JEE ADVANCED-2016 (PAPER-2)

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 of 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.

SECTION–1: (Maximum Marks: 18)

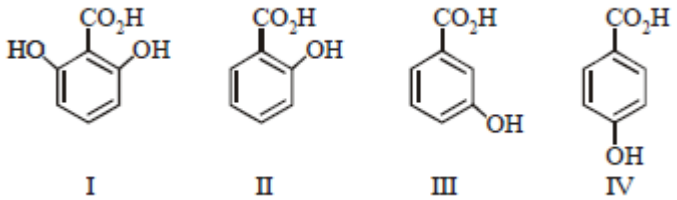
- This section contains **SIX** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following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



I II III IV

(A) I > II > III > IV

(B) III > I > II > IV

(C) III > IV > II > I

(D) I > III > IV > II

20. The geometries of the ammonia complexes of Ni^{2+}, Pt^{2+} and Zn^{2+}, respectively, are :

(A) octahedral, square planar and tetrahederal

(B) square planar, octahederal and tetrahederal

(C) tetrahederal, square planar and octahederal

(D) octahederal, tetrahederal and square planar

21. For the following electrochemical cell at $298K$,

$$Pt(s)\left|H_2(g,1bar)\right|H^+(aq,1M)\left\|M^{4+}(aq.),M^{2+}(aq.)\right|Pt(s)$$

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

$$\text{Given: } E^0_{M^{4+}/M^{2+}} = 0.151V; 2.303\frac{RT}{F} = 0.059$$

The value of x is –

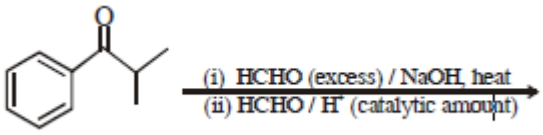
(A) -2

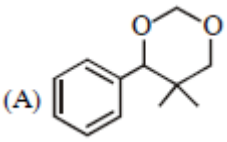
(B) -1

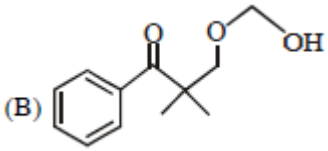
(C) 1

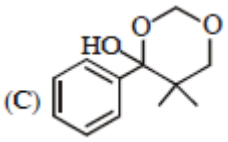
(D) 2

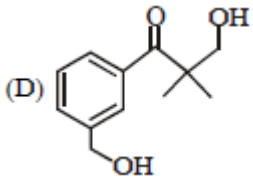
22. The major product of the following reaction sequence is:



(A) 

(B) 

(C) 

(D) 

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

$$S_2O_3^{2-} \xrightarrow{Ag^+} \underset{\text{clear solution}}{X} \xrightarrow{Ag^+} \underset{\text{white precipitate}}{Y} \xrightarrow{\text{With time}} \underset{\text{black precipitate}}{Z}$$

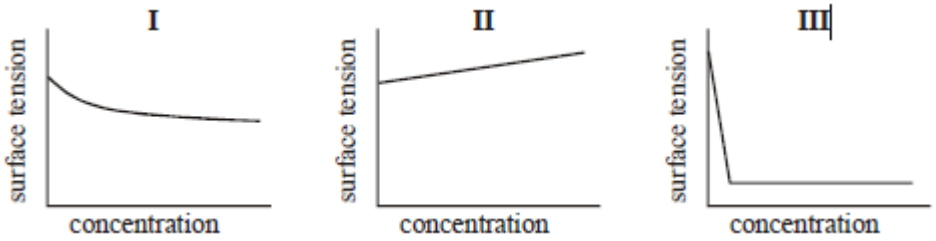
(A) $\left[Ag(S_2O_3)_2\right]^{3-}, Ag_2S_2O_3, Ag_2S$

(B) $\left[Ag(S_2O_3)_3\right]^{5-}, Ag_2S_2SO_3, Ag_2S$

(C) $\left[Ag(SO_3)_2\right]^{3-}, Ag_2S_2O_3, Ag$

(D) $\left[Ag(SO_3)_3\right]^{3-}, Ag_2SO_4, Ag$

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) $I: KCl \quad II: CH_3OH \quad III: CH_3(CH_2)_{11}OSO_3^-Na^+$

(B) $I: CH_3(CH_2)_{11}OSO_3^-Na^+ \quad II: CH_3OH \quad III: KCl$

(C) $I: KCl \quad II: CH_3(CH_2)_{11}OSO_3^-Na^+ \quad III: CH_3OH$

(D) $I: CH_3OH \quad II: KCl \quad III: CH_3(CH_2)_{11}OSO_3^-Na^+$

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)

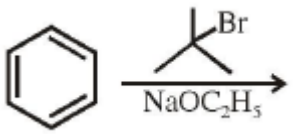
(A) 'invert sugar' is prepared by acid catalyzed hydrolysis of maltose

(B) 'invert sugar' is an equimolar mixture of $D-(+)$ glucose and $D-(-)$-fructose

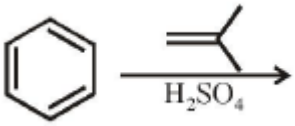
(C) specific rotation of 'invert surgar' is $-20°$

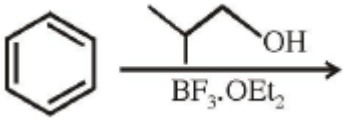
(D) on reaction with Br_2 water, 'invert sugar' forms saccharic acid as one of the products

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

(A) 

(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' follwoing evolution of SO_2

(D) refining of 'blister copper' by carbon reduction

28. The **CORRECT** statement(s) for cubic close packed (ccp) three dimensional structure is (are)

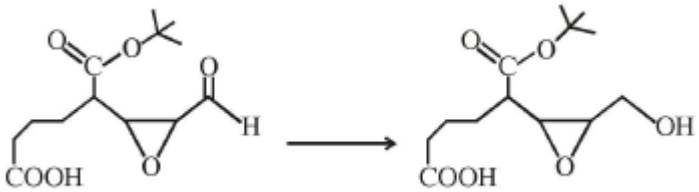
(A) The number of the nearest neighbours of an atom present in the topmost layer is 12

(B) The efficiency of atom packing is 74%

(C) The number of octahedral and tetrahedral voids per atom are 1 and 2, respectively

(D) The unit cell edge length is $2\sqrt{2}$ times the radius of the atom

29. Reagent(s) which can be used to bring about the following transformation is(are)



(A) $LiAlH_4$ in $(C_2H_5)_2O$

(B) BH_3 in THF

(C) $NaBH_4$ in C_2H_5OH

(D) Raney Ni/H_2 in THF

30. Mixture(s) showing positive deviation from Raoult's law at $35°C$ is (are)

(A) carbon tetrachloride + methanol

(B) carbon disulphide + acetone

(C) benzene + toluene

(D) phenol + aniline

31. The nitrogen containing compound produced in the reaction of HNO_3 with P_4O_{10}

(A) can also be prepared by reaction of P_4 and HNO_3

(B) is diamagnetic

(C) contains one N-N bond

(D) reacts with Na metal producing a brown gas

32. According to Molecular Orbital Theory,

(A) C_2^{2-} is expected to be diamagnetic

(B) O_2^{2+} is expected to have a longer bond length than O_2

(C) N_2^+ and N_2^- have the same bond order

(D) He_2^+ has the same energy as two isolated He atoms

SECTION–3: (Maximum Marks: 12)

- This section contains **TWO** paragraphs.
- Based on each paragraph, there are **TWO** 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 answer is darkened.

Zero Marks : 0 In all other cases.

PARAGRAPH 1

Thermal decomposition of gaseous X_2 to gaseous X at $298K$ takes place according to the following equation :

$$X_2(g) \rightleftharpoons 2X(g)$$

The standard reaction Gibbs energy, $\Delta_r G^\circ$, of this reaction is positive. At the start of the reaction, there is one mole of X_2 and no X. As the reaction proceeds, the number of moles of X formed is given by β. Thus, $\beta_{equilibrium}$ is the number of moles of X formed at equilibrium. The reaction is carried out at a constant total pressure of 2 bar. Consider the gases to behave ideally.

(Given : $R = 0.083\ L\ bar\ K^{-1}\ mol^{-1}$)

33. The equilibrium constant K_p for this reaction at $298K$, in terms of $\beta_{equilibrium}$, is

(A) $\dfrac{8\beta_{equilibrium}^2}{2-\beta_{equilibrium}}$

(B) $\dfrac{8\beta_{equilibrium}^2}{4-\beta_{equilibrium}^2}$

(C) $\dfrac{4\beta_{equilibrium}^2}{2-\beta_{equilibrium}}$

(D) $\dfrac{4\beta_{equilibrium}^2}{4-\beta_{equilibrium}^2}$

34. The **INCORRECT** statement among the following, for this reaction, is

(A) Decrease in the total pressure will result in formation of more moles of gaseous X

(B) At the start of the reaction, dissociation of gaseous X_2 takes place spontaneously

(C) $\beta_{\text{uilibrium}} = 0.7$

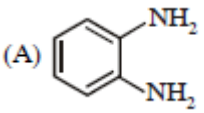
(D) $K_c < 1$

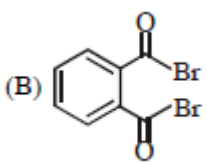
PARAGRAPH 2

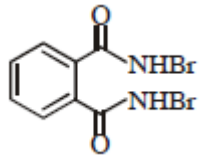
Treatment of compound **O** with $KMnO_4/H^+$ gave **P**, which on heating with ammonia gave **Q**. The compound **Q** on treatment with $Br_2/NaOH$ produced **R**. On strong heating, **Q** gave **S**, which on further treatmenet with ethyl 2-bromopropanoate in the presence of KOH following by acidification, **T**.

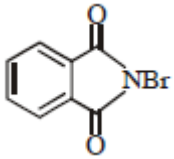
(O)

35. The compound **R** is:

(A) 

(B) 

(C) 

(D) 

36. The compound **T** is:

(A) Glycine

(B) Alanine

(C) Valine

(D) Serine