askIITians

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AskIITians IIT JEE Chemistry Test

Code – AC210

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.

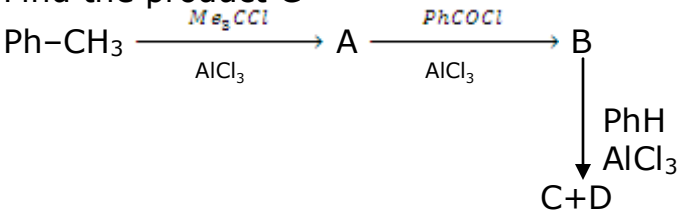
Useful Data

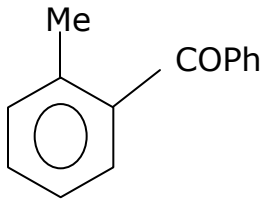
Gas Constant	R	= 8.314 J K^{-1} mol^{-1}	**1 Faraday**	=	96500 Coulomb
		= 0.0821 Lit atm K^{-1} mol^{-1}	**1 calorie**	=	4.2 Joule
		= 1.987 ≈ 2 Cal K^{-1} mol^{-1}	**1 Ev**	=	1.6 × 10^{-1} J
Avogadro's Number	Na	= 6.023 × 1023			

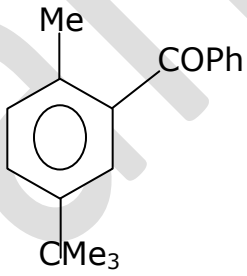
Planck's constant	h	$= 6.625 \times 10^{-34}$ J . s $= 6.625 \times 10^{-27}$ erg . s
Atomic No:		H = 1, D = 1, Li = 3, Na = 11, K = 19, Rb = 37, Cs = 55, F = 9, Ca = 20, He = 20, He = 2, O = 8, Au = 79, Ni = 28, Zn = 30, Cu = 29, Cl = 17, Br = 35, Cr = 24, Mn = 25, Fe = 26, S = 16, P = 15, C = 6, N = 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. Find the product C–



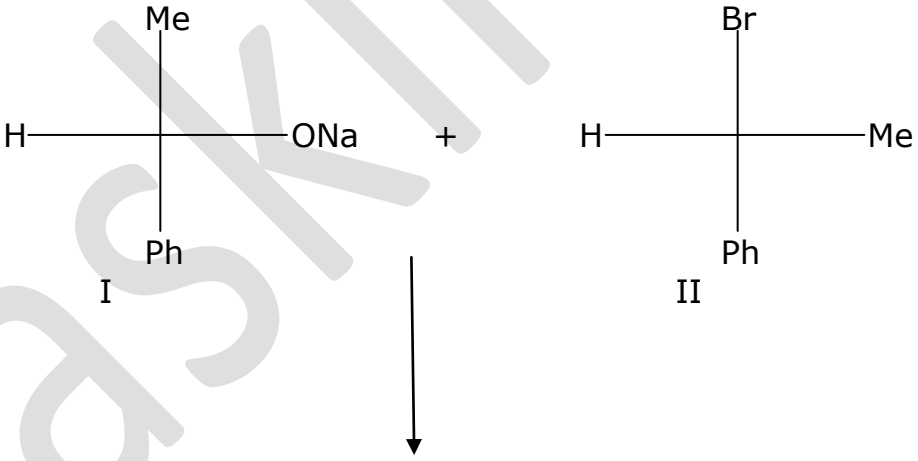
(a) 

(b) 

(c) $Me_2C{=}CH_2$

(d) Me_4C

2. The product of the given reaction is



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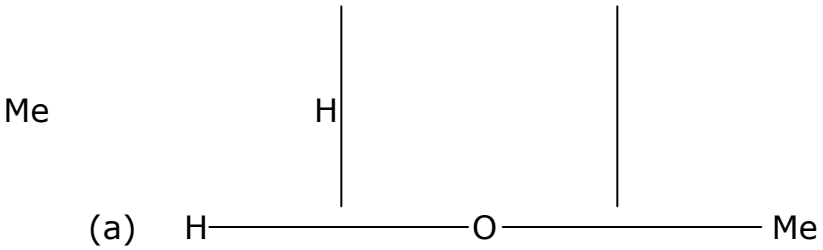

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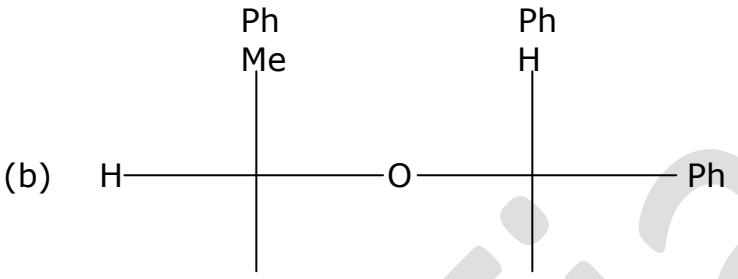

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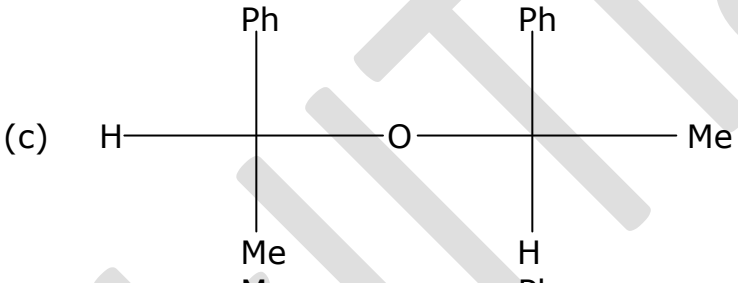

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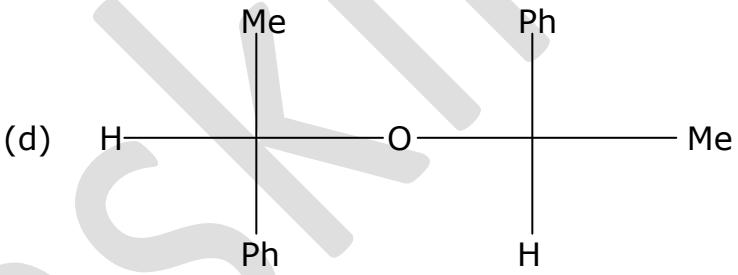


3. Which is wrong about P_4O_{10} molecule?
   (a) POP angle is 180^o
   (b) Each 'P' atom can be considered to be sp^3 hybridised.
   (c) There are two types of P—O bond lengths.
   (d) There are 6 P—O—P bonds.

4. $NH_4ClO_4 + HNO_3$ (dilute) $\downarrow$ $HClO_4 + [X]$

$[X] \xrightarrow{\Delta} Y(g)$

[X] and [Y] are respectively

(a) NH_4NO_3 and N_2O

(b) NH_4NO_2 and N_2

(c) HNO_3 and O_2

(d) none of these

5. A mixed solution of potassium hydroxide and sodium carbonate required 15ml of an N/20 HCl solution when titrated with phenolphthalein as an indicator But the same amount of the solution when titrated with methyl orange as an indicator required 25 ml of the same acid. The amount of KOH present in the solution is

(a) 0.014 g

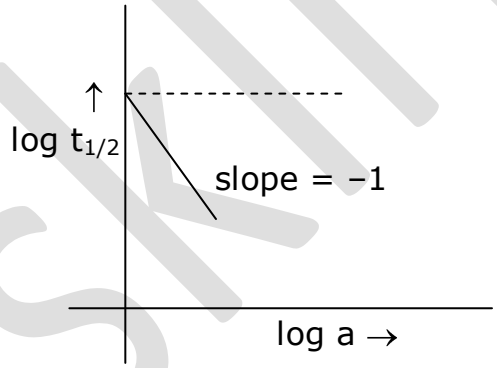
(b) 0.14 g

(c) 0.028 g

(d) 1.4 g

6. A graph between log $t_{1/2}$ and log a , where a is the initial concentration of A in the reaction is as shown :-

For reaction A → Product, the rate law is



(a) $\frac{-d[A]}{dt} = k$

(b) $\frac{-d[A]}{dt} = k[A]$

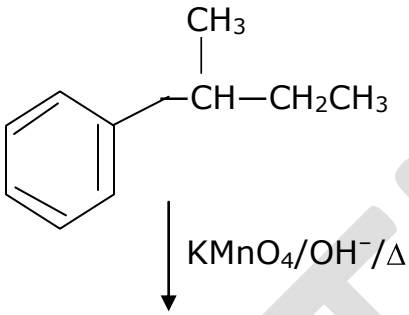
(c) $\frac{-d[A]}{dt} = k[A]^2$

(d) *none of these*

SECTION – II

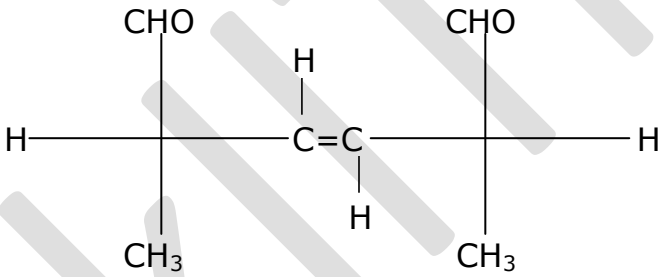
1. In which of the following reaction, a chiral reagent is giving a chiral product.

(a)



$KMnO_4/OH^-/\Delta$

(a)

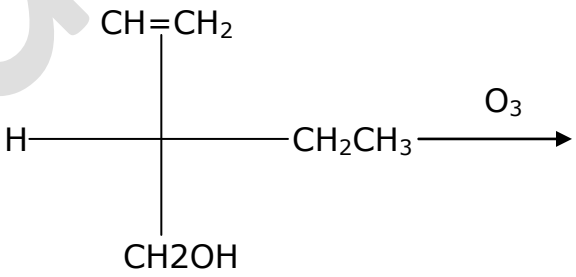


Reductive Ozonolysis

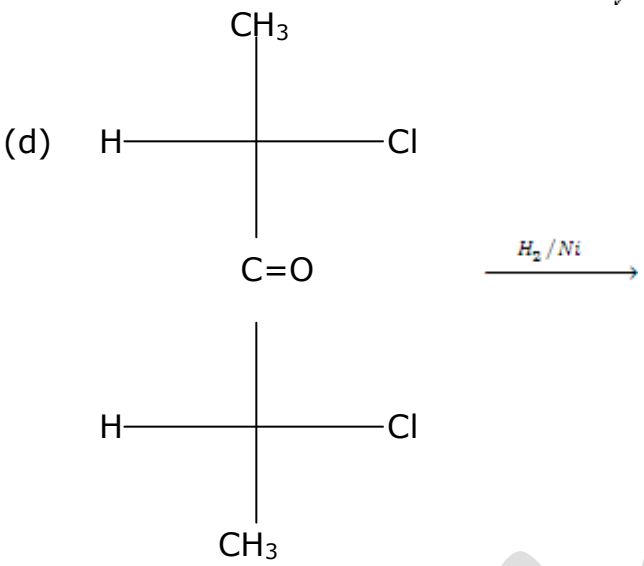
(i) O_3

(ii) Zn/H_2O

(c)

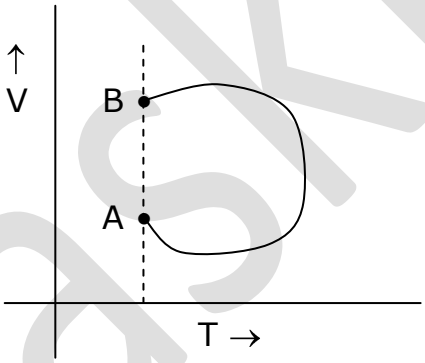


(d)



2. Choose the incorrect statement :-
   (a) Salicylic acid (o-hydroxy benzoic acid) is much stronger than its m–, p– isomers and benzoic acid itself.
   (b) Acidity of salicylic acid is due steric inhibition of resonance, as —OH group forces —COOH out of the plane of ring.
   (c) The orbitals which are in the same plane takes part in resonance
   (d) All the resonating structures have real existence.

3.



Above is the graph between Volume and temperature for gas.The gas is undergoing a proess from A to B.

With reference to the above graph, choose the correct alternative.

(a) $P_B > P_A$

(b) $P_A > P_B$
(c) Pressure first increases then decreases
(d) Pressure first decreases then increases

4. Which of the following complex(Δ) is/are matched correctly:-
(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.

SECTION – III

1. Statement 1 : In NaCl crystal each Na^+ ion is touching $6Cl^-$ ions but these chloride ions do not touch each other.
Statement 2 : The radius ratio r_{Na^+}/r_{Cl^-} is greater than 0.414, required for exact fitting.

2. Statement 1 : Ice melts at 0^oC under normal conditions, it would melt at lower temperature under higher pressure.
Statement 2 : Formation of ice is an exothermic progress.

3. Statement 1 : C—O bond length is shorter in an ester as compared with an anhydride.
Statement 2 : A degree of cross conjugation exist in the anhydride which decreases the delocalization to each carbonyl oxygen.

4. Statement 1 : No yellow precipitate is formed when an excess of a more concentrated (6M) solution of KI is added to a solution containing Pb^{2+} ions.
Statement 2 : Yellow precipitate of PbI_2 does not dissolve in excess of dilute solution of KI.

SECTION – IV

Paragraph

Properties, whose values depend only the concentration of solute particles in solution and not on the identity of the solute are called colligative properties. There may be change in number of moles of solute due to ionization or association hence these properties are also affected. Number of moles of the product is related to degree of ionization or association by Vant Hoff factor 'i'.

Given by $i = [1 + (n-1)\alpha]$ for dissociation and

$i = \left[1 + \left(\frac{1}{n} - 1\right)\alpha\right]$ for association

where n is the no. of products (ions or molecules) obtained per mole of the reactant. A dilute solution contains 't' moles of solute X in 1kg of solvent with molal elevation constant Kb. The solute dimerises in the solution according to the following equation. The degree of association is α.

$$2\,X \rightleftharpoons X_2$$

1. The Vant Hoff factor will be [if we start with one mole of X]
   (a) $i = 1-2\alpha$
   (b) $i = 1-\alpha/2$
   (c) $i = 1 + \alpha/2$
   (d) $i = 1 + \alpha$

2. The colligative properties observed will be
   (a) $\Delta P_{obs} > \Delta P_{actual}$
   $\Delta T_{bobs} > \Delta Tb_{actual}$
   $\Delta Tf_{obs} > \Delta Tf_{actual}$

   (b) $\Delta P_{obs} = \Delta P_{actual}$
   $\Delta T_{bobs} = \Delta Tb_{actual}$
   $\Delta Tf_{obs} = \Delta Tf_{actual}$

   (c) $\Delta P_{obs} < \Delta P_{actual}$
   $\Delta T_{bobs} < \Delta Tb_{actual}$
   $\Delta Tf_{obs} < \Delta Tf_{actual}$

   (d) $\Delta P_{obs} \geq \Delta P_{actual}$
   $\Delta T_{bobs} = \Delta Tb_{actual}$
   $\Delta Tf_{obs} < \Delta Tf_{actual}$

3. The equilibrium constant for the process can be expressed as
   (a) $K = \frac{K_b \frac{t}{\Delta T_b}}{1 - \frac{K_b t}{\Delta T_f}}$
   (b) $K = \frac{K_b (K_b t - \Delta T_b)}{[2\Delta T_b - K_b t]^2}$

© $K = \frac{2(K_b t - \Delta T_b/\Delta T_b)}{2t\left[1 - \frac{2(K_b t - \Delta t_b)^2}{\Delta T_b}\right]}$

(d) $K = \frac{\Delta T b_{obs}}{\Delta T f_{obs}}$

Paragraph

Alkyl derivatives of acetoacetic ester can undergo two types of hydrolysis, ketonic and acid hydrolysis. The scheme of these hydrolysis reactions are as follows:-

Ketonic Hydrolysis :-

$$CH_3COCHRCOOC_2H_5 \xrightarrow[(2)\ H_2SO_4]{(1)KOH(dil.)} CH_3—\underset{\underset{O}{||}}{C}—CH_2—R + CO_2 + EtOH$$

Acid hydrolysis :-

$$CH_3COCHRCOOC_2H_5 \xrightarrow{conc.KOH} CH_3COOK + RCHCOOK + EtOH$$

1. What is the final product S in the given reaction

$CH_3COCH_2COOC_2H_5$

↓ EtONa (1 mole)

P $\xrightarrow{EtI}$ Q

↓ (1) KOH, (2) H_3PO_4

S

(a) CH_3COOH

(b) $CH_3 — \underset{\underset{O}{||}}{C} —CH_2CH_2CH_3$

(c) $CH_3—\underset{\underset{O}{||}}{C}—\underset{\underset{CH_3}{|}}{CH}—CH_3$

(d) $CH_3 — \underset{\underset{O}{||}}{C} — Et$

2. Which reaction sequence can prepare succinic acid as final product

(a) CH_3COCH_2COOEt

↓ EtONa (1 eq.)

↓ $Cl—CH_2COOEt$

↓ $KOH/H^{\oplus}$

(b) $CH_3COCH_2COOEt \xrightarrow{EtONa(1eq.)}$ ↓ $Cl—CH_2COOH$ $\xleftarrow[H^{\oplus}]{KOH}$

(c) CH_3COCH_2COOEt

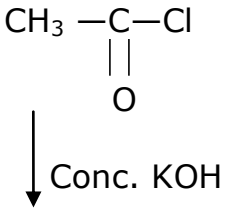
↓ EtONa (1 eq.)

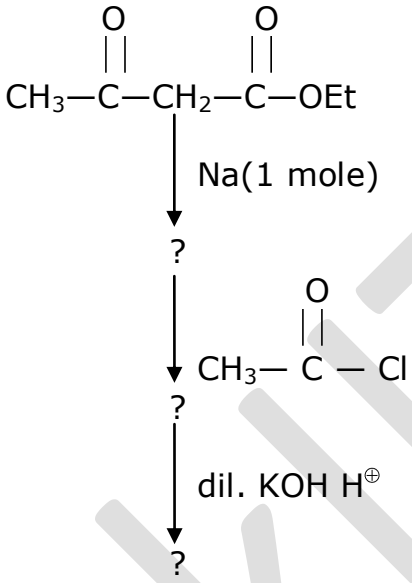
↓ $ClCH_2COOMe$

↓ Conc. KOH

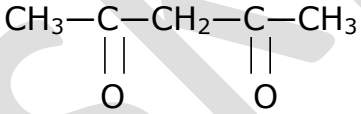
(d) CH_3COCH_2COOEt

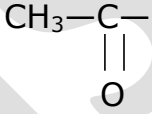
↓ EtONa (1 eq.)

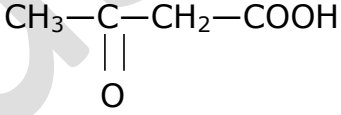


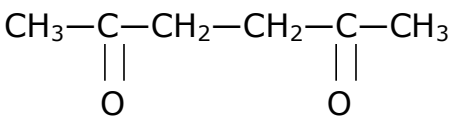
3. 

The final product is

(a) 

(b) 

(c) 

(d) 

Paragraph

Compound (A) on reduction with $LiAlH_4$ gives a hydride (P) containing 21.72% hydrogen along with other products.The one mole of hydrid (P) and 2 mole of ammonia at higher temperature gives a compound (Q) which is known as inorganic benzene. (A) hydrolyses incompletely and froms a compound (R) and H_3BO_3.

1. In hydride (P) (select correct statement):-
   (a) The central atom has trigonal planar geometry.
   (b) all H-atom lie in the same plane
   (c) all four terminal B-H bond lengths are equivalent but that of four bridging B-H bond lengths are not equivalent.
   (d) A three-centre two electron bond (3C-2e) is formed by overlap of an sp^3 hybrid orbital from each boron atom with the 1s orbital of hydrogen atom.

2. The hybridization of central atom of compound (R) is:-
   (a) sp^2
   (b) sp^3
   (c) sp
   (d) sp^3d

3. Which of the following statement is incorrect for the compound (A)?
   (a) It has trigonal planar geometry
   (b) The bond length between the central atom and the substituent atom is shorter than the sum of the covalent radii.
   (c) The coordination geometry around central atom of compound (A) and N atom in 1 : 1 complex of (A) and NH_3 is same.
   (d) In compound A, there is $P\pi—d\pi$ bonding.