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AskIITians IIT JEE Chemistry Test

Code – AC204

Time - One hour

Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.

A. General :

1. This booklet is your Question paper containing 69 questions.
2. Blank papers, clipboard, log tables, slide rules, calculators, cellular phones, pagers and electronic gadgets in any form are not allowed to be carried inside the examination hall.
3. The answer sheet, a machine-readable Objective Response Sheet (ORS), is provided separately.

B. Filling the ORS :

4. On the lower part of the ORS, write in ink, your name, your Registration No. Do not write these anywhere else.
5. Make sure the CODE on the ORS is the same as that on this booklet and put your signature on the ORS affirming that you have verified.
6. Write your Registration No. in ink, provided in the lower part of the ORS and darken the appropriate bubble UNDER each digit of your Registration No. with a good quality HB pencil.

C. Question paper format.

7. The question paper consists of 3 parts (Physics, Chemistry and Mathematics). Each part has 4 sections.
8. Section I contains 6 multiple choice question. Each question has four choices (A), (B), (C) and (D), out of which only one is correct.
9. Section II contains 4 questions. Each question has four choices (A), (B), (C) and (D), out of which one or more choices is correct.
10. Section III contains 4 questions. Each question contains Statement -1 (Assertion) and Statement -2 (Reason).
    Bubble (A) if both the statements are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1.
    Bubble (B) if both the statements are TRUE butSTATEMENT-2 is NOT the correct explanation of STATEMENT-2.
    Bubble (C) if STATEMENT-1 is TRUE and STATEMENT-2 is FALSE.
    Bubble (D) if STATEMENT-1 is FALSE and STATEMENT-2 is TRUE.
11. Section IV contains 3 paragraphs. Based upon each paragraph. Three multiple choice questions have to be answered. Each question has four choices (A) (B) (C) (D) out of which only one is correct.

D. Marking Scheme.

12. For each question in Section I, you will be awarded 3 marks if you have darkened only the bubble corresponding to the correct answer and zero mark if no bubble is darkened. In all other cases, minus one (–1) mark will be awarded.
13. For each question in Section II, you will be awarded 4 marks, if you darken only the bubble corresponding to the correct answer and zero mark if no bubble is darkened. In all other cases, (–1) mark will be awarded.
14. For each question in Section III, you will be awarded 3 marks, if you darken only the bubble corresponding to the correct answer and zero mark if no bubble is darkened. In all other cases, (–1) mark will be awarded.
15. For each question in Section IV, you will be awarded 3 marks, if you darken only the bubble corresponding to the correct answer and zero mark if no bubble is darkened. In all other cases, (–1) will be awarded.

Useful Data

Gas Constant	R	= 8.314 J K^{-1} mol^{-1}	**1 Faraday**	=	96500 Coulomb
		= 0.0821 Lit atm K^{-1} mol^{-1}	**1 calorie**	=	4.2 Joule
		= 1.987 ≈ 2 Cal K^{-1} mol^{-1}	**1 Ev**	=	1.6 × 10^{-1} J
Avogadro's Number	Na	= 6.023 × 1023			

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Planck's constant	h	$= 6.625 \times 10^{-34}$ J . s $= 6.625 \times 10^{-27}$ erg . s
Atomic No:		H = 1, D = 1, Li = 3, Na = 11, K = 19, Rb = 37, Cs = 55, F = 9, Ca = 20, He = 20, He = 2, O = 8, Au = 79, Ni = 28, Zn = 30, Cu = 29, Cl = 17, Br = 35, Cr = 24, Mn = 25, Fe = 26, S = 16, P = 15, C = 6, N = 7, Ag = 47.
Atomic Masses:		He = 4, Mg = 24, C = 12, O = 16, N = 14, P = 31, Br = 80, Cu = 63.5, Fe = 56, Mn = 55, Pb = 207, Au = 197, Ag = 108, F = 19, H = 1, Cl = 35.5, Sn = 118.6, Na = 23, D = 2, Cr = 52, K = 39, Ca = 40, Li = 7, Be = 4, Al = 27, S = 32.

SECTION I

1. Calculate the useful work of the reaction

$Ag_{(s)} + \frac{1}{2} Cl_{2(g)} \rightarrow AgCl(s)$

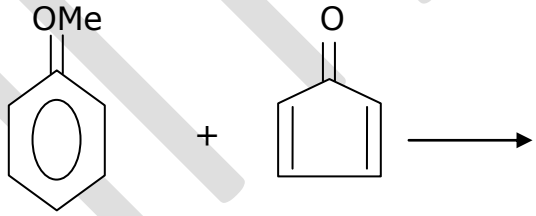
Given $E^{o}_{Cl_2/Cl^-} = + 1.36$ V

$E^{o}_{AgCl/Ag,Cl^-} = 0.22$ V

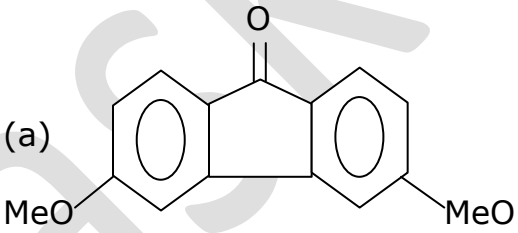
if $P_{Cl_2} = 1$ atm and T = 298 K

(a) 110 kJ/mol
(b) 220 kJ/mol
(c) 55 kJ/mol
(d) 1000 kJ/mol

2. The final product of the reaction



Excess

(a)


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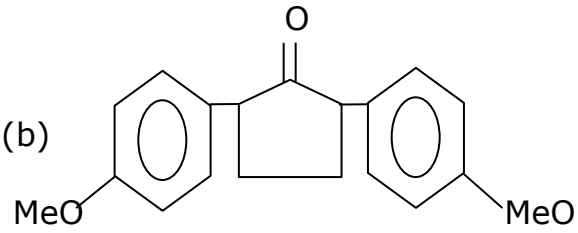

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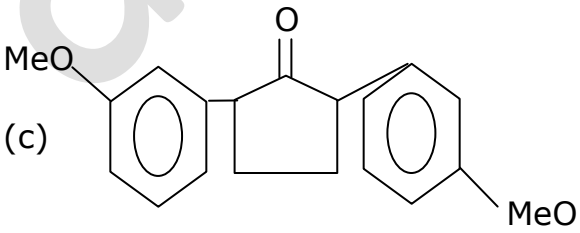

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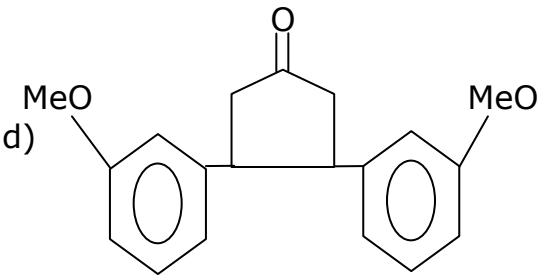
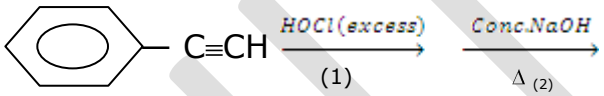


3. Which of the following process is used in the extractive metallurgy of magnesium?
   (a) fused salt electrolysis (b) self reduction
   (c) aqueous solution electrolysis (d) thermite process

4. PCl_5 molecule has
   (a) three fold axis of symmetry
   (b) two fold axis of symmetry
   (c) both
   (d) none of these

5. Which pairs gives Cl_2 gas at room temperature?
   (a) Conc. HCl + $KMnO_4$ (b) NaCl + Conc. H_2SO_4
   (c) NaCl + MnO_2 (d) NaCl + Conc. HNO_3

6. Which statement is correct about the end product of the following reaction series :-



   (a) it is optically inactive hydroxyl ketone
   (b) it is a resolvable hydroxyl acid
   (c) it is a non resolvable aldehyde
   (d) it is an optically inactive hydroxy acid.

SECTION II

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1. The solubility of a sparingly soluble salt A_xB_y in water at 25°C = 1.4×10^{-4} M. The solubility product is 1.1×10^{-11}. The possibilities are
   (a) x = 1, y = 2 (b) x = 2, y = 1
   (c) x = 1, y = 3 (d) x = 3, y = 1

2. Which of the following complex(s) is/are correctly matched with their geometry?
   (a) $[CoCl_4]^{2-}$ — tetrahedral
   (b) $[Co(Py)_4]^{2-}$ — square planar

(c) $[Cu(CN)_4]^{3-}$ — tetrahedral
(d) $[Fe(CO)_4]^{2-}$ — square planar

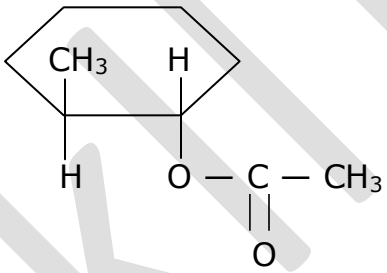
3. In the following gaseous phase first order reaction

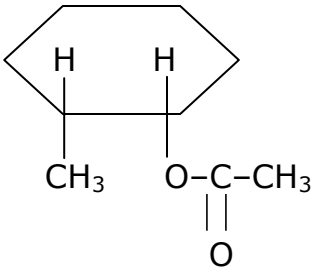
$$A_{(g)} \rightarrow 2B_{(g)} + C_{(g)}$$

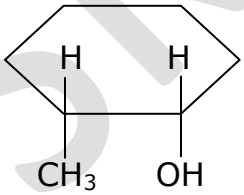
initial pressure was found to be 400 mm of Hg and it changed to 1000 mm of Hg after 20 min. Then:
(a) Half life for A is 10 min
(b) Rate constant is 0.0693 min^{-1}
(c) Partial pressure of C at 30 min is 350 mm of Hg.
(d) Total pressure after 30 min is 1150 mm of Hg.

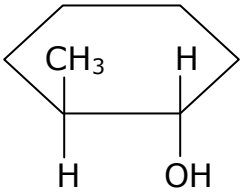
4. trans-2-methylcyclohexanol + acetyl chloride
↓
X

X + NaOH(aq). $\xrightarrow{\Delta}$ Y + sodium acetate

(a) X is 

(b) X is 

(c) Y is 

(d) Y is 

SECTION III

1. **Assertion :** $N_2F_3^+$ is planar at each nitrogen atom.
Reason : In N_3H, the bond angle H–N–N is 120° and both the N–N bond length are not equal.

2. **Assertion :** Potassium and Cesium are useful as electrodes in photoelectric cells.
Reason : Potassium and Cesium when irradiated with light, the light energy absorbed is sufficient to eject out of the electron from an atom.

3. **Assertion :** $CH_3\ddot{O} - CH = CH_2 \leftrightarrow CH_3\overset{+}{O} = CH - \overset{\ominus}{C}H_2$ is correct resonating structure.
Reason : Opposite charge separation is energetically unfavourable.

4. **Assertion :** Alkanes are monochlorinated with $(CH_3)_3$ COCl.
Reason : The initiating step is the heterolytic cleavage of hypochlorite.

SECTION IV

Paragraph

A solution is prepared by mixing 0.1 mol each of NH_3 and NH_4Cl (K_b of NH_3 = 1.8×10^{-5})

1. pH of the mixture is
(a) 9.25 (b) 4.0 (c) zero (d) 11.0

2. The ΔpH value upon addition of 0.06 mole of dissolved HCl is
(a) 0.3 (b) 0.602 (c) 0.2 (d) 0

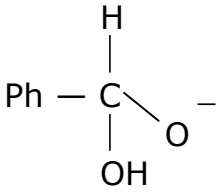
3. The ΔpH value upon addition of 0.06 mole of NaOH is
(a) 0.3 (b) 0.602 (c) 0.2 (d) zero

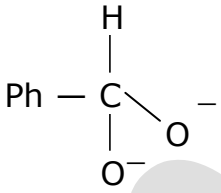
Paragraph

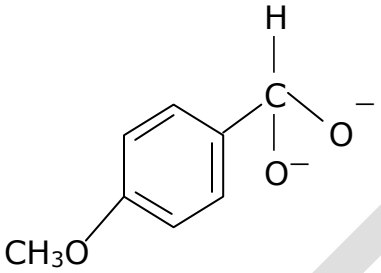
The α-hydrogen present in aldehydes and ketones are labile due to electron withdrawing – I effect of carbonyl group. Also the carbanion formed is stabilized by conjugation with C=O bond. Aldeydes and ketones behave differently in certain reactions. Some aldehydes undergo aldol condensation

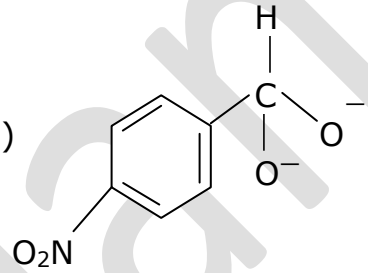
while some other undergo Cannizarro reaction.Methyl ketones also differ with other type of ketones.

1. In Cannizaro reaction, the intermediate that will be the best hydride donor is

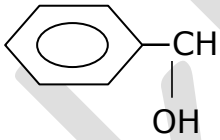
(a) 

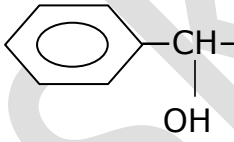
(b) 

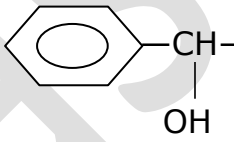
(c) 

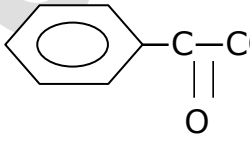
(d) 

2. Ph—C—CHO in the presence of concentrated solution of NaOH gives

(a) 

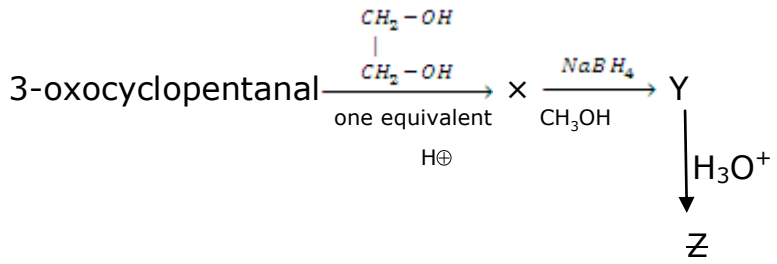
(b) 

(c) 

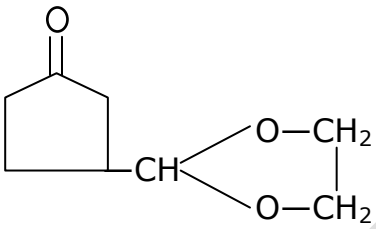
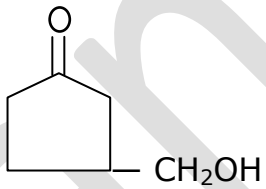
(d) 

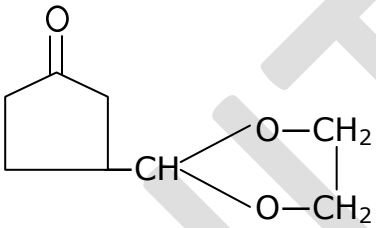
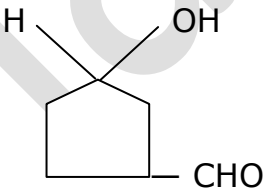
3. Aldehydes and ketones form acetals which are resistant to alkaline hydrolysis. Consider the following set of reaction:

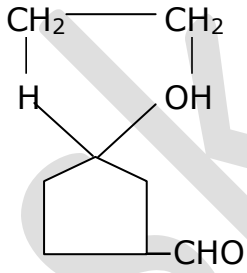
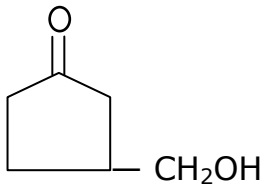
Consider the following set of reaction:

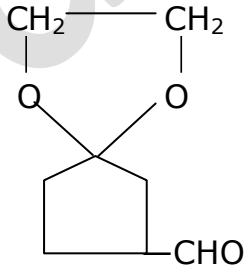
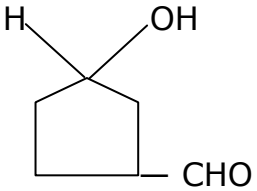


X and Z are

(a)  and 

(b)  and 

(c)  and 

(d)  and 

Paragraph

The enthalpy in the process HCl + $nH_2O \rightarrow$ HCl in n moles of H_2O, where n is the no. of moles of water is called the integral heat of solution. When n is large enough that continued addition of water does not increase the heat of solution, one simply writes

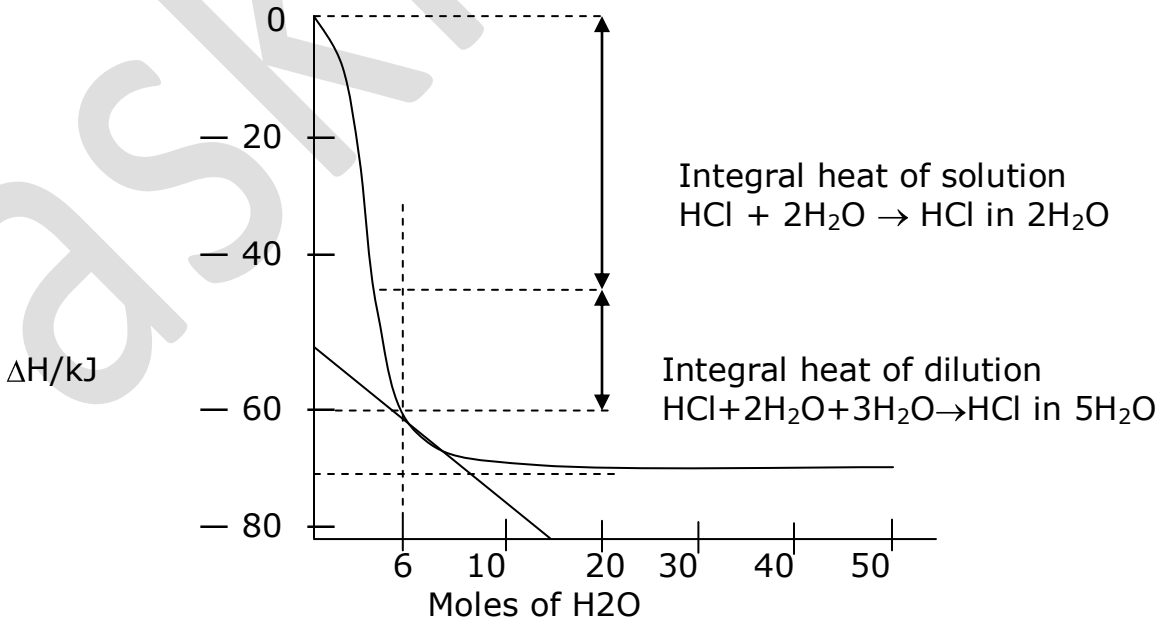
HCl + aq. $\rightarrow$ HCl(aq.)

The enthalpy for this process it the limiting value for the integral heat of solution.

The enthalpy of the process

HCl in n moles of H_2O + $mH_2O \rightarrow$ HCl in (m + n) moles of H_2O
is called the integral heat of dilution.

These quantities are indicated in figure. Another quantity of interest is the differential heat of solution, defined as the slope of the enthalpy curve. The heats of solution depend on the composition of the solution as shown in the figure :-



1. Integral heat of solution for the following step is
$HCl + 5H_2O \rightarrow HCl(5H_2O)$
(a) −12 kJ (b) −44kJ
(c) +60 kJ (d) −60kJ

2. What is the approximate enthalpy change for the reaction
(a) −80 kJ/mole (b) −60 kJ/mole
(c) −70 kJ/mole (d) −20 kJ/mole

3. Approximate value of differential heat of that solution in which 1 mole of HCl is dissolved in 6 moles of water is
(a) −2.4 kJ (b) −4.0 kJ
(c) −1.0 kJ (d) +30.33 kJ