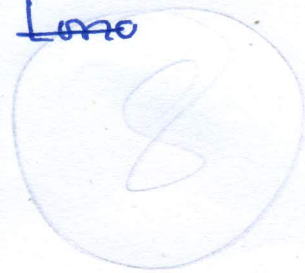
10 100 500

9. Among the following, Surfactant that will form micelles in aqueous solution at the lowest molar concentration at ambient condition

IIT 2008

- is
- a) $\text{CH}_3(\text{CH}_2)_{15}\text{N}^+(\text{CH}_2)_3\text{Br}^-$
- b) $\text{CH}_3(\text{CH}_2)_{11}\text{OSO}_3^- \text{Na}^+$
- c) $\text{CH}_3(\text{CH}_2)_6\text{COO}^- \text{Na}^+$
- d) $\text{CH}_3(\text{CH}_2)_{11}\text{N}^+(\text{CH}_3)_3\text{Br}^-$

Long



Longer the C-chain is greater the size of hydrophobic chain (tail), Less is the solubility in water and greater is the tendency of surfactant molecules to associate to form micelle is lower is the CMC

Hence (a) with the longest C-chain has the lowest CMC.

10. The charge of $\text{Fe}(\text{OH})_3$ sol is due to.

- a) adsorption of hydroxyl ion
- b) adsorption of hydrogen ion
- c) adsorption of ferric acid
- d) adsorption of ferric ion.

J&KCET 2010

11) Match the items of Column I & Column II 6

- | | |
|--------------------|-------------------------------|
| a) Dialysis | (i) Cleansing action of soap |
| b) peptisation | (ii) Coagulation |
| c) Emulsification | (iii) Colloidal Sol formation |
| d) Electrophoresis | (iv) purification. |

- a) (a) → (iv) ; (b) → (iii) ; (c) → (i) ; (d) → (ii)
- b) (a) → (iii) ; (b) → (i) ; (c) → (ii) ; (d) → (iv)
- c) (a) → (iv) ; (b) → (ii) ; (c) → (iii) ; (d) → (i)
- d) (a) → (ii) ; (b) → (iv) ; (c) → (i) ; (d) → (ii)
-

12) According to adsorption theory of Catalysis, the speed of the reaction increases because

- a) the concentration of the reactant molecules at the active centres of the catalyst becomes high due to adsorption
- b) In the process of adsorption, the Activation energy of the molecules becomes large
- c) adsorption produces heat which increases the speed of reaction.
- d) adsorption lowers the activation energy of the reaction.

12 Match the following

7

Catalyst

Industrial product

A V_2O_5

(i) High density polythene

B. Zeigler-Natta

(ii) polyacrylonitrile

C. peroxide

(iii) NH_3

D finely divided Fe

(iv) H_2SO_4

a) A - (iv) , B - (i) C - (ii) D - (iii)

b) A - (iv) , B - (iii) , C - (ii) D - (i)

c) A - (iii) , B - (i) C - (ii) D - (iv)

d) A - (iv) , B - (ii) C - (i) D - (iii)

① The correct order of decreasing second ionisation enthalpy of Ti (22), V (23), Cr (24), and Mn (25) is:

- a) $Cr > Mn > V > Ti$ b) $V > Mn > Cr > Ti$
 c) $Mn > Cr > Ti > V$ d) $Ti > V > Cr > Mn$



ENC increases from Ti \rightarrow Mn, therefore 1st I.E. increase in the same order



However, after the removal of 1st e^- , Cr acquires $3d^5$ configuration. Hence it has exceptional 2nd I.E. For remaining elements the trend remains the same



② Which of the following compounds will not give positive chromyl chloride test?

- a) $CuCl_2$ b) $HgCl_2$ c) $ZnCl_2$ d) $CoHSO_4^+ NH_4^+ Cl^-$

Chromyl chloride test is answered by water soluble ionic chloride salts only.

Since $HgCl_2$ is a covalent, it does not answer for chromyl chloride test

one
③ Which ^{one} of the following does not correctly represent the correct order of the property indicated against it?

- a) ~~Ti < V < Cr < Mn~~ : increasing melting points
b) Ti < V < Mn < Cr : increasing 2nd I.E
c) Ti < V < Cr < Mn : increasing number of oxidation states
d) $Ti^{3+} < V^{3+} < Cr^{3+} < Mn^{3+}$: Increasing magnetic moment

The m.p. first increases to a maximum & then fall as atomic number increases.

Mn, however, has abnormally low m.p. due to stable configuration & weak metallic bonding.

④ The catalytic activity of transition metals and their compounds is ascribed mainly to

- a) ~~their ability to adopt variable oxidation states~~
b) their chemical reactivity
c) their magnetic behaviour
d) their unfilled d-orbitals.

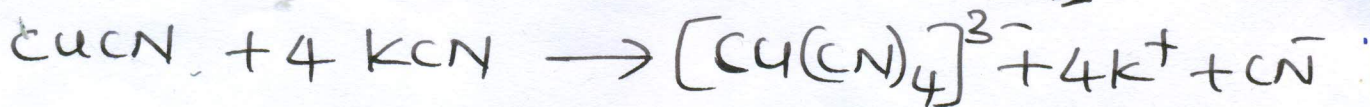
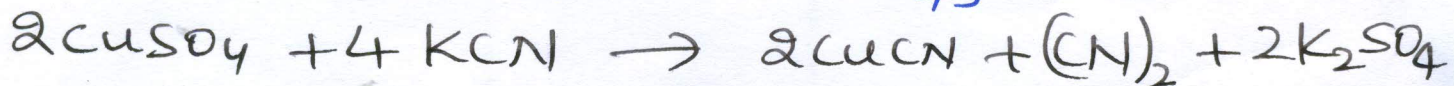
AIPMT 2012

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5) Blue solution of CuSO_4 on treatment with excess of KCN give colourless solution due to the

IIT 2006

- a) formation of CuCN
- b) formation of $\text{Cu}(\text{OH})_2$
- c) formation of $[\text{Cu}(\text{CN})_4]^{2-}$
- d) Cu^{2+} is reduced by CN^- to Cu^+ , which forms the complex $[\text{Cu}(\text{CN})_4]^{3-}$



6) The colour of light absorbed by an aqueous solution of CuSO_4 is:

- a) orange-red
- b) Blue-green
- c) yellow
- d) violet

IIT-2012

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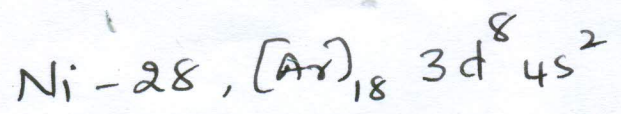
The colour of aqueous solution of CuSO_4 is bluish-green. \therefore it absorbs its complementary colour orange-red.

7) The complex showing a spin only magnetic moment of 2.82 B.M. is: IIT-2010

- a) $[Ni(CO)_4]$ b) $[Ni(Cl)_4]^{2-}$
 c) $[Ni(PPh_3)_4]$ d) $[Ni(CN)_4]^{2-}$

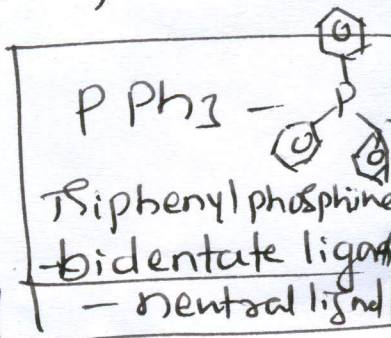
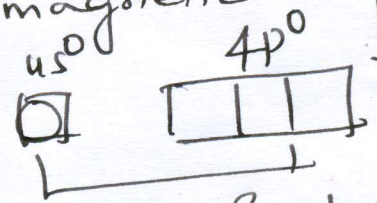
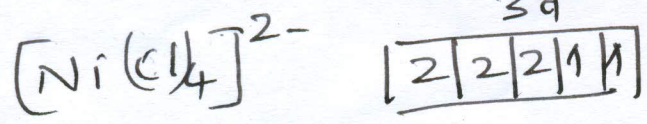
$[Ni(Cl)_4]^{2-}$ is tetrahedral and has two

unpaired electrons $\mu = \sqrt{n(n+2)}$
 $= \sqrt{2(2+2)} = 2.83 \text{ BM}$



$Ni(CO)_4$ - sp^3 - diamagnetic

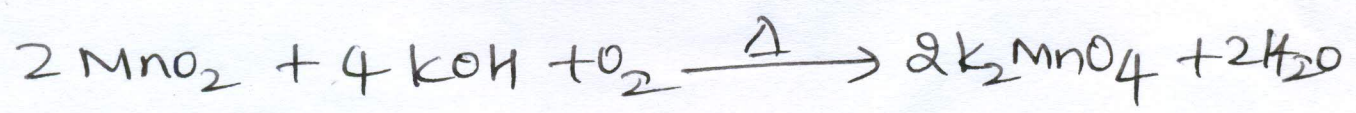
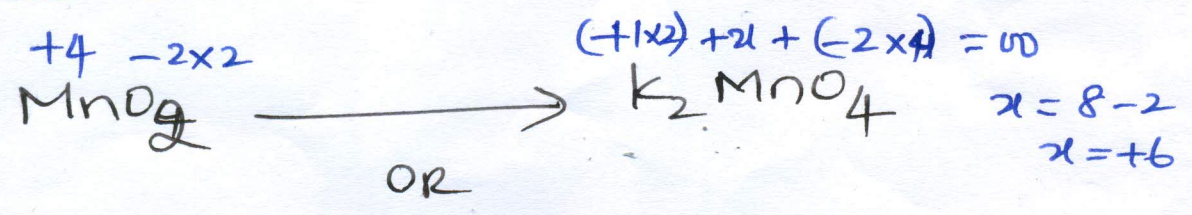
$[Ni(CN)_4]^{2-}$ - dsp^2 - diamagnetic



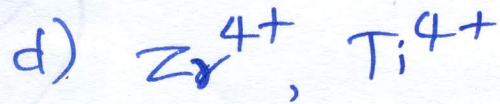
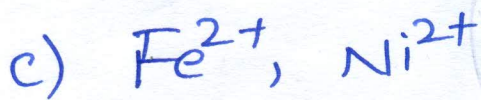
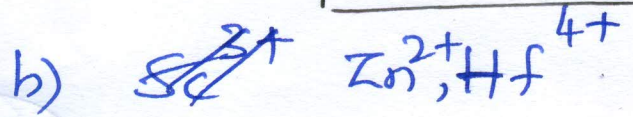
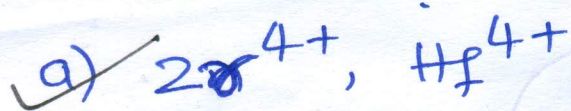
sp^3 - hybridization

8) In the preparation of $KMnO_4$, pyrolusite (MnO_2) is first converted to potassium manganate (K_2MnO_4). In this conversion, the oxidation state of manganese changes from Kerala CET 2001

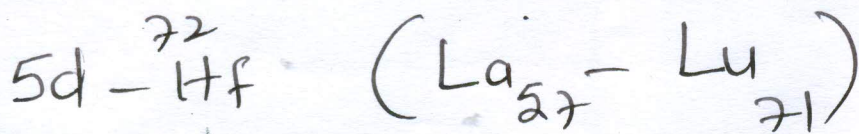
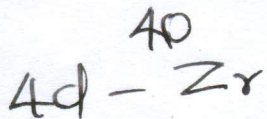
- a) +1 to +3 b) +2 to +4
 c) +3 to +5 d) +4 to +6



9) Which of the following pairs has the same size? CBSE PMT 2010



Due to Lanthanoid contraction.



10) Which of the following statement is not true? (AIPMT 2012)

a) on passing H₂S through acidified K₂Cr₂O₇ solution, a milky colour is observed.

b) Na₂Cr₂O₇ is preferred over K₂Cr₂O₇ in volumetric analysis.

c) K₂Cr₂O₇ solution in acidic medium is orange.

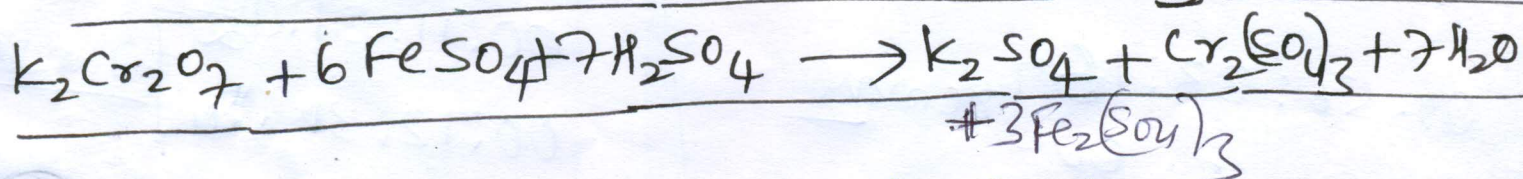
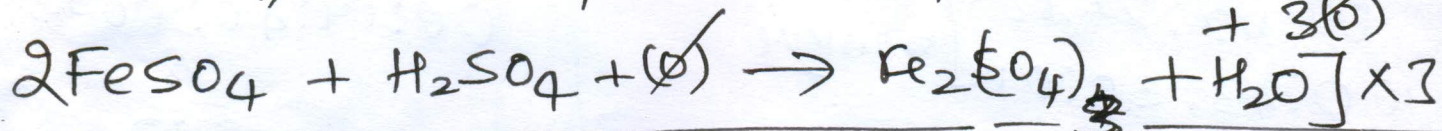
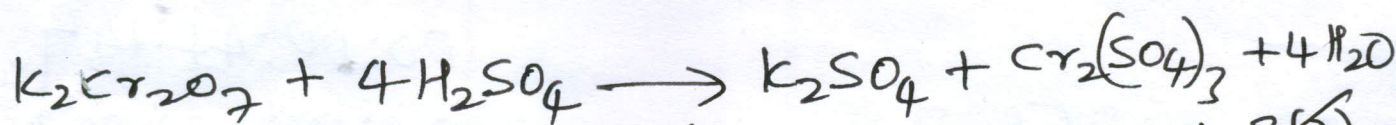
d) K₂Cr₂O₇ solution becomes yellow on increasing the pH beyond 7.

K₂Cr₂O₇ is preferred over Na₂Cr₂O₇ in volumetric analysis because Na₂Cr₂O₇ is deliquescent.

consider a titration of potassium-dichromate solution with acidified Mohr's Salt solution using diphenylamine as indicator. The number of moles of Mohr's Salt required per mole of dichromate is

IIT 2007

- a) 3 b) 4 c) 5 d) 6



14. Identify the incorrect statement among the following:

- a) Shielding power of 4f electron is quite-
 b) There is ~~de~~ decrease in the radii ^{Weak} of the atoms or ions as one proceeds from La to Lu
 c) Lanthanide contraction is the accumulation of successive shrinkages.
 d) As a result of lanthanoid contraction, the properties of 4d series of the transition elements have no similarities with the 5d series of the elements.