

# IIT-JAM: 2013

## Chemistry

1. Q.1-10 (Objective questions) carry two marks each and Q.11-20(fill in the blank questions) carry three marks each and Q.21-30 (descriptive questions) carry five marks each.
2. The marking scheme for the objective type question, is as follows: i) For each correct answer, you will be answered 2(two) marks. ii) For each wrong answer, you will be answered  $-0.5$  (Negative half) mark. iii) Multiple answers to a question will be treated as a wrong answer. iv) For each un-attempted question, you will be awarded 0(zero) marks. v) Negative marks for objective part will be carried over to total marks.
3. There is no negative marking for fill in the blank questions.

### ❖ Question Paper

#### Part I: Objective Questions

Q.1 The most polar compound among the following is:

- (a)  $\text{SF}_4$  (b)  $\text{BF}_3$  (c)  $\text{XeF}_4$  (d)  $\text{SO}_3$

Q.2 Which one of the following order of the carbonates is correct for their decomposition temperature?

- (a)  $\text{BaCO}_3 > \text{CaCO}_3 > \text{SrCO}_3 > \text{MgCO}_3$  (b)  $\text{BaCO}_3 > \text{SrCO}_3 > \text{CaCO}_3 > \text{MgCO}_3$   
(c)  $\text{MgCO}_3 > \text{CaCO}_3 > \text{SrCO}_3 > \text{BaCO}_3$  (d)  $\text{MgCO}_3 > \text{CaCO}_3 > \text{BaCO}_3 > \text{SrCO}_3$

Q.3 The correct order of CO vibrational stretching frequency in the following complexes is

- (I)  $(\text{PF}_3)_3\text{Mo}(\text{CO})_3$  (II)  $(\text{PCl}_3)_3\text{Mo}(\text{CO})_3$  (III)  $\{\text{P}(\text{OMe})_3\}_3\text{Mo}(\text{CO})_3$   
(a)  $\text{I} < \text{II} < \text{III}$  (b)  $\text{III} < \text{II} < \text{I}$  (c)  $\text{II} < \text{I} < \text{III}$  (d)  $\text{III} < \text{I} < \text{II}$

Q.4 Among the following, the ligand that best stabilizes low oxidation state of tungsten (W) is

- (a)  $\text{H}_2\text{O}$  (b)  $\text{NH}_3$  (c)  $\text{CO}$  (d)  $\text{F}^-$

Q.5 The function  $y = x \cdot \exp(-x^2)$  has a minimum at  $x = -\frac{1}{\sqrt{2}}$ . The second derivative of the function at the minimum is

- (a)  $2\sqrt{2}\exp\left(-\frac{1}{2}\right)$  (b)  $-2\sqrt{2}\exp\left(-\frac{1}{2}\right)$  (c) 0 (d)  $-\sqrt{2}\exp\left(-\frac{1}{2}\right)$

Q.6 For a particular reaction at constant temperature, a plot of inverse of reactant concentration  $\left(\frac{1}{[A]}\right)$  versus time is a straight line with a slope of  $4.0 \times 10^{-2} \text{ L mol}^{-1} \text{ s}^{-1}$ . The time required (in seconds) for 1.0 M of reactant to decrease to 0.25 M is:

- (a) 18.8 (b) 34.7 (c) 75.0 (d) 187.5

Q.7 For a physisorption process, which one of the following statements is not correct?

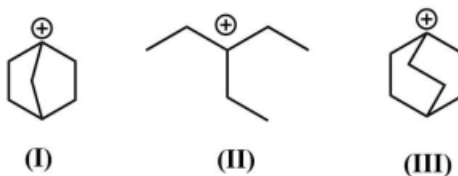
- (a) There are van der Waals interactions between the adsorbate and the adsorbent.  
 (b) The process predominates at low temperature.  
 (c) The process cannot proceed beyond a monolayer.  
 (d) The process is reversible.

Q.8 The product of the following reaction is



- (a) (b) (c) (d)

Q.9 The correct order of stability of the following carbonium ions is



- (a) III < I < II (b) I < II < III (c) II < III < I (d) I < III < II

Q.10 Which one of the following statements is correct?

- (a) Naturally occurring DNA has B-configuration.
- (b) Nucleic acids are derived from proteins.
- (c) Proteins store genetic information
- (d) Vitamins generally act as enzymes.

### Part II: Fill in the Blank Questions

Q.11 The reaction of anhydrous  $\text{FeCl}_2$  with sodium-pentadienyl in ether gives an air-stable diamagnetic orange solid, which on oxidation gives an air-sensitive paramagnetic blue-green compound in solution. The blue-green compound is.....

Q.12  $\text{CaO}$ ,  $\text{VO}$  and  $\text{MnO}$  have octahedral coordination of the metal ions in a rock-salt structure. The correct increasing order of their lattice enthalpies is.....

Q.13 The shape of the tetrahalide  $\text{IF}_4$  is .....

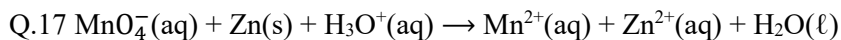
Q.14 The vapour pressures of solid and liquid chlorine are given by

$$\log_e p^{\text{solid}} = 24 - \frac{3900}{T} \text{ and } \log_e p^{\text{liq}} = 18 - \frac{2600}{T}$$

Where  $p^{\text{solid}}$  and  $p^{\text{liq}}$  are the vapour pressures (in Torr) of solid and liquid chlorine near the triple point, respectively and  $T$  is the absolute temperature. The ratio of the slope of the solid gas curve to the slope of the liquid gas curve at the triple point in the P-T diagram is.....

Q.15 For unnormalized wave-function,  $\Psi(r, \theta, \phi) = \sin\theta \cos\phi \left\{ \frac{2r}{a_0} - \left( \frac{r}{a_0} \right)^2 \right\} \exp\left(-\frac{r}{a_0}\right)$ , the number of radial node(s) is.....

Q.16 A hypothetical element (atomic weight = 300) crystallizes in a simple cubic lattice. For this crystal, the first order X-ray diffraction with wavelength of  $5\text{\AA}$  appears at an angle of  $30^\circ$ . The density of the crystal is .....  $\text{g cm}^{-3}$ . [Avogadro number,  $N_A = 6.02 \times 10^{23}$ ]



For the above reaction if the equilibrium constant at 298K is represented by  $10^x$ , then the value of X is .....

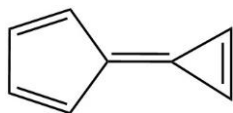
[Given: The standard cell potential  $E^0 = 2.4\text{V}$  and  $\frac{2.303}{F} = 0.06\text{V}$  at 298K]

Q.18 The rotational energy barrier between the most stable and the least stable conformations of 2,3-dimethylbutane along  $\text{C}_2\text{--C}_3$  bond is..... $\text{kcal mol}^{-1}$ .

[Given: The energies( $\text{kcal mol}^{-1}$ ) for  $\text{H/CH}_3$  eclipsing = 1.8,  $\text{CH}_3/\text{CH}_3$  eclipsing = 2.9 and  $\text{CH}_3/\text{CH}_3$  gauche = 0.9]

Q.19 The number of peaks or signals in  $^1\text{H}$  NMR of N,N-dimethylformamide (DMF) at  $25^\circ\text{C}$  is.....

Q.20



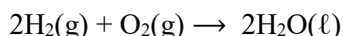
Calixene is a polar hydrocarbon with a high dipole moment. The most stable dipolar canonical structure is.....

**DALAL INSTITUTE**  
(info@dalalinstitute.com, +91-9802825820)

**Part III: Descriptive Questions**

Q.21 A mixture of  $\text{C}_3\text{H}_8$  and oxygen in 1L closed vessel has an internal pressure of 4atm at  $100^\circ\text{C}$ . when the mixture is ignited, the reaction produces  $\text{CO}_2(\text{g})$  and  $\text{H}_2\text{O}(\text{g})$  until all oxygen is consumed. After the reaction, pressure of the vessel is 4.2atm at the same temperature. Calculate the weight of oxygen present before the reaction. [Gas constant,  $R = 0.082 \text{ L atm mol}^{-1}\text{K}^{-1}$ ].

Q.22 The following reaction is carried out at 1atm and 300K

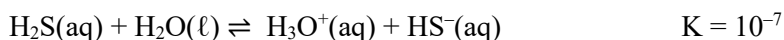


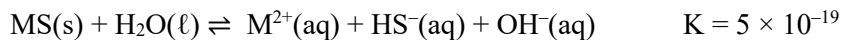
$\Delta U$  for the above reaction is 550 kJ. Assuming ideal gas behaviour for  $\text{H}_2$  and  $\text{O}_2$ , calculate the value of  $\Delta H$ . The value of gas constant,  $R = 0.082 \text{ L atm mol}^{-1}\text{K}^{-1} = 8.314 \text{ J mol}^{-1}\text{K}^{-1}$ .

[Given: The value of 1 mole of liquid water is 18mL under the above reaction condition]

Q.23 At 298K, calculate the solubility of the metal sulphide,  $\text{MS}(\text{s})$ , in a saturated solution of  $\text{H}_2\text{S}$  where the concentration of  $\text{H}_2\text{S}$  and pH are maintained at 0.1M and 3, respectively

Given at 298K,





Q.24 For each of the following metallo-proteins identify the metal-ion at the active-site and the function of the proteins:

Deoxy-hemoglobin, deoxy-myoglobin, oxy-hemocyanin, cytochrome-c and carbonic anhydrase.

Q.25 A solution containing 250 ppm of  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  (formula weight = 250) has an absorbance of 0.1 measured in 1 cm cell at 600 nm. Calculate the molar absorptivity ( $\epsilon$ ) of  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  in  $\text{L M}^{-1}\text{cm}^{-1}$ . 25 mL of  $\text{Na}_2\text{EDTA(aq)}$  solution is titrated against  $\text{Na}_2\text{EDTA(aq)}$  solution, it consumes at 50 mL of  $\text{Na}_2\text{EDTA(aq)}$  solution. Calculate the concentration of  $\text{Na}_2\text{EDTA(aq)}$  solution in moles  $\text{L}^{-1}$ .

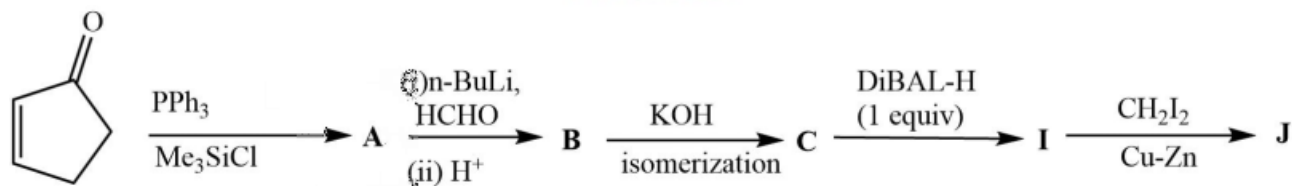
Q.26 assume the complex  $[\text{Ni}(\text{PPh}_3)_2(\text{SCN})_2]$  is paramagnetic. The analogous complex of  $\text{Pd(II)}$  is diamagnetic. Draw all the probable isomers for both the complexes considering  $\text{SCN}^{-}$  is an ambidentate ligand.

Q.27 Write the structures of A to E in the following reaction sequence:

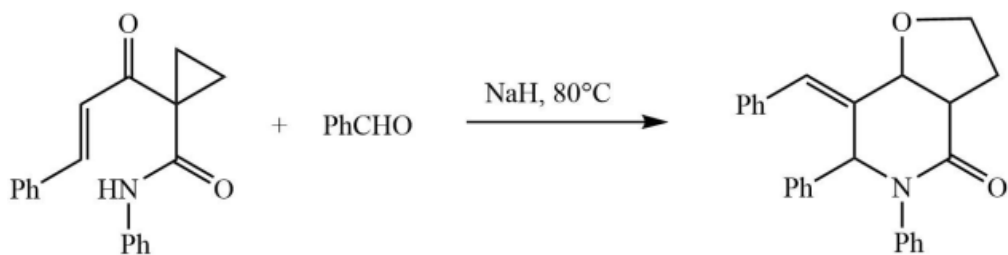


Q.28 Write the structures of A to E in the following reaction scheme:

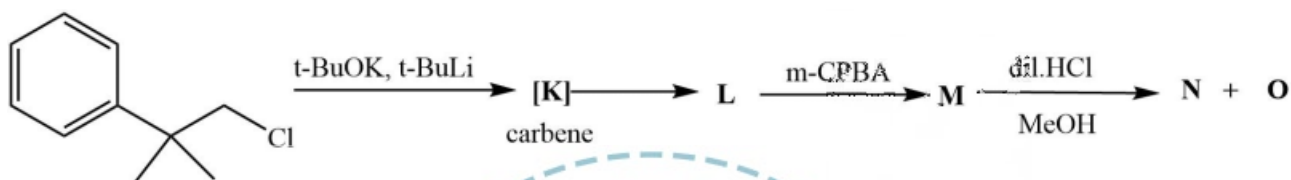
[DIBAL-H = diisobutylaluminium hydride]



Q.29 Propose a mechanism for the following reaction. Show stepwise correct reactive intermediates



Q.30 Complete the following reaction sequence and write structures of K to O.





## LEGAL NOTICE

This document is an excerpt from the book entitled “IIT-JAM Chemistry Solved Papers”, and is the intellectual property of the Publisher. The content of this document is protected by international copyright law and is valid only for the personal preview of the user who has originally downloaded it from the publisher’s website ([www.dalalinstitute.com](http://www.dalalinstitute.com)). Any act of copying (including plagiarizing its language) or sharing this document will result in severe civil and criminal prosecution to the maximum extent possible under law.



*This is a low resolution version only for preview purpose. If you want to read the full book, please consider buying.*

**Buy the complete book with TOC navigation, high resolution images and no watermark.**

## Home

### CLASSES

#### NET-JRF, IIT-GATE, M.Sc Entrance & IIT-JAM

Want to study chemistry for CSIR UGC – NET JRF, IIT-GATE, M.Sc Entrance, IIT-JAM, UPSC, ISRO, IISc, TIFR, DRDO, BARC, JEST, GRE, Ph.D Entrance or any other competitive examination where chemistry is a paper ?

[READ MORE](#)

### BOOKS

#### Publications

Are you interested in books (Print and Ebook) published by Dalal Institute ?

[READ MORE](#)

### VIDEOS

#### Video Lectures

Want video lectures in chemistry for CSIR UGC – NET JRF, IIT-GATE, M.Sc Entrance, IIT-JAM, UPSC, ISRO, IISc, TIFR, DRDO, BARC, JEST, GRE, Ph.D Entrance or any other competitive examination where chemistry is a paper ?

[READ MORE](#)

[Home](https://www.dalalinstitute.com/): <https://www.dalalinstitute.com/>

[Classes](https://www.dalalinstitute.com/classes/): <https://www.dalalinstitute.com/classes/>

[Books](https://www.dalalinstitute.com/books/): <https://www.dalalinstitute.com/books/>

[Videos](https://www.dalalinstitute.com/videos/): <https://www.dalalinstitute.com/videos/>

[Location](https://www.dalalinstitute.com/location/): <https://www.dalalinstitute.com/location/>

[Contact Us](https://www.dalalinstitute.com/contact-us/): <https://www.dalalinstitute.com/contact-us/>

[About Us](https://www.dalalinstitute.com/about-us/): <https://www.dalalinstitute.com/about-us/>

#### Postgraduate Level Classes (NET-JRF & IIT-GATE)

##### [Admission](#)

[Regular Program](#)

[Test Series](#)

[Distance Learning](#)

[Result](#)

#### Undergraduate Level Classes (M.Sc Entrance & IIT-JAM)

##### [Admission](#)

[Regular Program](#)

[Test Series](#)

[Distance Learning](#)

[Result](#)

#### [IIT-JAM Chemistry Solved Papers](#)

“IIT-JAM Chemistry Solved Papers” is now available, visit our website for more info.

[READ MORE](#)

*Join the revolution by becoming a part of our community and get all of the member benefits like downloading any PDF document for your personal preview.*

[Sign Up](#)



*Dalal Institute's*

# IIT-JAM

*Chemistry*

## Solved Papers



2011-2020 & Letest Model Test

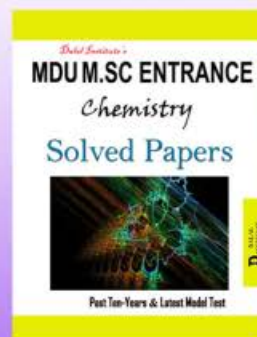
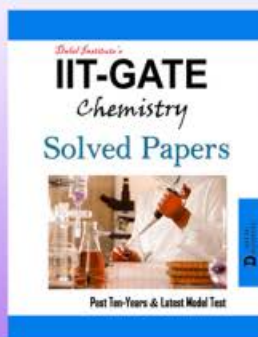
# Table of Contents

<b>IIT-JAM: Model Test.....</b>	<b>5</b>
<b>Chemistry .....</b>	<b>5</b>
❖ Question Paper.....	5
❖ Answer Key .....	15
❖ Solution.....	16
<b>IIT-JAM: 2011 .....</b>	<b>19</b>
<b>Chemistry .....</b>	<b>19</b>
❖ Question Paper.....	19
❖ Answer Key .....	31
❖ Solution.....	32
<b>IIT-JAM: 2012.....</b>	<b>36</b>
<b>Chemistry .....</b>	<b>36</b>
❖ Question Paper.....	36
❖ Answer Key .....	46
❖ Solution.....	47
<b>IIT-JAM: 2013.....</b>	<b>50</b>
<b>Chemistry .....</b>	<b>50</b>
❖ Question Paper.....	50
❖ Answer Key .....	56
❖ Solution.....	57
<b>IIT-JAM: 2014.....</b>	<b>60</b>
<b>Chemistry .....</b>	<b>60</b>
❖ Question Paper.....	60
❖ Answer Key .....	71
❖ Solution.....	72
<b>IIT-JAM: 2015.....</b>	<b>76</b>
<b>Chemistry .....</b>	<b>76</b>
❖ Question Paper.....	76

❖ Answer Key .....	88
❖ Solution.....	89
<b>IIT-JAM: 2016 .....</b>	<b>92</b>
<b>Chemistry .....</b>	<b>92</b>
❖ Question Paper.....	92
❖ Answer Key .....	105
❖ Solution.....	106
<b>IIT-JAM: 2017 .....</b>	<b>110</b>
<b>Chemistry .....</b>	<b>110</b>
❖ Question Paper.....	110
❖ Answer Key .....	123
❖ Solution.....	124
<b>IIT-JAM: 2018 .....</b>	<b>128</b>
<b>Chemistry .....</b>	<b>128</b>
❖ Question Paper.....	128
❖ Answer Key .....	142
❖ Solution.....	143
<b>IIT-JAM: 2019 .....</b>	<b>148</b>
<b>Chemistry .....</b>	<b>148</b>
❖ Question Paper.....	148
❖ Answer Key .....	161
❖ Solution.....	162
<b>IIT-JAM: 2020 .....</b>	<b>166</b>
<b>Chemistry .....</b>	<b>166</b>
❖ Question Paper.....	166
❖ Answer Key .....	181
❖ Solution.....	182

***The best institute for CSIR-JRF, UGC-NET, IIT-GATE, IIT-JAM, UPSC, GRE, IISc, TIFR, DRDO, BARC, JEST, ISRO and all Ph.D-M.Sc entrance examinations where chemistry is a paper.***

***Dalal Institute's  
other publications in this series***



**D DALAL  
INSTITUTE**

**Main Market, Sector 14, Rohtak, Haryana 124001, India  
(info@dalalinstitute.com, +91-9802825820)  
www.dalalinstitute.com**