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IIT-JEE'07
Paper - I (code 5)
Chemistry

23. **Solution :**

$\Delta T_f = i\, K_f\, m$

$2 = i\,(1.72)\,\frac{20\times1000}{172\times50}$

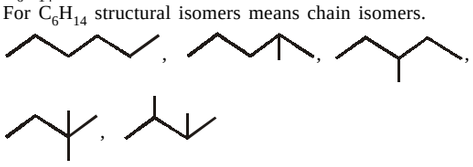
$\Rightarrow$ $i = 0.5$

Hence the answer is (a).

24. **Solution :**

C_6H_{14}

For C_6H_{14} structural isomers means chain isomers.



Hence the answer is (c).

25. **Solution :**

$\Delta G^o = \Delta H^o - T\Delta S^o$

$= -54.07 - 298 \times 10^{-2}$ KJ/mole

$= -57.05$ KJ/mole

$= -57050$ J/mole

Now

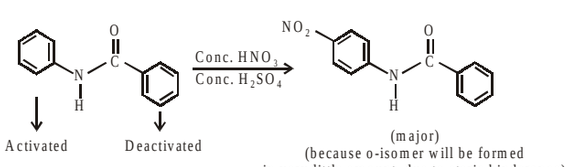
$\Delta G^o = -2.303\, RT \log_{10} K$

$\Rightarrow -57050 = -2.303 \times 8.314 \times 298 \log_{10} K$

$\Rightarrow 10 = \log_{10} K$

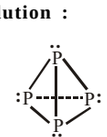
Hence the answer is (b).

26. **Solution :**



Hence the answer is (b).

27. **Solution :**



Tetrahedral
Phosphorus molecule

P in P-P bond is sp^3 hybridised.

$\therefore$ p character is 75%

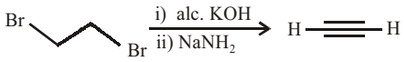
Hence the answer is (d).

28. **Solution :**

O_2^- (Superoxide) is paramagnetic.

Hence the answer is (d).

29. **Solution :**



Reason : for first dehydrohalogenation we require alc KOH, but for second dehydrohalogenation we require stronger base so $NaNH_2$.

Hence the answer is (b).

30. **Solution :**

CO ; total electrons = 14

NO^- $\Rightarrow$ total electrons = 16

NO^+ $\Rightarrow$ total electrons = 14

CN^- $\Rightarrow$ total electrons = 14

N_2 $\Rightarrow$ total electrons = 14

$\therefore$ Answer is NO^-

Hence the answer is (a).

31. **Solution :**

Roasting : $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO2$

Reduction : $ZnO + C \rightarrow Zn + CO$

$ZnO + CO \rightarrow Zn + CO_2$

Hence the answer is (b).

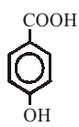
32. **Solution :**

Reason : According to Fajan's rules – small size of B^{+3}, (because of high charge) favours formation of covalent bonds.

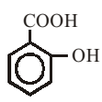
Therefore, statement-1 is true, statement-2 is true.

Hence the answer is (a).

33. **Solution :**



(p-hydroxybenzoic acid) forms inter-molecular H-bonding,



so its boiling point is higher than the (o-hydroxy benzoic acid) which forms intramolecular H-bonding.

Hence the answer is (d).

34. **Solution :**

Reason : Orthoboric acid H_3BO_3 is soluble in water, and behaves as a weak monobasic acid. It does not donate protons like most acids, but rather it accepts $OH^{\ominus}$. It is therfore a Lewis acid and is better written as $B(OH)_3$.

$B(OH)_3 + 2H_2O \rightleftharpoons H_3O^{\oplus} + [B(OH)_4]^-$ $\qquad P_{k_a} = 9.25$

$[H_3BO_3]$

Hence the answer is (c).

35. Solution :

There are some substances which at low concentrations behave as normal, strong electrolytes but at higher concentrations exhibit collidal behaviour due to formation of aggregate molecules called micelles. The formation of micelles takes place above a particular concentrations called critical micell concentration (CMC).

Because of aggreation, the electrolytic tendency gets decreased so, conductivity decreases.

Therefore, both statements are correct but statement-II is not correct reason for statement-I.

Hence the answer is (b).

36. Solution :

At Anode : $2Cl^- \rightarrow Cl_2 + 2e$

500 ml of 4 molar solution of NaCl contains 2 moles of NaCl.

$\therefore$ 2 moles of Cl^-

A/c to reaction 2 moles of Cl^- produces 1 mole of Cl_2 gas.

Hence the answer is (b).

37. Solution :

For sodium-amalgum, we required 1 mole of Hg for 1 moles of sodium. In electrolysis, first H^+ will reduce at cathode and forms H_2 (g), after that Na^+ will reduced at cathode to form Na(s)

Reaction at cathode :

$Na^+ + e \rightarrow Na(s)$

2 moles Na^+ will be reduced & form 2 moles Na(s) and for this purpose, we require 2 moles of Hg. So, total wt. of Na-Hg (maximum) is 446 gms.

Hence the answer is (d).

38. Solution :

For 2 moles of Cl^- which is equal to 2 equivalents the total charge required is 2 Faradays of electricity

$\therefore$ 2 × 96500 coulombs

= 193000 coulombs

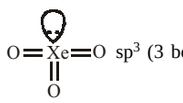
Hence the answer is (d).

39. Solution :

Reason : Ar provides an inert atmosphere for metallurgical processes which includes welding stainless steel, titanium, magnesium & aluminium.

Hence the answer is (a).

40. Solution :



sp^3 (3 bond pair & 1 lone pair)

Hence, shape is pyramidal

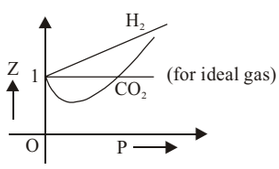
Hence the answer is (c).

41. Solution :

The lower fluorides form higher fluorides when heated with F_2 under pressure. The fluorides are all extremely strong oxidising and fluorinating agents.

Hence the answer is (a).

43. Solution :



A ® p, s

As graph shows that

Z for H_2O is > 1 as 'a' is very-very small, so by Vander Waal's equation of state for 1 mole.

P (B – b) = RT

PV – Pb = RT

$$\frac{PV}{RT} = 1 + \frac{Pb}{RT} \Rightarrow Z = 1 + \frac{Pb}{RT} > 1$$

so, (p) is correct.

but as 'a' is very small even at very high pressure attractive forces are not dominant, so, (q) is wrong.

for 'n' moles, Vander Waal's equation is (when 'a' is very very small) P(V – nb) = nRT, so, 's' is correct.

'r' is obviously wrong.

B ® r

From graph we can see that when P ~ 0, Z = 1, therefore gas is ideal. so, 'r' is correct.

C ® p, q

From graph we can see that under these conditions Z < 1 (Z ¹ 1) for CO_2.

As, 'a' is large and temperature is low so attractive forces are dominant. so, 'q' is correct.

D ® r

With very large molar volume, 'b' will be become insignificant and also the attractive forces. So, Vander Waal's constant 'a' also become insignificant.

Therefore, gas behaves like an ideal gas.

so, 'r' is correct.

Hence the answer is

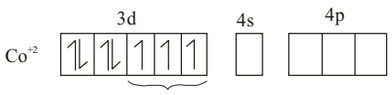
A ® p, s,
B ® r,
C ® p, q
D ® r.

44. Solution :

A ® p, q, s

Co has oxidation state of +2, so 's' is correct.

$[Co(NH_3)_4(H_2O)_2]^{+2}$ of the form $[Ma_4b_2]^{\pm n}$ so it will show geometrical isomerism, hence 'p' is correct.



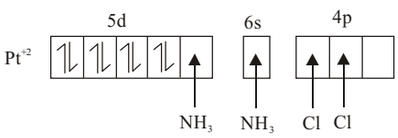
even if they pair up in thepnesence of NH_3 it will be paramagnetic, so 'q' is correct.

B ® p, r, s

In $[Pt(NH_3)_2Cl_2]$

It has oxidation state of +2, Hence 's' is correct.

It is of the form $[Ma_2b_2]^{\pm n}$ and dsp^2 hybridisewd so it will show geometrical isomerism. Hence 'p' is correct.



(dsp^2 hybridised, square planar)

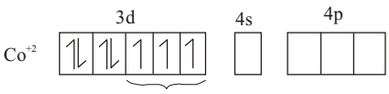
As no unpaired electron, it is dimagnetic.

So, 'r' is correct.

C ® q, s

Co has oxidation state of +2, so 's' is correct.

It is of the form $[Ma_5b]^{\pm n}$, therefore it does not show geometrical isomerism.

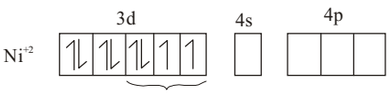


In no way this can have all electrons paired so paramagnetic, so ‘q’ is correct.

D ® q, s

Ni has oxidation state of +2, so ‘s’ is correct.

It is of the form $[Ma_6]^{\pm n}$, therefore it does not show geometrical isomerism.



For octahedral complex, this will be always outer orbital complex i.e., d^2sp^3. So the electrons will not pair up, hence paramagnetic. So, ‘q’ is correct.

Hence the answer is

A ® p, q, s

B ® p, r, s

C ® q, s

D ® q, s