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Thank you for downloading sample questions of IIT-JEE / AIEEE Chemistry Rank Booster. This sample consists of 50 questions at randomly chosen from 1000 questions in the Rank Booster.

The questions included in **IIT Chemistry Rank Booster** has originated from a large number of questions which were created by our team and which were rigorously scrutinised, edited and pretested to ensure their relevance to the IIT JEE and AIEEE chemistry preparation. Over a period of last 6 months our contributors submitted hundreds of IIT JEE level questions, of which our editors selected 1000 questions to be included in this book. Thus only the best of the original questions are included in the IIT Chemistry Rank Booster. This ensures that you preparation time spend on these questions is rightly utilised and will help you boost you rank at IIT JEE and AIEEE exam.

Preparation of **IIT Chemistry**, involves mastering the key concepts in physical chemistry and ability to apply the concepts in numerical settings, understanding reaction mechanism in Organic chemistry and understating key properties of Inorganic compounds. This requires systematic preparation and systematic testing of understanding and skills learned over the variety of subject matter. It is very important that you test your concepts with real IIT JEE level questions. Many coaching and teachers in India do provide some good pre-test material but lack to provide comprehensive and right material for **IIT Chemistry preparation**. It is important that questions you practice are at IIT JEE level and not too hard or easy from the **IIT Chemistry level**. With this view we have prepared **IIT Chemistry Rank** Booster and we are sure you will enjoy this.

All the best,
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Sample Chemistry Questions

Single Answer Type

1. *X, Y* and *Z* are three different compounds from the list below. *X* and *Y* react together to form an ester. *X* and *Z* also react to give the same ester as *X* and *Y* but much less readily. *X* reacts with sodium to produce hydrogen and a white solid.

   Compound *Y* could be

   A. propanoyl chloride
   B. propanoic acid
   C. propan-1-ol
   D. propanal
   E. ethyl cyanide (cyanoethane)

2. Which of the following would NOT take place if butan-1-ol were under test?
   A. The formation of a yellow derivative on the addition of 2,4-dinitrophenylhydrazine solution
   B. The formation of a green colour when warmed with a little acidified potassium dichromate(VI) ($K_2Cr_2O_7$) solution
   C. The production of a sweet smelling compound when heated with a mixture of ethanoic acid (acetic acid) and concentrated sulphuric acid
   D. The evolution of hydrogen when sodium is added to it
   E. The formation of 1-bromobutane when reacted with sodium bromide and concentrated sulphuric acid

3. The substance of a formula

$$(...CH_2CH_2O_2CC_6H_4CO_2CH_2CH_2O_2CC_6H_4CO_2...)_n$$

   is a

   A. polyester
   B. rubber
   C. natural oil or fat
   D. detergent
   E. protein

4. Of the compounds listed below, the one most likely to have the highest boiling point is

A. CH_3Cl

B. CH_2Cl_2

C. $CHCl_3$

D. CCl_4

E. C_2H_5Cl

5. Four chemically similar substances all of which contained at least one carbon and one halogen atom were found to be extremely stable towards oxidation, decomposition, and attack by acid and alkali. The most likely general formula amongst those listed in A–E is

A. $C_nH_{2n+1}Cl$

B. $C_nH_{2n+1}I$

C. C_nF_{2n+2}

D. $C_6H_5CH_2X$

E. $CHX = CHX$, where X= halogen

Multiple Answer Type

6. A nucleophilic substitution occurs when one negative group is replaced by another at a saturated carbon atom. Examples of nucleophilic substitution include

A. $CH_2 = CH_2 + Br \rightarrow CH_2Br - CH_2Br$

B. $C_2H_5I + NaOH \xrightarrow{H_2O} C_2H_5OH + NaI$

C. $C_4H_9I + KOH \xrightarrow{\text{alcohol}} C_4H_8 + KI + H_2O$

D. $C_3H_7Br + KCN \xrightarrow{\text{alcohol}} C_3H_7CN + KBr$

7. Which of the following exhibit optical activity?

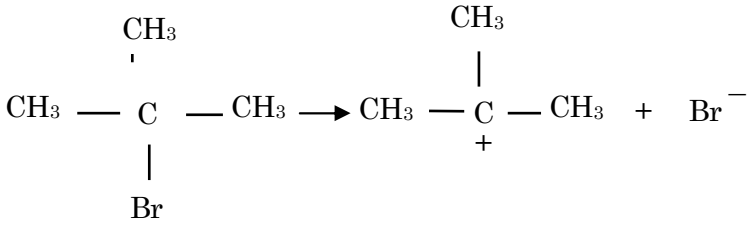
A. CH_3-$CH(NH_2)CH$=CH-CH_3

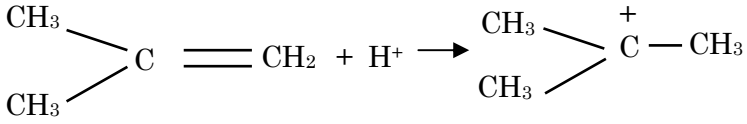
B. CH_3-$CH(Cl)CH(Cl)$-C_2H_5

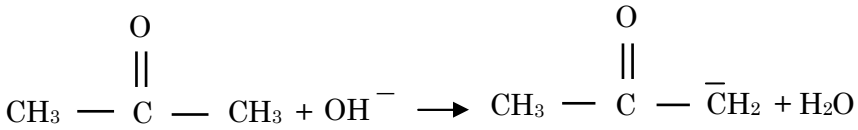
C. CH_3-$C(Br)$=$C(Br)$-CH_3

D. None of the above

8. Carbonium ions are formed in the reactions

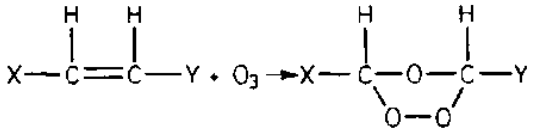
A. 

B. 

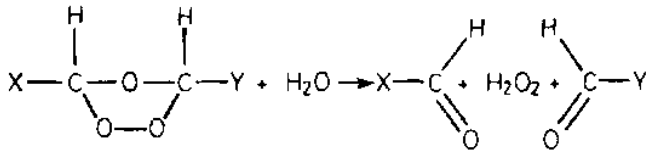
C. 

D. None of the above

9. Ozone is a form of oxygen in which the molecules are triatomic. Ozone reacts with compounds containing carbon-to-carbon double bonds thus:



The product of this reaction can be carefully hydrolysed as shown:



Which of the following would be reasonable uses of either or both of these reactions?

A. To find out if a compound contains a carbonyl group

B. To find the percentage of ozone in a sample of partially ozonised oxygen

C. To promote polymerization of compounds containing double bonds

D. Determining the location of double bonds in suitable compounds

10. The compound of formula

$CH_3CO(CH_2)_5CH=CHCO_2H$

Would be expected to

A. give tri-iodomethane (iodoform) with iodine and potassium hydroxide

B. decolorize bromine water

C. have *cis*- and *trans*- isomers

D. exist in optically active forms

11. Which is the order of INCREASING acid strength of the compounds below?

I. C_6H_5OH

II. CH_3CO_2H

III. C_2H_5OH

IV. HCO_2H

V. Cl_3CCO_2H

A. I–III–IV–V–II

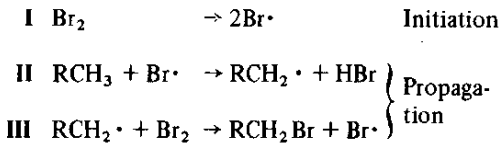
B. II–IV–V–I–III

C. III–I–II–IV–V

D. IV–II–III–I–V

E. V–I–III–IV–II

12. The bromination of an alkane takes place in the following stages:



Given the bond energy terms (in $kJ\ mol^{-1}$)

C–H 409; Br–Br 192; H–Br 367;
C–Br 284

which of the following statements is/are correct

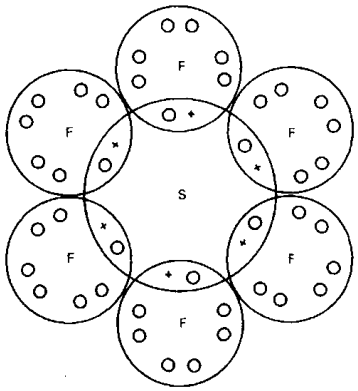
A. The initiation stage is exothermic

B. Heat is emitted in stage II

C. Heat is absorbed in stage III

D. The propagation (stages II and III) is exothermic

13. The diagram represents the electronic structure of the sulphur hexafluoride molecule.



Correct statements about sulphur hexafluoride include that

A. all S—F bonds are equivalent

B. SF6 is a planar molecule the oxidation number of sulphur is the same as the number of electrons it uses in bonding

C. sulphur has acquired the electronic structure of the inert gas argon

D. None of the above

14. The following equation represents the catalytic decomposition of H_20_2:

$$2H_2O_2\,(l) \xrightarrow{Pt} 2H_2O\,(l) + O_2\,(g)$$

What volume of 0_2 (g), measured at s.t.p., can be obtained from the catalytic decomposition of 1.0 dm^3 of 0.50 mol dm^{-3} H_20_2?

A 0.5 dm^3 B 5.6 dm^3 C 11.2 dm^3 D 5.6/34 dm^3 E 11.2/34 dm^3

15. Given the following redox potentials

$$Fe^{3+}(aq)/Fe^{2+}(aq), \quad E^{\ominus} = +0.77\ V$$
$$\tfrac{1}{2}I_2(aq)/I^-(aq), \quad E^{\ominus} = +0.54\ V$$
$$\tfrac{1}{2}Cl_2(aq)/Cl^-(aq), \quad E^{\ominus} = +1.36\ V$$
$$\tfrac{1}{2}Br_2(aq)/Br^-(aq), \quad E^{\ominus} = +1.07\ V$$

which of the following statements may correctly be made?

A. $I^-(aq)$ is likely to reduce $Fe^{3+}(aq)$ to $Fe^{2+}(aq)$.

B. $Fe^{2+}(aq)$ is likely to reduce $2Cl_2(aq)$ to $Cl^-(aq)$.

C. $Br^-(aq)$ is likely to reduce $Fe^{3+}(aq)$ to $Fe^{2+}(aq)$.

D. None of the above

Incorrect Answer Type

16. The reagents sodium dichromate, sulphuric acid and ethanol are used in the preparation of both acetaldehyde and acetic acid. In the preparation of

A. acetic acid, alcohol is dropped into a large excess of oxidising agent (moderately concentrated H_2SO_4 + $Na_2Cr_2O_7$)

B. acetic acid, the three reactants, when mixed, are heated under reflux so that they are in prolonged contact

C. acetaldehyde, a mixture of C_2H_5OH and $Na_2Cr_2O_7$ solution is dropped into boiling diluted H_2SO_4 at the rate at which acetaldehyde distils off

D. acetaldehyde, an adaptor is fitted to the end of the condenser and the distillate collected in a flask surrounded by ice

E. both acetaldehyde and acetic acid, the impure product is shaken with sodium carbonate to remove SO_2, washed with water and re-distilled

17. The alkanes

A. have the general formula C_nH_{2n+2} where n= 1, 2, 3, etc.

B. form isomers if $n \geq 4$

C. are gases at room temperature (25°C) if $n < 5$

D. are also known as paraffins (Given: the word paraffin is derived from the Latin words “parum” = little, and “affinis” = activity)

E. cannot undergo pyrolysis or “cracking” (thermal decomposition), if $n < 10$

18. Isomers of n-hexane include

A. 2-methyl pentane

B. 3-methyl pentane

C. 1, 3-diethyl propane

D. 2, 2-dimethyl butane

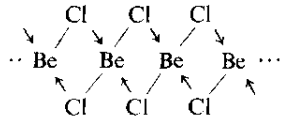
E. 2, 3-dimethyl butane

19. Beryllium

A. is the only element in the group to be attacked by aqueous alkali

B. forms an amphoteric hydroxide.

C. forms a chloride which, in the solid state, consists of beryllium atoms linked by chlorine atoms



D. will not burn in air or steam

E. unlike the other members of Group II, forms a soluble fluoride

Statement Type

A. STATEMENT-1 is True, STATEMENT-2 is True, STATEMENT-2 is correct explanation of STATEMENT-2

B. STATEMENT-1 is True, STATEMENT-2 is True, STATEMENT-2 is NOT a correct explanation of STATEMENT-2

C. STATEMENT-1 is True, STATEMENT-2 is False

D. STATEMENT-1 is False, STATEMENT-2 is True

E. STATEMENT-1 is False, STATEMENT-2 is False

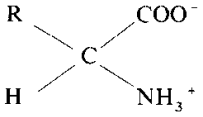
20. STATEMENT-1

Compounds containing both an amine group and a carboxyl group, such as glycine, NH_2CH_2COOH, are the building blocks from which proteins are made

and

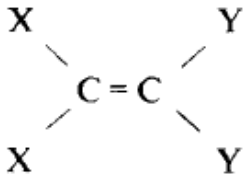
STATEMENT-2

Amino-acids are soluble in water and have high melting points indicating that they are actually salts and their formulae should be written.



21. STATEMENT-1

A compound of general formula



Where X and Y are atoms or groups of atoms, can exist in only one form

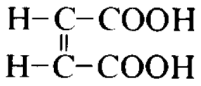
and

STATEMENT-2

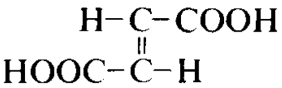
Geometric isomers can only occur when each carbon atom at the end of a double bond has two different substituents.

22. STATEMENT-1

Maleic acid



and fumaric acid



are geometrical isomers or stereoisomers

and

STATEMENT-2

maleic acid and fumaric acid have atoms arranged differently in space and may be called “space isomers” or stereoisomers

23. STATEMENT-1

$NaHCO_3$ solution (but not NaOH solution) is added to As_2O_3 solution in volumetric analysis before running in iodine

and

STATEMENT-2

The reaction $As_2O_3 + 2I_2 + 2H_2O \rightleftharpoons As_2O_5 + 4HI$

is reversible and NaOH, unlike $NaHCO_3$, reacts with iodine

24. STATEMENT-1

Nitric oxide is able to replace a cyanide ion in the hexacyanoferrate (III) ion to form $[Fe(CN)_5NO]^{2-}$.

and

STATEMENT-2

The molecule of nitric oxide contains an odd electron which it can donate to the ion and then it can further donate a lone pair of electrons to the metal.

25. STATEMENT-1

In the contact process for the manufacture of sulphuric acid, the reactants must be highly compressed to obtain a profitable yield.

and

STATEMENT-2

The equation $2SO_2 + O_2 \rightleftharpoons 2SO_3$, $\Delta H = -2 \times 22.6$ kcal shows that 3 volumes of reactants form 2 volumes of product in the gaseous state, at the same temperature and pressure.

26. STATEMENT-1

If H_2S is passed into a solution containing $Cu(CN)_4^{3-}$ and $Cd(CN)_4^{2-}$, a yellow precipitate of CdS is seen but there is no precipitation of Cu_2S

and

STATEMENT-2

The complex $Cd(CN)_4^{2-}$ is less stable than the complex $Cu(CN)_4^{3-}$ and consequently there are sufficient Cd^{2+} ions to exceed the solubility product of CdS, but not enough Cu^+ ions to reach the solubility product of Cu_2S

(Given:

$$K_1 = \frac{\left[Cu^+\right]\left[CN^-\right]^4}{\left[Cu(CN_4)^{3-}\right]}$$

$$= 5.0 \times 10^{-28}$$

$$K_2 = \frac{\left[Cd^{2+}\right]\left[CN^-\right]^4}{\left[Cd(CN_4)^{2-}\right]}$$

$$= 1.4 \times 10^{-17})$$

Matrix Type

Select the formula which most closely fits the description of each compound given below.

Column 1	Column 2
A. $CH_3CH=CHCHO$	27. A colourless liquid which initially forms an immiscible layer with sodium hydroxide solution but, after refluxing for several hours, two organic products, a solid and a liquid, can be separated.
B. $CH_3CH_2CO_2CH_2CH_3$	28. An optically active substance.
C. $CH_3CHOHCO_2H$	29. A colourless liquid which decolorizes acidified potassium manganate(VII) ($KMnO_4$) solution and forms a crystalline precipitate with 2,4-dinitrophenylhydrazine.
D. $CH_3COCH_2CO_2H$	30. A liquid which reacts with metallic sodium evolving hydrogen and decolorizes both bromine water and acidified potassium manganate(VII) ($KMnO_4$) solution in the cold
E. $CH_2=CHCO_2H$	

Match the columns below:

Column 1	Column 2
A. $Co(NO_2)_6^{3-}$	31. On exposure to air, solid salts containing this complex ion, evolve a gas and absorb water vapour
B. $Fe(CN)_6^{3-}$	32. The arrangement of the ligands around the central atom is square planar and the hydrated sodium salt is yellow
C. $Ni(CO)_4$	33. In the presence of acetic acid these complex ions form a yellow crystalline precipitate with K^+ ions
D. $Ni(CN)_4^{2-}$	34. The potassium salt containing this complex ion is a red crystalline substance which in aqueous solution forms a prussian blue precipitate with Fe^{2+} ions
E. $Cu(NH_3)_4^{2+}$	35. The number of electrons associated with the metal together with the lone pairs contributed by ligands add up to 36, the number found in an atom of krypton

Paragraph Type

Questions below concern an experiment to determine the initial rate of reaction between oxidizing agent ammonium peroxydisulphate [$(NH_4)_2S_2O_8$] and potassium iodide.

A series of experimental runs was carried out. In these exactly 10 cm^3 of 5 **X** 10^{-3} **M** sodium thiosulphate together with exactly 3 drops of a starch solution were placed in a conical flask and 20 cm^3 each of the $(NH_4)_2S_2O_8$ solution and KI solution were poured into this together. The flask was swirled and a stop clock started. The time taken for the solution to darken was noted.

The initial concentrations of the $(NH_4)_2S_2O_8$ and KI solutions in the mixture together with the times to darken, for the various experimental runs, are given below.

Initial concentrations/mol dm^{-3}		*Times to darken*/s
$(NH_4)_2S_2O_8$	KI	
0·10	0·20	35
0·05	0·20	69
0·03	0·20	103
0·10	0·10	70
0·10	0·067	104

36. The darkening of the solution was due to the

A. formation of a complex ion from the peroxydisulphate

B. formation of an iodine-thiosulphate compound

C. formation of a polysaccharide-iodine complex

D oxidation of sodium thiosulphate E precipitation of colloidal sulphur

E. precipitation of colloidal sulphur

37. The experiment was carried out by visual inspection. Which of the following methods could also be used?

A. Polarimetry

B. Colorimetry

C. Dilatometry

D. Titration with standard hydrochloric acid solution

E. Titration with standard iodine solution

38. The purpose of the sodium thiosulphate is to

A. react with some iodine

B. react with some potassium iodide

C. react with some peroxydisulphate

D. catalyse the overall reaction

E. act as an oxidising agent

39. A rate equation which would be consistent with the given data would be

A rate $\propto [S_2O_8^{2-}]$

B rate $\propto [I^-]$

C rate $\propto [I^-]\,[S_2O_8^{2-}]$

D rate $\propto [I^-]^2\,[S_2O_8^{2-}]$

E rate $\propto [I^-]\,[S_2O_8^{2-}]^2$

40. In a further experimental run, the initial concentrations were:

peroxydisulphate 0.10 M iodide 0.1 5 m

The expected time, in seconds, for the appearance of the dark colour would be

A. 36
B. 47
C. 71
D. 87
E. 105

Paragraph Type

Questions 41-44 concern the preparation of iodobenzene (C_6H_5I)

I. A mixture of concentrated hydrochloric acid, aniline and an equal volume of water was cooled in an ice bath to about 5 °C. A cooled aqueous solution of sodium nitrite was added slowly keeping the temperature below 10 °C. Benzenediazonium chloride was formed

$$C_6H_5NH_2 + HNO_2 + HCl \rightarrow C_6H_5N_2Cl + 2H_2O$$

II. After a few minutes the mixture was transferred to a distillation flask and a solution of potassium iodide added. A vigorous reaction took place. When the reaction subsided, the flask was gently heated until a dark crude oil of iodobenzene separated out. The iodobenzene was separated from the aqueous layer, washed twice with water and once with an aqueous solution of sodium thiosulphate

$$C_6H_5N_2Cl + KI \rightarrow C_6H_5I + N_2 + KCl$$

III. The washed iodobenzene was mixed with water and steam distilled.

IV. The iodobenzene was separated from the aqueous layer and dried.

41. The most probable reason for keeping the temperature below 10 °C in operation I was to prevent

A. loss of aniline by volatization

B.benzenediazonium chloride being formed too quickly

C. a reaction between aniline and sodium nitrite

D. the formation of nitrous acid

E. decomposition of benzenediazonium chloride

42. The most likely reason for washing with sodium thiosulphate would be to remove

A. iodine
B. sodium nitrite
C. potassium iodide
D. None of these
D. nitrous acid
E. aniline

43. In an actual preparation of iodobenzene, 9.3 g of aniline (relative molecular mass 93) were used and 16.32 g of iodobenzene (relative molecular mass 204) were formed.

The percentage yield of iodobenzene is

A. 8 per cent
B.50 per cent
C. 75 per cent
D. 80 per cent
E. 100 per cent

44. Diazonium salts are useful in the synthesis of aromatic compounds. Another compound usually prepared from a diazonium salt is

A. benzoic acid
B. benzylamine
C. benzene-azo-2-naphthol
D. toluene
E. benzyl alcohol

Multiple Answer Type

45. When aqueous ammonia is added to silver chloride, the salt dissolves. Which of the following help to explain this observation?

A The ionic product $[Ag^+ (aq)]$ $[Cl^- (aq)]$ in the solution is less than the solubility product of silver chloride.

B. A complex ion, $Ag(NH_3)_2^+$ is formed.

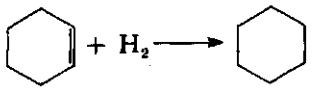
C. Ammonium ions and chloride ions have great affinity for each other.

D. None of the above

46. Some bond energies at 298 K are:

C—C 346 kJ mol^{-1}	C=C 611 kJ mol^{-1}
C—H 413 kJ mol^{-1}	H—H 437 kJ mol^{-1}

For the reaction:



$(C_6H_{10} + H_2 \rightarrow C_6H_{12})$

cyclohexene cyclohexane

what is the value of ΔH^{Θ}_{298}

A -561 kJ mol-1

B -124kJmol-1

C +124kJmol"1

D +289kJmol-1

E +561kJmol"1

47. The e.m.f. of the cell $\mathbf{Pt|H_2(g),\ HCl(aq)|ZnSO_4(aq)|Zn}$ depends on

A the pressure of the hydrogen.

B the concentration of the hydrochloric acid.

C the concentration of the zinc sulphate solution.

D None of the above

48. A solution containing one of the following metal ions gave a white precipitate when aqueous sodium carbonate was added. After being filtered off, washed and dried, the precipitate did not give carbon dioxide when treated with acid. Which metal ion was present initially?

A $Al^{3+}(aq)$ B $Fe^{3+}(aq)$ C $Mg^{2+}(aq)$ D $Pb^{2+}(aq)$ E $Zn^{2+}(aq)$

49. The relative reactivity of propene (propylene) and ethanol (acetaldehyde) towards attack by cyanide ion can be explained in terms of the general principle that

A nucleophiles attack a C=0 carbon atom more readily than a C=C carbon atom.

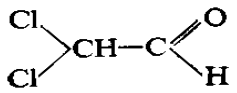
B electrophiles attack a C=0 carbon atom more readily than a C=C carbon atom.

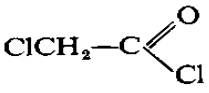
C both nucleophiles and electrophiles attack a C=0 carbon atom more readily than a C=C carbon atom.

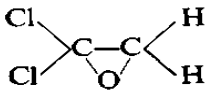
D nucleophiles attack a C=C carbon atom more readily than a C=0 carbon atom.

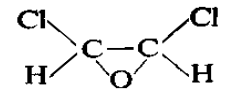
E electrophiles attack a C=C carbon atom more readily than a C=0 carbon atom.

50. A substance *X*, $C_2H_2C1_20$, reacts with cold water to give an acid $C_2H_3C10_2$, and this is converted slowly by hot water into another acid $C_2H_40_3$. What is *X*?

A 

B 

C 

D 

E none of these