

IIT-JEE

QUESTION
PAPERS
PAPER 2

SOLUTIONS
2011

PAPER 2

Time : 3 Hours

Maximum Marks : 240

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

INSTRUCTIONS

A. General:

1. The **question paper CODE** is printed on the right hand top corner of this sheet and on the back page (page No. 32) of this booklet.
2. No additional sheets will be provided for rough work.
3. Blank papers, clipboards, log tables, slide rules, calculators, cellular phones, pagers and electronic gadgets are NOT allowed.
4. Write your name and registration number in the space provided on the back page of this booklet.
5. The answer sheet, a machine-gradable Optical Response Sheet (ORS), is provided separately.
6. **DO NOT TAMPER WITH/MUTILATE THE ORS OR THE BOOKLET.**
7. Do not break the seals of the question-paper booklet before being instructed to do so by the invigilators.
8. This Question Paper contains 32 pages having 60 questions.
9. On breaking the seals, please check that all the questions are legible.

B. Filling the Right Part of the ORS :

10. The ORS also has a CODE printed on its Left and Right parts.
11. Make sure the CODE on the ORS is the same as that on this booklet. **If the codes do not match, ask for a change of the booklet.**
12. Write your Name, Registration No. and the name of centre and sign **with pen** in the boxes provided. **Do not write them anywhere else.** Darken the appropriate bubble **UNDER** each digit of your Registration No. with a **good quality HB pencil**.

C. Question paper format and Marking Scheme:

13. The question paper consists of **3 parts** (Chemistry, Physics and Mathematics). Each part consists of **four sections**.
14. In **Section I** (Total Marks: 24), for each question you will be awarded **3 marks** if you darken **ONLY** the bubble corresponding to the correct answer and **zero marks** if no bubble is darkened. In all other cases, **minus one (-1)** mark will be awarded.
15. In **Section II** (Total Marks: 16), for each question you will be awarded **4 marks** if you darken **ALL** the bubble(s) corresponding to the correct answer(s) **ONLY** and **zero marks** otherwise. There are **no negative marks** in this section.
16. In **Section III** (Total Marks: 24), for each question you will be awarded **4 marks** if you darken **ONLY** the bubble corresponding to the correct answer and **zero marks** otherwise. There are **no negative marks** in this section.
17. In **Section IV** (Total Marks: 16), for each question you will be awarded **2 marks** for each row in which you have darkened **ALL** the bubble(s) corresponding to the correct answer(s) **ONLY** and **zero marks** otherwise. Thus, each question in this section carries a **maximum of 8 marks**. There are **no negative marks** in this section.

Useful Data

$$R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1} \text{ or } 8.206 \times 10^{-2} \text{ L atm K}^{-1} \text{ mol}^{-1}$$

$$1F = 96500 \text{ C mol}^{-1}$$

$$h = 6.626 \times 10^{-34} \text{ Js}$$

$$1 \text{ eV} = 1.602 \times 10^{-19} \text{ J}$$

$$c = 3.0 \times 10^8 \text{ ms}^{-1}$$

$$N_A = 6.022 \times 10^{23}$$

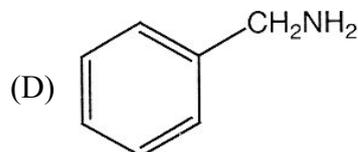
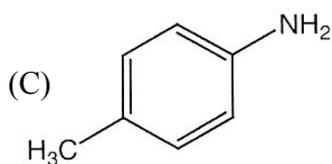
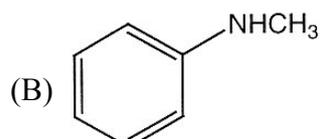
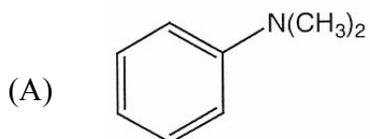
PART - I : CHEMISTRY

SECTION – I (Total Marks : 24)

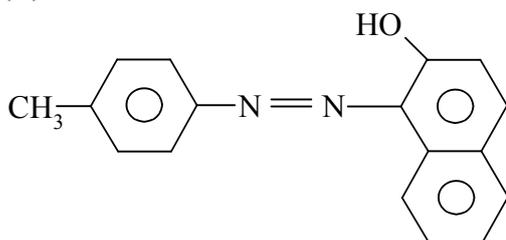
Single Correct Answer Type

This section contains **8 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) for its answer, out of which **ONLY ONE** is correct.

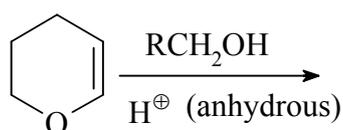
1. Amongst the compounds given, the one that would form a brilliant colored dye on treatment with NaNO_2 in dil. HCl followed by addition to an alkaline solution of β -naphthol is



1. (C)

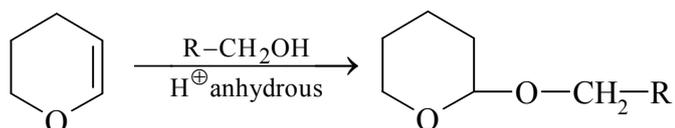


2. The major product of the following reaction is



- (A) a hemiacetal (B) an acetal (C) an ether (D) an ester

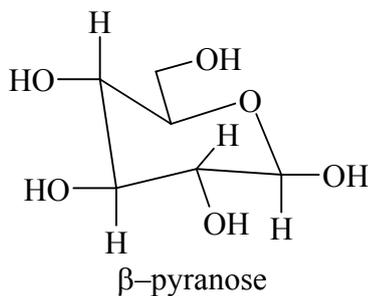
2. (B)



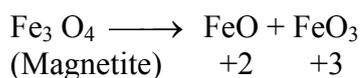
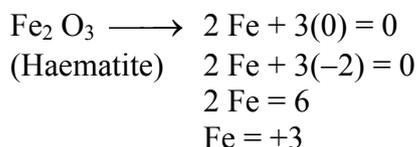
3. The following carbohydrate is



- (A) a ketohexose (B) an aldohexose (C) an α – furanose (D) an α –pyranose
3. (B)
Carbohydrates is an aldohexase

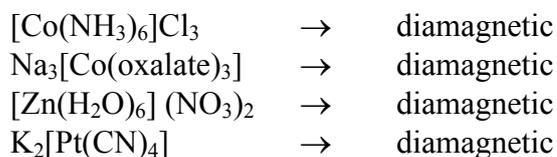
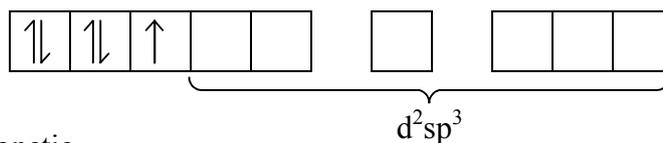


4. Oxidation states of the metal in the minerals haematite and magnetite, respectively, are
- (A) II, III in haematite and III in magnetite
(B) II, III in haematite and II in magnetite
(C) II in haematite and II, III in magnetite
(D) III in haematite and II, III in magnetite
4. (D)



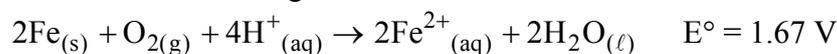
5. Among the following complexes (K – P),
 $\text{K}_3[\text{Fe}(\text{CN})_6]$ (K) , $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ (L) , $\text{Na}_3[\text{Co}(\text{oxalate})_3]$ (M) , $[\text{Ni}(\text{H}_2\text{O})_6]\text{Cl}_2$ (N),
 $\text{K}_2[\text{Pt}(\text{CN})_4]$ (O) and $[\text{Zn}(\text{H}_2\text{O})_6](\text{NO}_3)_2$ (P)
 The diamagnetic complexes are
- (A) K, L, M, N (B) K, M, O, P (C) L, M, O, P (D) L, M, N, O

5. (C)



6. Passing H_2S gas into a mixture of Mn^{2+} , Ni^{2+} , Cu^{2+} and Hg^{2+} ions in an acidified aqueous solution precipitates
- (A) CuS and HgS (B) MnS and CuS (C) MnS and NiS (D) NiS and HgS
6. (A)
Group II → Hg^{2+} and Cu^{+2}

7. Consider the following cell reaction :



At $[\text{Fe}^{2+}] = 10^{-3} \text{ M}$, $P(\text{O}_2) = 0.1 \text{ atm}$ and $\text{pH} = 3$, the cell potential at 25°C is

- (A) 1.47 V (B) 1.77 V (C) 1.87 V (D) 1.57 V

7. (D)

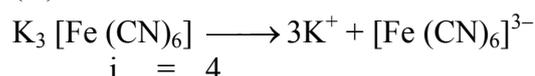
$$E = 1.67 - \frac{0.0591}{4} \log_{10} \frac{[\text{Fe}^{+2}]^2}{[\text{H}^+]^4 (\text{P}_{\text{O}_2})}$$

$$= 1.67 - 0.103 = 1.567 \text{ V}$$

8. The freezing point (in °C) of a solution containing 0.1 g of $\text{K}_3[\text{Fe}(\text{CN})_6]$ (Mol. Wt. 329) in 100 g of water ($K_f = 1.86 \text{ K kg mol}^{-1}$) is

- (A) -2.3×10^{-2} (B) -5.7×10^{-2} (C) -5.7×10^{-3} (D) -1.2×10^{-2}

8. (A)



$$\Delta T_f = iK_f m = 4 \times 1.86 \times \left(\frac{0.1 \times 1000}{329 \times 100} \right)$$

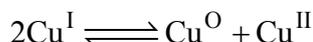
$$= \frac{4 \times 1.86}{329} = 0.0226 = 2.23 \times 10^{-2}$$

$$T_f = -2.23 \times 10^{-2}$$

SECTION – II (Total Marks : 16)
(Multiple Correct Answer(s) Type)

This section contains **4 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE** may be correct.

9. The equilibrium



In aqueous medium at 25°C shifts towards the left in the presence of

- (A) NO_3^- (B) Cl^- (C) SCN^- (D) CN^-

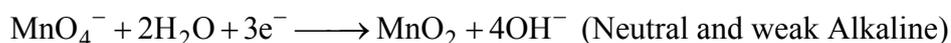
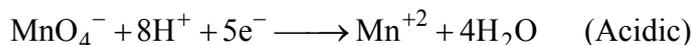
9. (B), (C), (D)

Cl^- , SCN^- , CN^- forms ppt. with Cu^+ .

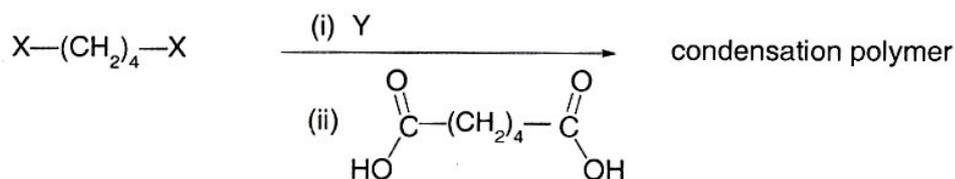
10. Reduction of the metal centre in aqueous permanganate ion involves

- (A) 3 electrons in neutral medium (B) 5 electrons in neutral medium
(C) 3 electrons in alkaline medium (D) 5 electrons in acidic medium

10. (A), (C), (D)



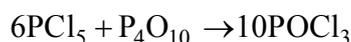
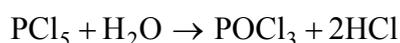
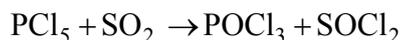
11. The correct functional group X and the reagent/reaction conditions Y in the following scheme are



- (A) $\text{X} = \text{COOCH}_3$, $\text{Y} = \text{H}_2/\text{Ni}/\text{heat}$ (B) $\text{X} = \text{CONH}_2$, $\text{Y} = \text{H}_2/\text{Ni}/\text{heat}$
(C) $\text{X} = \text{CONH}_2$, $\text{Y} = \text{Br}_2/\text{NaOH}$ (D) $\text{X} = \text{CN}$, $\text{Y} = \text{H}_2/\text{Ni}/\text{heat}$

14. Among the following, the number of compounds than can react with PCl_5 to give POCl_3 is $\text{O}_2, \text{CO}_2, \text{SO}_2, \text{H}_2\text{O}, \text{H}_2\text{SO}_4, \text{P}_4\text{O}_{10}$

14. [4]



15. The volume (in mL) of 0.1 M AgNO_3 required for complete precipitation of chloride ions present in 30 mL of 0.01 M solution of $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2$, as silver chloride is close to

15. [6]

$$\text{No. of moles of } \text{AgNO}_3 \text{ required} = 2 \left(\frac{0.01 \times 30}{1000} \right) = \frac{0.1 \times V}{1000}$$

$$\Rightarrow \frac{0.01 \times 30 \times 2}{1000} = \frac{0.1 \times V}{1000}$$

$$V = 6 \text{ mL}$$

16. In 1L saturated solution of AgCl [$K_{\text{sp}}(\text{AgCl}) = 1.6 \times 10^{-10}$], 0.1 mol of CuCl [$K_{\text{sp}}(\text{CuCl}) = 1.0 \times 10^{-6}$] is added. The resultant concentration of Ag^+ in the solution is 1.6×10^{-x} . The value of "x" is

16. [7]

$$[\text{Ag}^+] = \frac{K_{\text{sp}}(\text{AgCl})}{\sqrt{K_{\text{sp}}(\text{CuCl}) + K_{\text{sp}}(\text{AgCl})}}$$

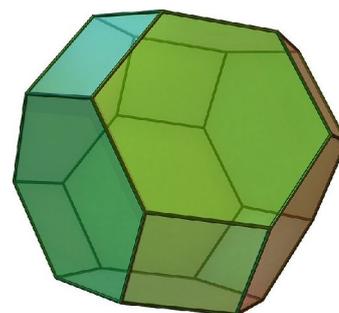
$$= \frac{1.6 \times 10^{-10}}{\sqrt{1.6 \times 10^{-10} + 10^{-6}}} = \frac{1.6 \times 10^{-10}}{10^{-3}} = 1.6 \times 10^{-7}$$

17. The number of hexagonal faces that are present in a truncated octahedron is

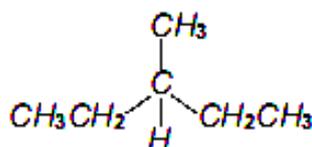
17. [8]

In geometry, the **truncated octahedron** is an Archimedean solid. It has 14 faces (8 regular hexagonal and 6 square), 36 edges, and 24 vertices. Since each of its faces has point symmetry the truncated octahedron is a zonohedron.

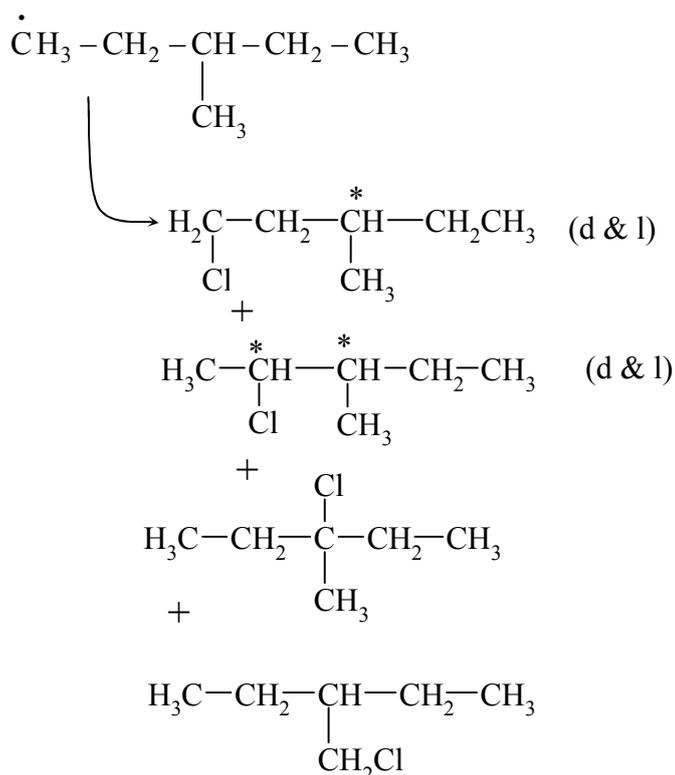
If the original truncated octahedron has unit edge length, its dual tetrakis cube has edge lengths $\frac{9}{8}\sqrt{2}$ and $\frac{3}{2}\sqrt{2}$.



18. The maximum number of isomers (including stereoisomers) that are possible on monochlorination of the following compound, is



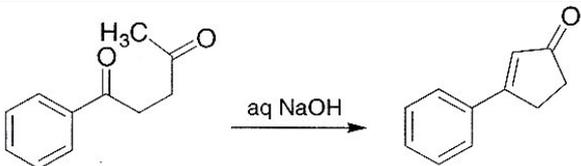
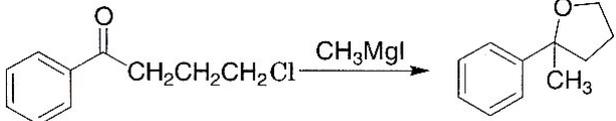
18. [8]



SECTION – IV (Total Marks : 16)
(Matrix Match Type)

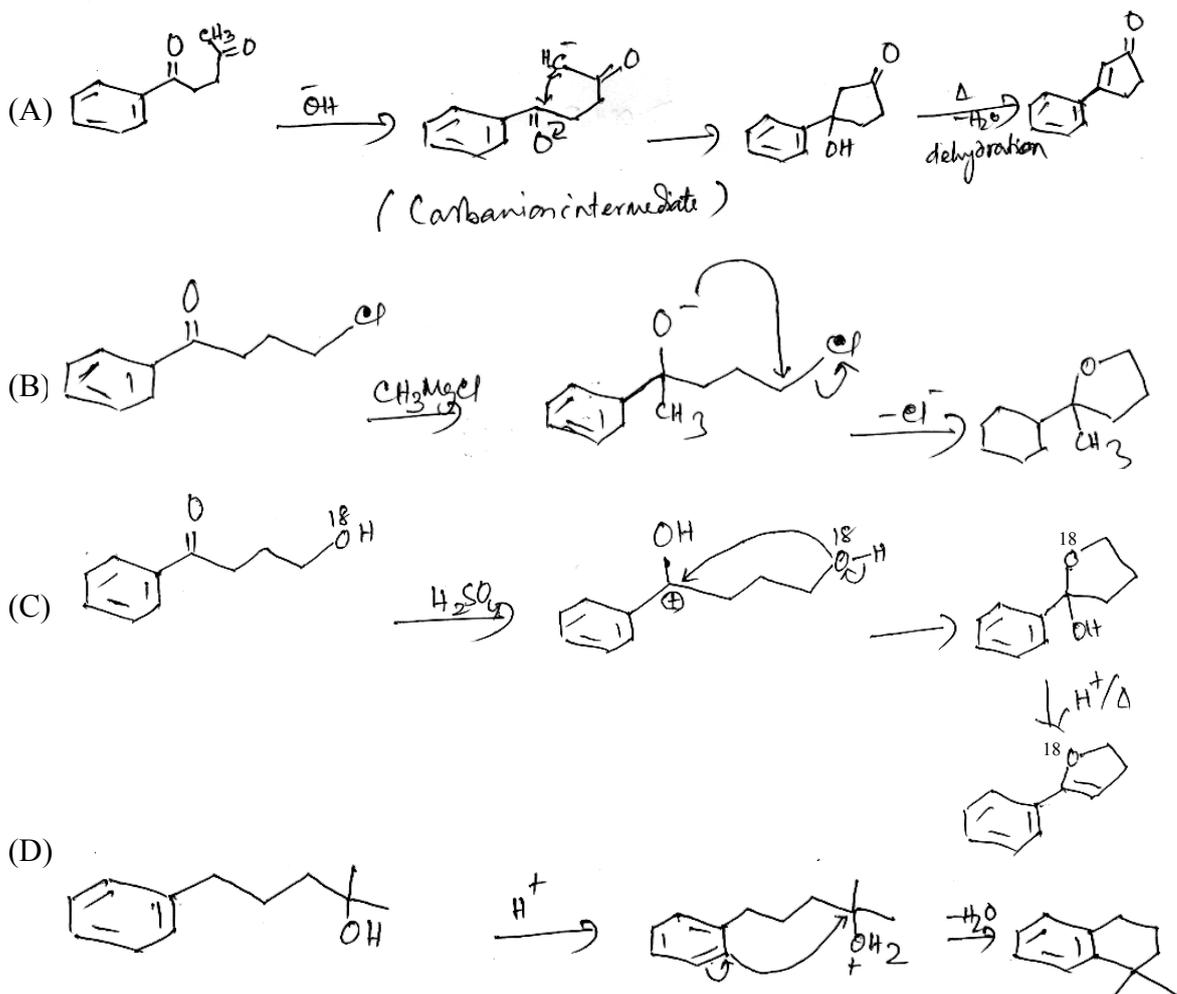
This section contains **2 questions**. Each question has four statements (A,B,C and D) given in **Column I** and **five statements** (p, q, r, s and t) in **Column II**. Any given statement in **Column I** can have correct matching with **ONE** or **MORE** statement(s) given in **Column II**. For example, if for a given question, statement B matches with the statements given in q and r, then for the particular question, against statement B, darken the bubbles corresponding to q and r in the ORS.

19. Match the reactions in **Column I** with appropriate types of steps/reactive intermediate involved in these reactions as given in **Column II**

Column I	Column II
<p>(A)</p> 	<p>(p) Nucleophilic substitution</p>
<p>(B)</p> 	<p>(q) Electrophilic substitution</p>
<p>(C)</p>	<p>(r) Dehydration</p>

(D)	(s) Nucleophilic addition
	(t) Carbanion

19. (A) → (r), (s), (t); (B) → (p), (s), (t); (C) → (r), (s); (D) → (q), (r)



20. Match the transformations in Column I with appropriate options in Column II

Column I	Column II
(A) $\text{CO}_2(\text{s}) \rightarrow \text{CO}_2(\text{g})$	(p) Phase transition
(B) $\text{CaCO}_3(\text{s}) \rightarrow \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$	(q) Allotropic change
(C) $2\text{H}\cdot \rightarrow \text{H}_2(\text{g})$	(r) ΔH is positive
(D) $\text{P}_{(\text{white, solid})} \rightarrow \text{P}_{(\text{red, solid})}$	(s) ΔS is positive
	(t) ΔS is negative

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