



Sri Chaitanya IIT Academy, India

A.P, TELANGANA, KARNATAKA, TAMILNADU, MAHARASHTRA, DELHI, RANCHI

A right Choice for the Real Aspirant

ICON CENTRAL OFFICE, MADHAPUR-HYD

Sec: Sr. IPLCO
TIME : 3:00

JEE ADVANCED
2013_P1 MODEL

DATE : 08-11-15
MAX MARKS : 180

KEY & SOLUTIONS

PHYSICS

1	C	2	A	3	B	4	B	5	B
6	C	7	B	8	D	9	D	10	C
11	ABC	12	ABC	13	ACD	14	ABC	15	ABCD
16	2	17	6	18	2	19	6	20	6

CHEMISTRY

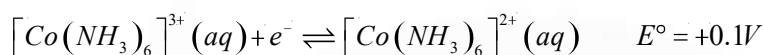
21	C	22	D	23	D	24	C	25	C
26	C	27	C	28	D	29	B	30	A
31	ABCD	32	BC	33	ABC	34	ABCD	35	ABCD
36	8	37	4	38	5	39	6	40	3

MATHEMATICS

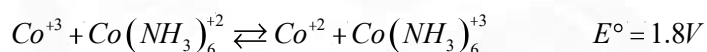
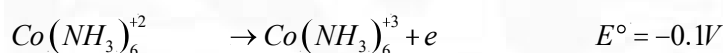
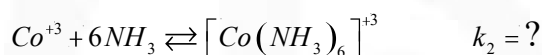
41	D	42	B	43	A	44	B	45	B
46	A	47	B	48	A	49	D	50	C
51	BCD	52	BCD	53	BD	54	B	55	ABC
56	2	57	3	58	8	59	2	60	4

CHEMISTRY

21. The overall formation constant of the $[\text{Co}(\text{NH}_3)_6]^{2+}$ ion in aqueous solution is 10^5 and the standard potentials for the reaction of $\text{Co}^{3+}(\text{aq})$ and $[\text{Co}(\text{NH}_3)_6]^{3+}(\text{aq})$ are as follows



Calculate the overall formation constant of the $[\text{Co}(\text{NH}_3)_6]^{3+}$

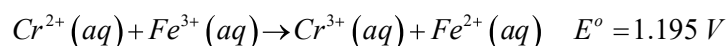


$$E^\circ = \frac{0.059}{1} \log \frac{k_2}{k_1} \quad 1.8 = 0.059 \log \frac{x}{10^5} \quad k_2 = 10^{35}$$

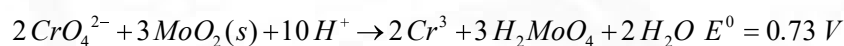
22. Total number of unpaired electrons should be 8 and they should present in 3 iron atoms. So formula must be $[\text{Fe}(\text{H}_2\text{O})_6]_2[\text{Fe}(\text{CN})_6]$. Each $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ contain 4 unpaired electrons while $[\text{Fe}(\text{CN})_6]^{4-}$ contain zero unpaired electrons. So Total unpaired electrons are 8 which give $8/3$ or $2\frac{2}{3}$

23. (a) $\text{Cr}^{2+} + \text{Fe}^{3+}$? As you move from left to right across the d block, stable oxidation states in aqueous solution tend to get lower (for example, form TiO^{2+} and VO_2^+ on the left to Co^{2+} , Ni^{2+} , Cu^{2+} and Zn^{2+} on the right). Based on this trend,

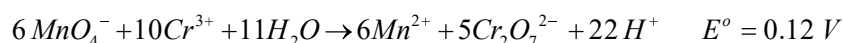
you should expect Cr^{2+} to be oxidized to Cr^{3+} at the expense of Fe^{3+} , which will be reduced to Fe^{2+} . That is, iron is to the right of chromium, and the trend is left higher, right lower. In fact, the net potential for this redox reaction in aqueous acid is 1.195 V (see Resource Section 3)



(b) $CrO_4^{2-} + MoO_2$? Recall the trend that higher oxidation numbers become increasingly more stable as you descend a group in the d block. Since you are given two compounds containing $Cr(VI)$ AND $Mo(IV)$, you should expect a redox reaction to occur, with the oxidation of MoO_2 and reduction of CrO_4^{2-} . The products should be Cr^{3+} and H_2MoO_4 (see Resource Section 3). Note $Cr(V)$ and $Cr(VI)$ are unstable with respect to disproportionation.



(c) $MnO_4^- + Cr^{3+}$? This is another case where you should apply the trend left higher, right lower, predicting a reaction between these two species in which Cr^{3+} is oxidized and MnO_4^- is reduced. However, since these two elements are immediate neighbours, you should not expect the net E° to be very large. In fact, the products are Mn^{2+} and $Cr_2O_7^{2-}$ and $E^{\circ} = 0.12 V$.



24. The metals of the second and third series have greater enthalpies of atomisation than the corresponding elements of first series. This is due to much more

frequent metal-metal bonding Mn belongs to 1st series and Re belongs to IIIrd series in the same group

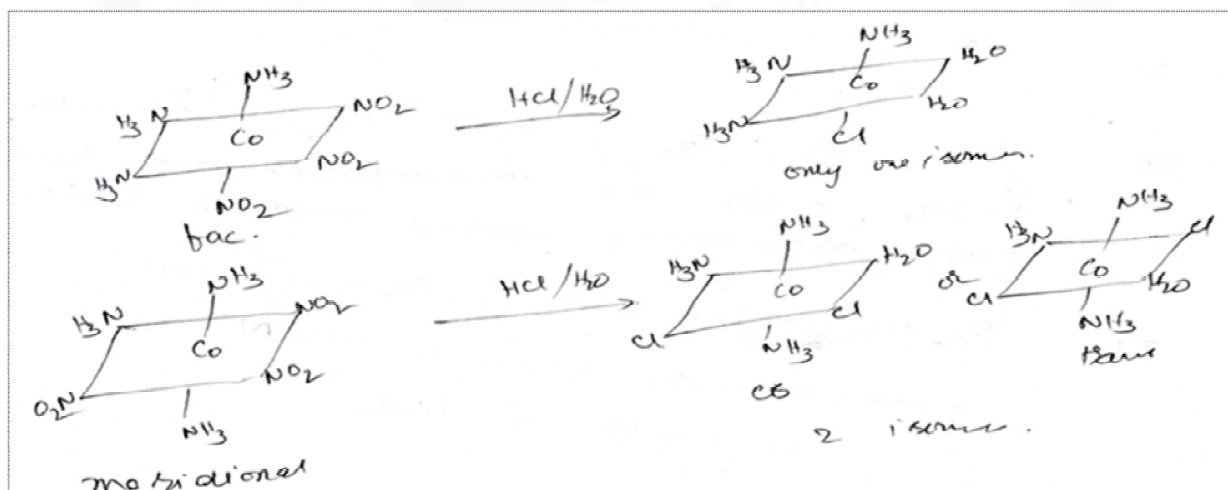
25. More the number of positive charges on cation more the polarising power and thus have more acidic character. So Sc^{3+} strongest among the given species among Mn^{2+} and Ni^{2+} , Ni^{2+} is more acidic due to small size.
26. In a transition series from left to right the number of oxidation states increases with increase in the number of $ns+(n-1)d$ electrons up to middle. After d^5 configuration as pairing of electrons starts, number of unpaired electrons decreases. Further as the difference in energy increases between ns and $(n-1)d$ orbitals $(n-1)d$ electrons cannot participate in bonding. So number of oxidation states decrease at the end. Unlike in p-block elements, in d-block elements stability of higher oxidation states are generally stabilized in oxide and fluoride compounds
27. Strongly reducing states such as $\text{Ti}^{2+}, \text{V}^{2+}, \text{V}^{3+}$ can also form compounds like $\text{TiF}_2, \text{VF}_2, \text{VF}_3, \text{TiO}, \text{VO}$ etc. So statement 3 is wrong other statements are correct.
28. Persulphate ion can oxidise Mn^{+2} to MnO_4^- . So $\text{S}_2\text{O}_8^{2-}$ is stronger oxidising agent than MnO_4^- Permanganate is stronger oxidising agent than dichromate
29. - Glycine forms a chelate $[\text{Cu}(\text{Gly})_2]$ which is non electrolyte Acetic acid is produced which is also weak electrolyte. Hence conductivity decreases
30. SCN^- is an ambidentate ligand. If N is donating atom it act as strong ligand but when S is donating atom it act as weak ligand. So $\text{Cr(III)}-\text{SCN}$ bonded

thiocyanate complexes slowly rearrange to given N-bonded Cr(III) –NCS

isothiocyanate complex (Cr^{3+} is a hard acid and hence prefers the hard donor N in preference to softer S donor).

31. CoCl_4^{2-} is tetrahedral while $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ is octahedral complexes. Δ_t is smaller than Δ_o . So comparatively $[\text{CoCl}_4]^{2-}$ absorb a radiation of longer wavelength. While $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ absorb radiation of shorter wavelength. Tetrahedral complexes are generally intense coloured due to the absence of centre of symmetry both complexes have same magnetic moment as they have same number of unpaired electrons $3 t_{2g}^5 e_g^2$ in $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ and $e_g^4 t_{2g}^3$ in $[\text{CoCl}_4]^{2-}$

32.



33. A) in both Mn and Cr the electron is to be removed from 4s but in Mn effective nuclear charge is more

B) $_{46}\text{Pd}$ has more effective nuclear charge than $_{45}\text{Rh}$. So IE_1 of $\text{Pd} > \text{Rh}$. In Pd the electronic config. is $4d^{10}5s^0$ whereas in silver it is $4d^{10}5s^1$ to remove an electron from stable d^{10} config. In Pd energy required is more than in Ag .

C) In a transition group generally atomic size increases from first element to second element. So IP decreases. But the atomic sizes of 2nd and 3rd elements are almost equal due to lanthanide contraction. As the effective nuclear charge is more in 3rd element i.e. 5d series IP is more

D) As explained above N will have more IP than Mo.

34. All the statements are correct

35. All the statements are correct

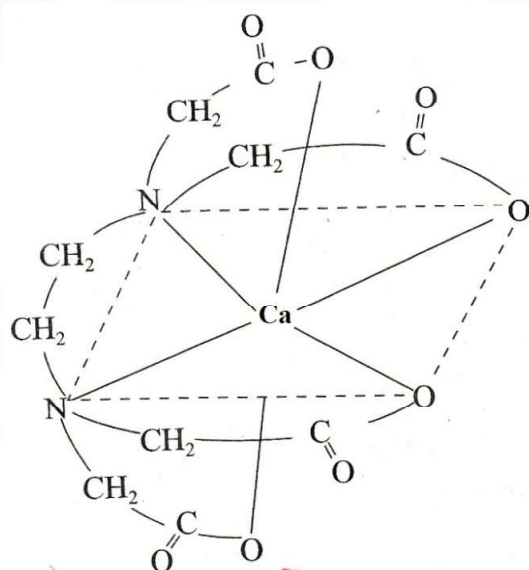
36. NO , NO_2 , O_2 , $\text{K}_3[\text{Fe}(\text{CN})_6]$, KO_2 , MnSO_4 , NiSO_4 , CuSO_4 are paramagnetic and their weight increases in applied magnetic field

37. $[\text{Co}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2 \rightarrow [\text{Co}(\text{H}_2\text{O})_5\text{Cl}]^{2+} + 2\text{Cl}^-$

0.01M of complex solution is 0.02N

$$\therefore \frac{20 \times 0.02}{0.1} = 4\text{ml}$$

38.



39. Keeping the bidentate ligand constant and changing the monodentate ligands we get 6 geometrical isomers. All of which do not contain plane of symmetry. So six enantiomeric pairs are possible.

40. $[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3$, $[\text{V}(\text{H}_2\text{O})_6]\text{SO}_4$ and $[\text{Mn}(\text{NH}_3)_6]\text{SO}_4$ are inner orbital complexes and are paramagnetic