

Paper-2
JEE Advanced, 2016
Part II: Chemistry

Read the instructions carefully:

General:



1. This sealed booklet is your Question Paper. Do not break the seal till you are instructed to do so.
2. The question paper CODE is printed on the left hand top corner of this sheet and the right hand top corner of the back cover of this booklet.
3. Use the Optical Response Sheet (ORS) provided separately for answering the questions.
4. The paper CODE is printed on its left part as well as the right part of the ORS. Ensure that both these codes are identical and same as that on the question paper booklet. If not, contact the invigilator.
5. Blank spaces are provided within this booklet for rough work.
6. Write your name and roll number in the space provided on the back cover of this booklet.
7. After breaking the seal of the booklet at 2:00 pm, verify that the booklet contains 36 pages and that all the 54 questions along with the options are legible. If not, contact the invigilator for replacement of the booklet.
8. You are allowed to take away the Question Paper at the end of the examination.

Optical Response Sheet

9. The ORS (top sheet) will be provided with an attached Candidate's Sheet (bottom sheet). The Candidate's Sheet is a carbon – less copy of the ORS.
10. Darken the appropriate bubbles on the ORS by applying sufficient pressure. This will leave an impression at the corresponding place on the Candidate's Sheet.
11. The ORS will be collected by the invigilator at the end of the examination.
12. You will be allowed to take away the Candidate's Sheet at the end of the examination.
13. Do not tamper with or mutilate the ORS. Do not use the ORS for rough work.

14. Write your name, roll number and code of the examination center, and sign with pen in the space provided for this purpose on the ORS. Do not write any of these details anywhere else on the ORS. Darken the appropriate bubble under each digit of your roll number.

Darken the Bubbles on the ORS

15. Use a Black Ball Point Pen to darken the bubbles on the ORS.
16. Darken the bubble  completely.
17. The correct way of darkening a bubble is as: 
18. The ORS is machine – gradable. Ensure that the bubbles are darkened in the correct way.
19. Darken the bubbles only if you are sure of the answer. There is no way to erase or “un-darken” a darkened bubble.

PART - II : CHEMISTRY

SECTION-1 : (Maximum Marks : 18)

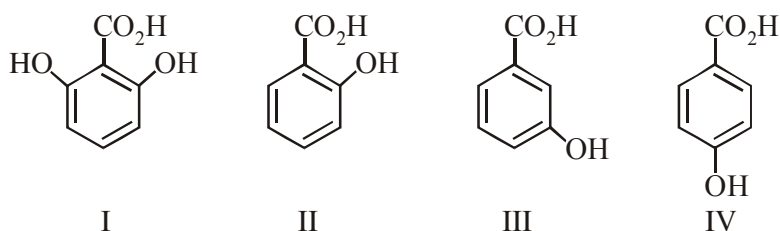
- This section contains **SIX** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories :

Full Marks : +3 If only the bubble corresponding to the correct option is darkened.

Zero Marks : 0 If none of the bubbles is darkened.

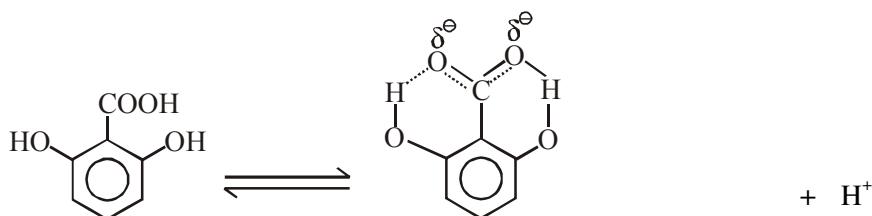
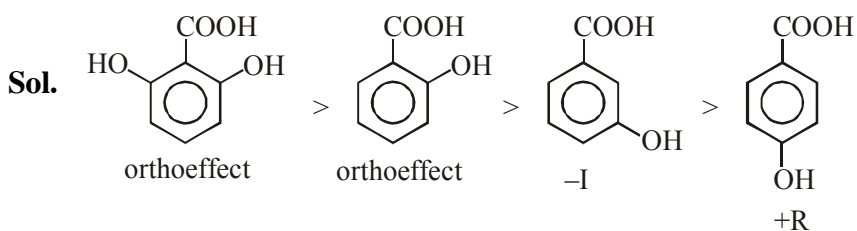
Negative Marks : -1 In all other cases.

19. The correct order of acidity for the following compounds is :

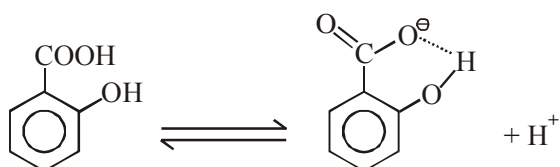


- (A) I > II > III > IV (B) III > I > II > IV (C) III > IV > II > I (D) I > III > IV > II

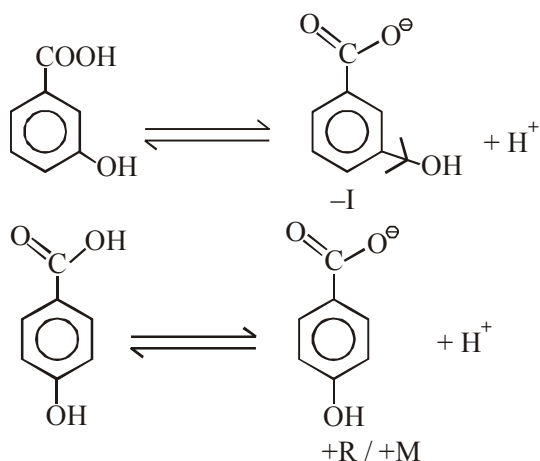
Ans. (A)



Most stable due to chelation of two
-OH group with -COO⁻ group



Stable due to chelation of one
-OH group with -COO⁻ group



20. The geometries of the ammonia complexes of Ni²⁺, Pt²⁺ and Zn²⁺, respectively, are :
- (A) octahedral, square planar and tetrahedral
 (B) square planar, octahedral and tetrahedral
 (C) tetrahedral, square planar and octahedral
 (D) octahedral, tetrahedral and square planar

Ans. (A)

Sol. Metal ion	Complex with NH ₃	Geometry
Ni ²⁺	[Ni(NH ₃) ₆] ²⁺	Octahedral
Pt ²⁺	[Pt(NH ₃) ₄] ²⁺	Square planar
Zn ²⁺	[Zn(NH ₃) ₄] ²⁺	Tetrahedral

So, option (A) is correct.

21. For the following electrochemical cell at 298K,
 Pt(s) | H₂(g, 1bar) | H⁺ (aq, 1M) || M⁴⁺(aq.), M²⁺(aq.) | Pt(s)

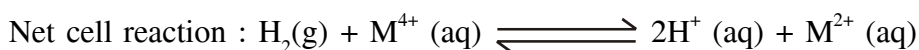
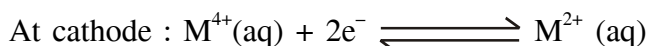
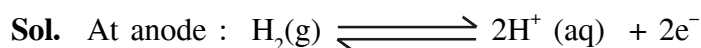
$$E_{\text{cell}} = 0.092 \text{ V when } \frac{[M^{2+}(\text{aq.})]}{[M^{4+}(\text{aq.})]} = 10^x$$

$$\text{Given : } E_{M^{4+}/M^{2+}}^{\circ} = 0.151 \text{ V ; } 2.303 \frac{RT}{F} = 0.059$$

The value of x is -

- (A) -2 (B) -1 (C) 1 (D) 2

Ans. (D)

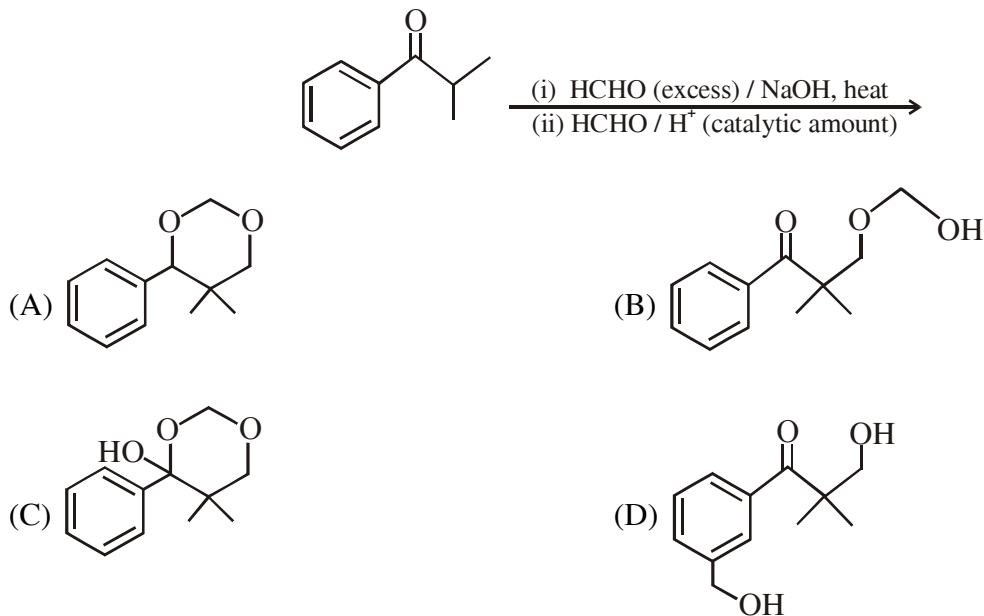


$$\text{Now, } E_{\text{cell}} = \left(E_{M^{4+}/M^{2+}}^{\circ} - E_{\text{H}^+/\text{H}_2}^{\circ} \right) - \frac{0.059}{n} \cdot \log \frac{[\text{H}^+]^2 [\text{M}^{2+}]}{P_{\text{H}_2} \cdot [\text{M}^{4+}]}$$

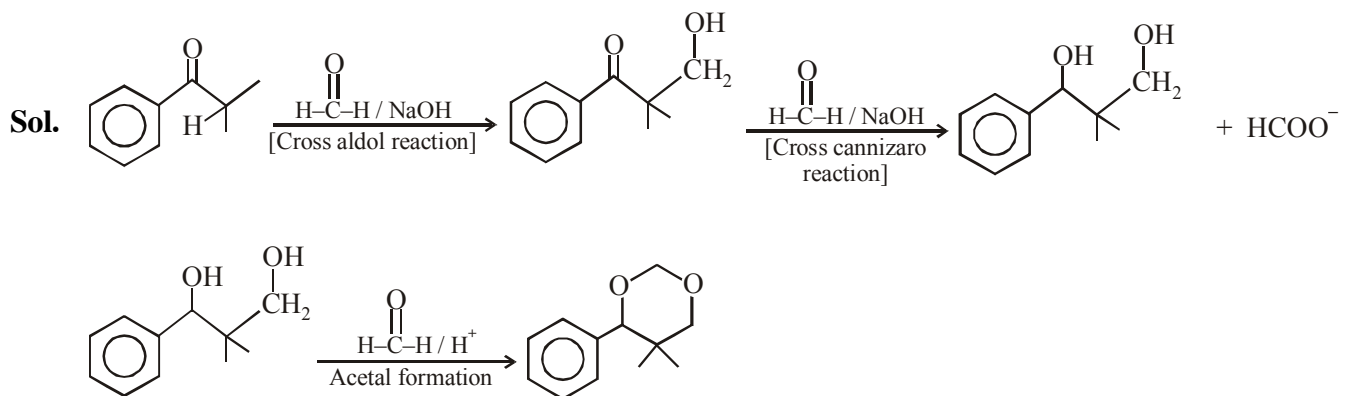
$$\text{or, } 0.092 = (0.151 - 0) - \frac{0.059}{2} \cdot \log \frac{1^2 \times [M^{2+}]}{1 \times [M^{4+}]}$$

$$\therefore \frac{[M^{2+}]}{[M^{4+}]} = 10^2 \Rightarrow x = 2$$

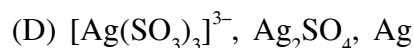
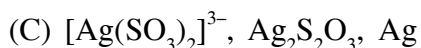
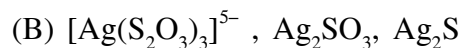
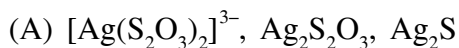
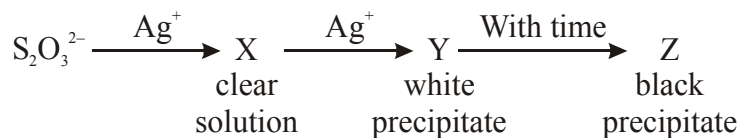
22. The major product of the following reaction sequence is :



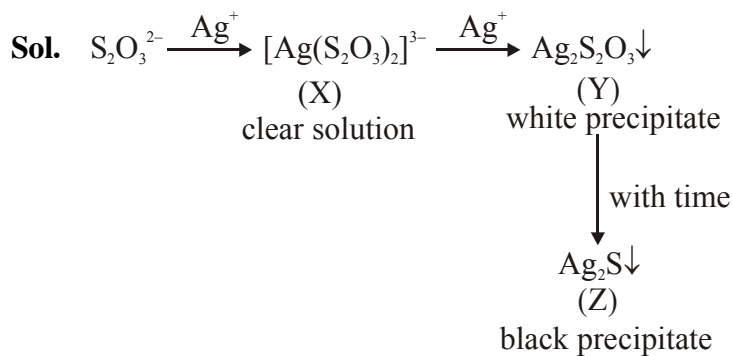
Ans. (A)



23. In the following reaction sequence in aqueous solution, the species X, Y and Z respectively, are -

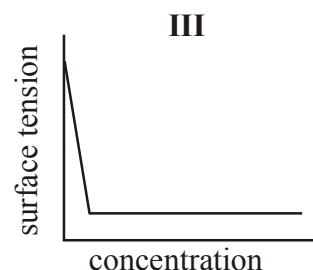
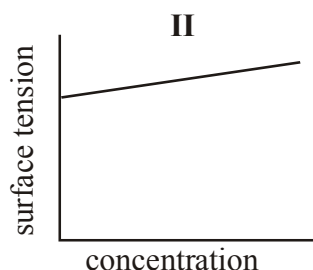
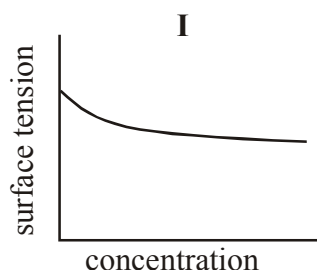


Ans. (A)



So, X, Y and Z are $[Ag(S_2O_3)_2]^{3-}$, $Ag_2S_2O_3$ and Ag_2S respectively.

24. The qualitative sketches I, II and III given below show the variation of surface tension with molar concentration of three different aqueous solutions of KCl, CH_3OH and $CH_3(CH_2)_{11}OSO_3^- Na^+$ at room temperature. The correct assignment of the sketches is -



- | | | |
|---------------------------------------|------------------------------------|-------------------------------------|
| (A) I : KCl | II : CH_3OH | III : $CH_3(CH_2)_{11}OSO_3^- Na^+$ |
| (B) I : $CH_3(CH_2)_{11}OSO_3^- Na^+$ | II : CH_3OH | III : KCl |
| (C) I : KCl | II : $CH_3(CH_2)_{11}OSO_3^- Na^+$ | III : CH_3OH |
| (D) I : CH_3OH | II : KCl | III : $CH_3(CH_2)_{11}OSO_3^- Na^+$ |

Ans. (D)

Sol. Water has large surface tension due to very strong interaction. Generally adding organic derivatives to water decreases its surface tension due to hydrophobic interaction.

In case III, hydrophobic interaction is stronger than case I causing surface tension to decrease more rapidly.

Due to K^+Cl^- (inorganic electrolyte) intermolecular forces increases, surface tension increases.

SECTION-2 : (Maximum Marks : 32)

- This section contains **EIGHT** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct.
- For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS.
- For each question, marks will be awarded in one of the following categories :
 - Full Marks* : +4 If only the bubble(s) corresponding to all the correct option(s) is (are) darkened.
 - Partial Marks* : +1 For darkening a bubble corresponding **to each correct option**, Provided **NO** incorrect option is darkened.
 - Zero Marks* : 0 If none of the bubbles is darkened.
 - Negative Marks* : -2 In all other cases.
- for example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will result in +4 marks; darkening only (A) and (D) will result in +2 marks; and darkening (A) and (B) will result in -2 marks, as a wrong option is also darkened.

25. For 'invert sugar', the correct statement(s) is (are)

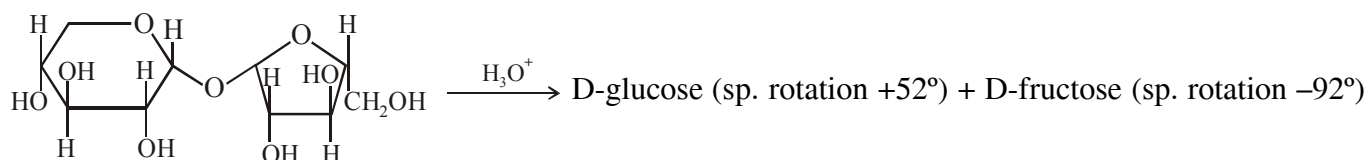
(Given : specific rotations of (+)-sucrose, (+)-maltose, L-(-)-glucose and L-(+)-fructose in aqueous solution are + 66°, +140°, -52° and + 92°, respectively)

- (A) 'invert sugar' is prepared by acid catalyzed hydrolysis of maltose
- (B) 'invert sugar' is an equimolar mixture of D-(+) glucose and D-(-)-fructose
- (C) specific rotation of 'invert sugar' is -20°
- (D) on reaction with Br₂ water, 'invert sugar' forms saccharic acid as one of the products

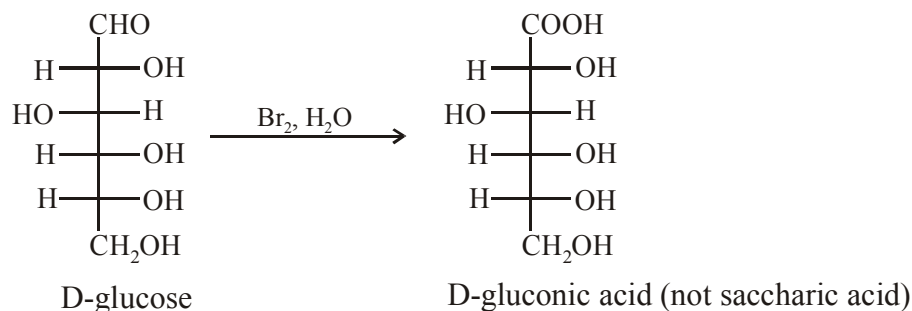
Ans. (B,C)

Sol. Invert sugar is equimolar mixture of D-glucose and D-fructose which is obtained by hydrolysis of sucrose

Specific rotation of mixture is half of sum of sp. rotation of both components $\frac{+52^\circ + (-92^\circ)}{2} = -20^\circ$

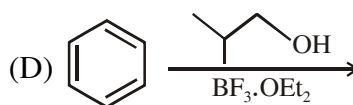
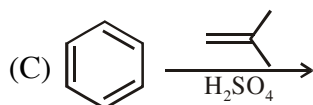
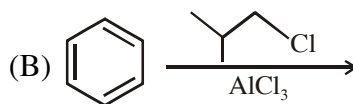
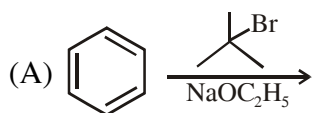


Sucrose sp. rotation + 66°

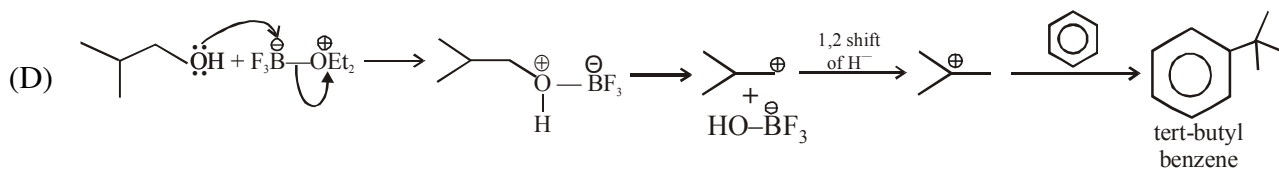
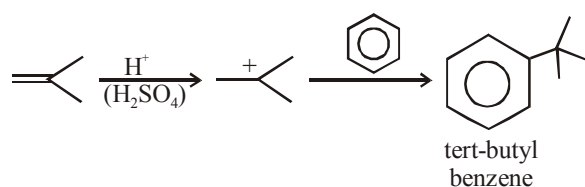
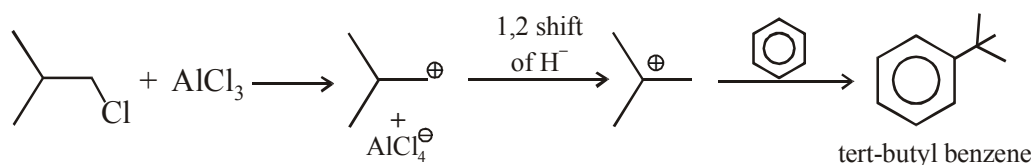
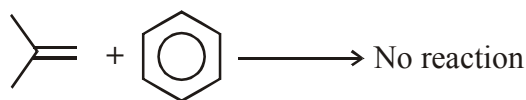
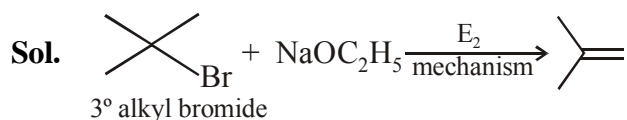


D-fructose $\xrightarrow{\text{Br}_2, \text{H}_2\text{O}}$ No reaction

26. Among the following reaction(s) which gives (give) tert-butyl benzene as the major product is(are)



Ans. (B,C,D)



27. Extraction of copper from copper pyrite (CuFeS_2) involves

- (A) crushing followed by concentration of the ore by froth-flotation
- (B) removal of iron as slag
- (C) self-reduction step to produce 'blister copper' following evolution of SO_2
- (D) refining of 'blister copper' by carbon reduction

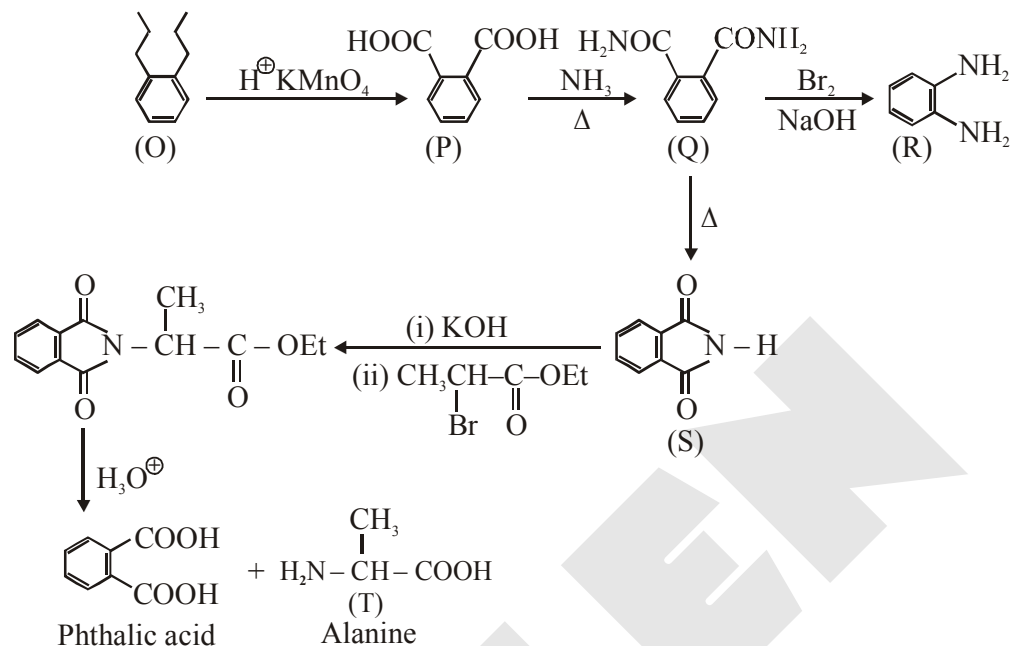
Ans. (A,B,C)

36. The compound **T** is :
 (A) Glycine (B) Alanine (C) Valine (D) Serine

Ans. (B)

Sol.

Solution Q.35 & 36.



Q to R is Hoffmann's bromamide degradation reaction

S to T is Gabriel's phthalimide synthesis