

## JEE ADVANCED-2018

### CHEMISTRY

- This question paper has three (03) parts: PART-I: Physics, PART-II: Chemistry and PART-III: Mathematics.
- Each part has total of eighteen (18) questions divided into three (03) sections (Section-1, Section-2 and Section-3).
- Total number of questions in Paper-1: Fifty-four (54).
- Paper-1 Maximum Marks: One Hundred Eighty (180).

#### Instructions for Section-1 : Questions and Marking Scheme

##### SECTION-1 (Maximum Mark : 24)

- This section contains **SIX (06)** questions.
- Each question has **FOUR options** for correct answer(s). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct option(s).
- For each question, choose the correct option(s) to answer the question.
- Answer to each question will be evaluated according to the following marking scheme.

Full Marks : +4 If only (all) the correct option(s) is (are) chosen.

Partial Marks : +3 If all the four options are correct but **ONLY** three options are chosen.

Partial Marks : +2 If three or more options are correct but **ONLY** two options are chosen, both of which are correct options.

Partial Marks : +1 If two or more options are correct but **ONLY** one option is chosen and it is a correct option.

Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered).

Negative Marks : -2 In all other cases.

- **For Example:** If first, third and fourth are the **ONLY** three correct options for a question with second option being an incorrect option; selecting only two of the three correct options (e.g. the first and fourth options), without selecting any incorrect option (second option in this case), will result in +2 marks. Selecting only one of the three correct options (either first or third or fourth option), without selecting any incorrect option (second option in this case), will result in +1 marks. Selecting any incorrect option(s) (second option in this case), with or without selection of any correct option(s) will result in -2 marks.

## Answering Section-1 Questions :

- To select the option(s), **using the mouse click** on the corresponding button(s) of the option(s).
- To deselect chosen option(s), click on the button(s) of the chosen option(s) again or click on the **Clear Response** button to clear all the chosen options.
- To change the option(s) of a previously answered question, if required, first click on the **Clear Response** button to clear all the chosen options and then select the new option(s).
- To mark a question ONLY for review (i.e. without answering it), click on the **Mark for Review & Next button**.
- To mark a question for review (after answering it), click on **Mark for Review & Next button** – answered question which is also marked for review will be evaluated.
- To save the answer, click on the **Save & Next** button – the answered question will be evaluated.

## Instructions for Section-2: Questions and Marking Scheme

### SECTION-2 (Maximum Marks: 24)

- This section contains **EIGHT (08)** questions. The answer to each question is **NUMERICAL VALUE**.
- For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the second decimal place; e.g. 6.25, 7.00, -0.33, -0.30, 30.27, -127.30) using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme :  
Full Marks : +3 If **ONLY** the correct numerical value is entered as answer.  
Zero Marks : 0 In all other cases.

## Answering Section-2 Questions:

- Using the attached computer mouse, click on numbers (and/or symbols) on the on-screen virtual numeric keypad to enter the numerical value as answer in the space provided for answer.
- To change the answer, if required, first click on the **Clear Response** button to clear the entered answer and then enter the new numerical value.

- To mark a question **ONLY** for review (i.e. answering it), click on **Mark for Review & Next button** – the answered question which is also marked for review will be evaluated.
- To mark a question for review (after answering it), click **Mark for Review & Next button** – the answered question which is also marked for review will be evaluated.
- To save the answer, click on the **Save & Next button** – the answered question will be evaluated.

### Instructions for Section-3: Questions and Marking Scheme

#### SECTION-3 (Maximum Marks: 12)

- This section contains **TWO (02)** paragraphs. Based on each paragraph, there are **TWO (02)** questions.
- Each question has **FOUR** options. **ONLY ONE** of these four options corresponds to the correct answer.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +3 If **ONLY** the correct option is chosen.

Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered).

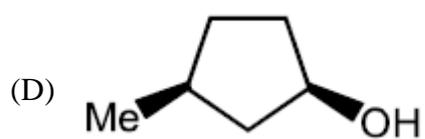
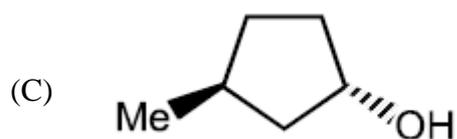
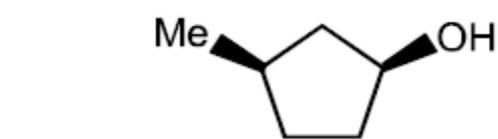
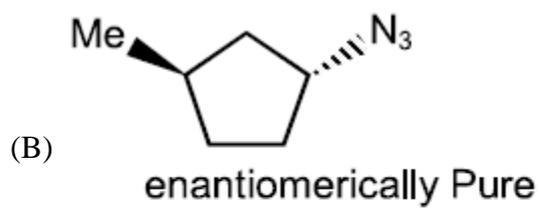
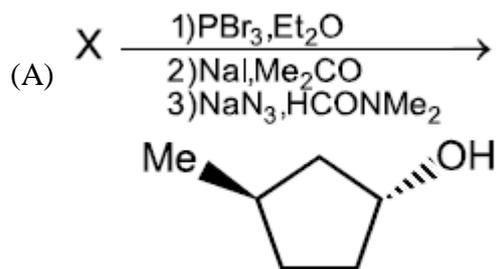
Negative Marks : -1 In all other cases.

#### Answering Section-3 Questions:

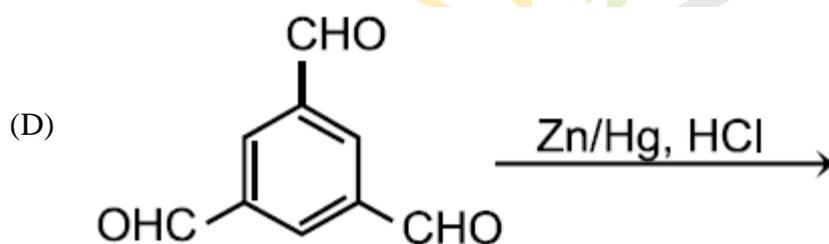
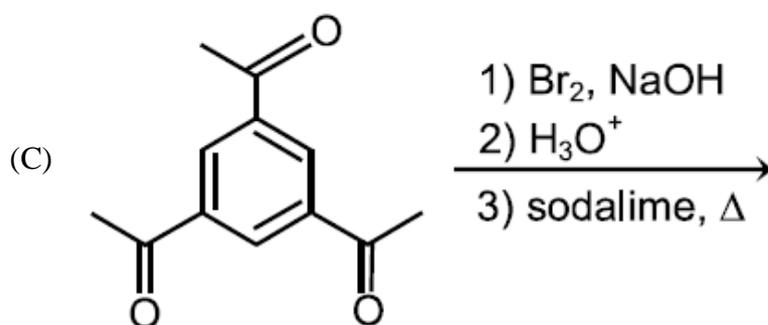
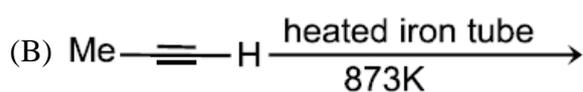
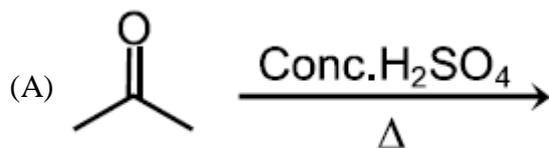
- To select an option, using the mouse click on the corresponding button of the option.
- To deselect the chosen answer, click on the button of the chosen option again or click on the **Clear Response button**.
- To change the chosen answer, click on the button of another option.
- To mark a question **ONLY** for review (i.e. without answering it), click on **Mark for Review & Next button**.
- To mark a question for review (after answering it), click on **Mark for Review & Next button** – the answered which is also marked for review will be evaluated.
- To save the answer, click on the **Save & Next button** – the answered question will be evaluated.

1. The compound(s) which generate(s)  $N_2$  gas upon thermal decomposition below  $300^\circ\text{C}$  is (are)
  - (A)  $NH_4NO_3$
  - (B)  $(NH_4)_2Cr_2O_7$
  - (C)  $Ba(N_3)_2$
  - (D)  $Mg_3N_2$
  
2. The correct statement(s) regarding the binary transition metal carbonyl compounds is (are) (Atomic numbers: Fe = 26, Ni = 28)
  - (A) Total number of valence shell electrons at metal centre in  $Fe(CO)_5$  or  $Ni(CO)_4$  is 16
  - (B) These are predominantly low spin in nature
  - (C) Metal-carbon bond strengthens when the oxidation state of the metal is lowered
  - (D) The carbonyl C–O bond weakens when the oxidation state of the metal is increased
  
3. Based on the compounds of group 15 elements, the correct statement(s) is (are)
  - (A)  $Bi_2O_5$  is more basic than  $N_2O_5$
  - (B)  $NF_3$  is more covalent than  $BiF_3$
  - (C)  $PH_3$  boils at lower temperature than  $NH_3$
  - (D) The N–N single bond is stronger than the P–P single bond

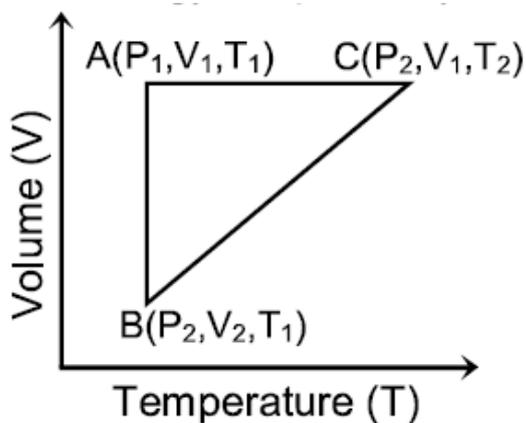
4. In the following reaction sequence, the correct structure(s) of X is (are)



5. The reaction(s) leading to the formation of 1,3,5-trimethylbenzene is (are)



6. A reversible cyclic process for an ideal gas is shown below. Here,  $P, V,$  and  $T$  are pressure, volume and temperature, respectively. The thermodynamic parameters  $q, w, H$  and  $T$  are heat, work, enthalpy and internal energy, respectively.



The correct option(s) is (are)

- (A)  $q_{AC} = \Delta U_{BC}$  and  $W_{AB} = P_2(V_2 - V_1)$
- (B)  $W_{BC} = P_2(V_2 - V_1)$  and  $q_{BC} = \Delta H_{AC}$
- (C)  $\Delta H_{CA} < \Delta U_{CA}$  and  $q_{AC} = \Delta U_{BC}$
- (D)  $q_{BC} = \Delta H_{AC}$  and  $\Delta H_{CA} > \Delta U_{CA}$

7. Among the species given below, the total number of diamagnetic species is\_\_\_\_\_.

H atom,  $\text{NO}_2$  monomer,  $\text{O}_2^-$  (superoxide), dimeric sulphur in vapour phase,

$\text{Mn}_3\text{O}_4, (\text{NH}_4)_2[\text{FeCl}_4], (\text{NH}_4)_2[\text{NiCl}_4], \text{K}_2\text{MnO}_4, \text{K}_2\text{CrO}_4$

8. The ammonia prepared by treating ammonium sulphate with calcium hydroxide is completely used by  $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$  to form a stable coordination compound. Assume that both the reactions are 100% complete. If 1584 g of ammonium sulphate and 952 g of  $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$  are used in the preparation, the combined weight (in grams) of gypsum and the nickel-ammonia coordination compound thus produced is \_\_\_\_\_.

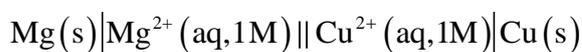
(Atomic weights in  $\text{g mol}^{-1}$  : H = 1, N = 14, O = 16, S = 32, Cl = 35.5, Ca = 40, Ni = 59)

9. Consider an ionic solid  $\text{MX}$  with NaCl structure. Construct a new structure ( $\text{Z}$ ) whose unit cell is constructed from the unit cell of  $\text{MX}$  following the sequential instructions given below. Neglect the charge balance.

- (i) Remove all the anions ( $\text{X}$ ) except the central one
- (ii) Replace all the face centered cations ( $\text{M}$ ) by anions ( $\text{X}$ )
- (iii) Remove all the corner cations ( $\text{M}$ )
- (iv) Replace the central anion ( $\text{X}$ ) with cation ( $\text{M}$ )

The value of  $\left( \frac{\text{number of anions}}{\text{number of cations}} \right)$  in  $\text{Z}$  is \_\_\_\_\_.

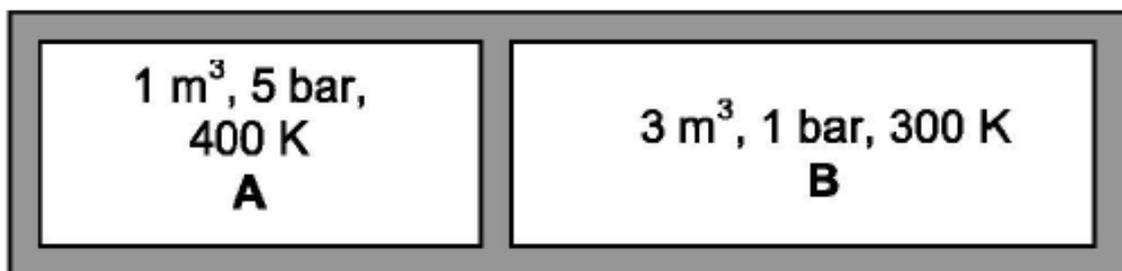
10. For the electrochemical cell,



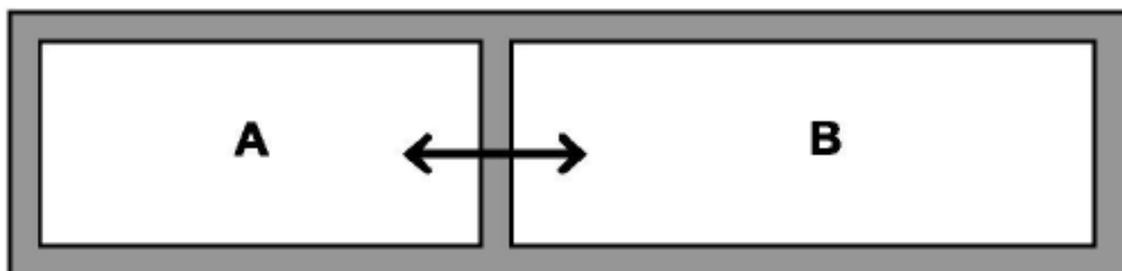
the standard emf of the cell is 2.70 V at 300 K. When the concentration of  $\text{Mg}^{2+}$  is changed to  $x\text{M}$ , the cell potential changes to 2.67 V at 300 K. The value of  $x$  is \_\_\_\_\_.

(given,  $\frac{F}{R} = 11500 \text{KV}^{-1}$ , where  $F$  is the Faraday constant and  $R$  is the gas constant,  $\ln(10) = 2.30$ )

11. A closed tank has two compartments  $A$  and  $B$ , both filled with oxygen (assumed to be ideal gas). The partition separating the two compartments is fixed and is a perfect heat insulator (Figure 1). If the old partition is replaced by a new partition which can slide and conduct heat but does NOT allow the gas to leak across (Figure 2), the volume (in  $\text{m}^3$ ) of the compartment  $A$  after the system attains equilibrium is\_\_\_\_\_.



**Figure 1**



**Figure 2**

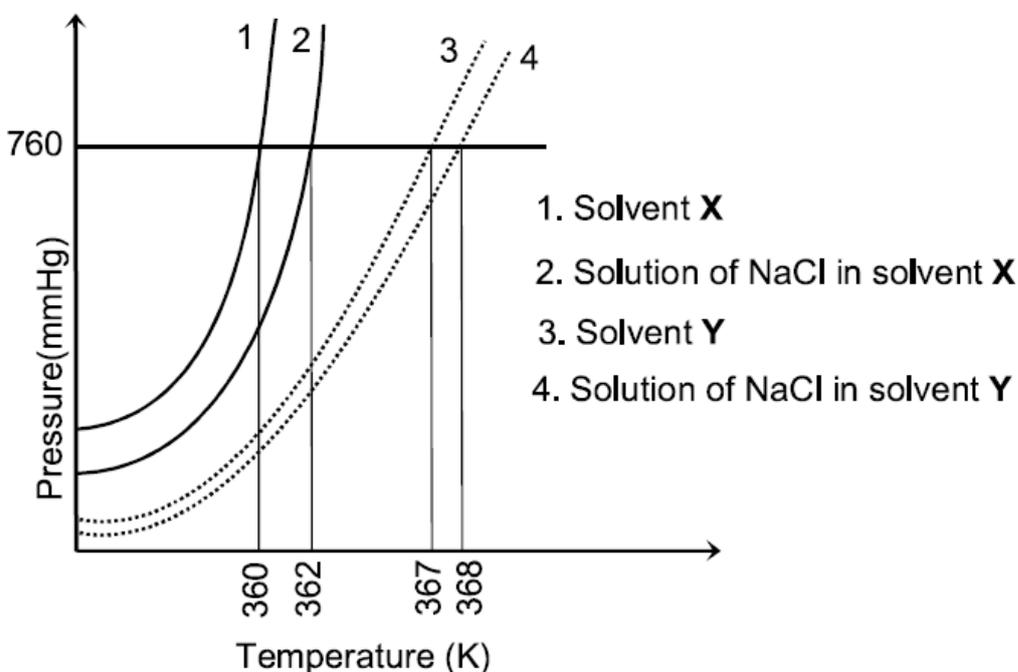
12. Liquids  $A$  and  $B$  form ideal solution over the entire range of composition. At temperature  $T$ , equimolar binary solution of liquids  $A$  and  $B$  has vapour pressure 45Torr. At the same temperature, a new solution of  $A$  and  $B$  having mole fractions  $x_A$  and  $x_B$ , respectively, has vapour pressure of 22.5Torr. The value of  $x_A/x_B$  in the new solution is \_\_\_\_\_.

(given that the vapour pressure of pure liquid  $A$  is 20Torr at temperature  $T$ )

13. The solubility of a salt of weak acid ( $AB$ ) at  $\text{pH}3$  is  $Y \times 10^{-3} \text{ mol L}^{-1}$ . The value of  $Y$  is \_\_\_\_\_.

(Given that the value of solubility product of  $AB(K_{sp}) = 2 \times 10^{-10}$  and the value of ionization constant of  $HB(K_a) = 1 \times 10^{-8}$ )

14. The plot given below shows  $P-T$  curves (where  $P$  is the pressure and  $T$  is the temperature) for two solvents  $X$  and  $Y$  and isomolal solutions of  $\text{NaCl}$  in these solvents.  $\text{NaCl}$  completely dissociates in both the solvents.



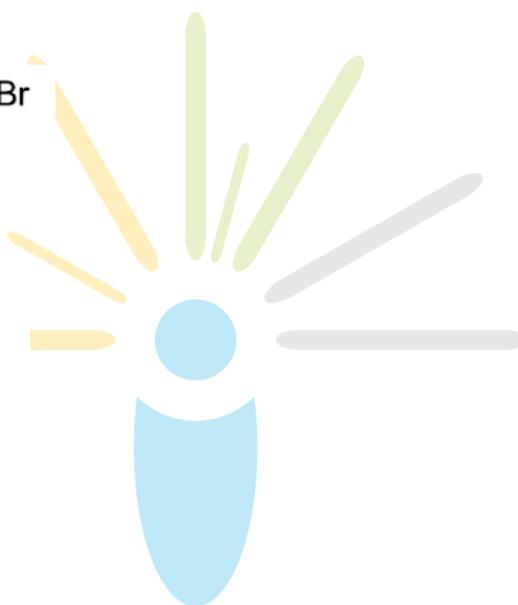
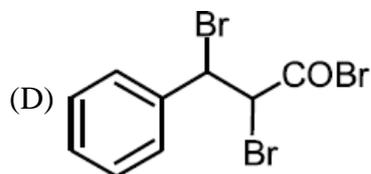
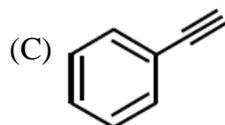
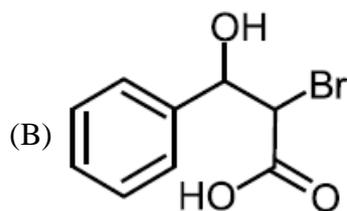
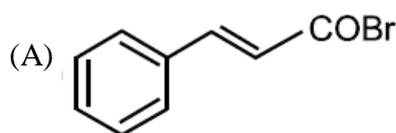
On addition of equal number of moles of a non-volatile solute  $S$  in equal amount (in kg) of these solvents, the elevation of boiling point of solvent  $X$  is three times that of solvent  $Y$ . Solute  $S$  is known to undergo dimerization in these solvents. If the degree of dimerization is  $0.7$  in solvent  $Y$ , the degree of dimerization in solvent  $X$  is \_\_\_\_\_.

**PARAGRAPH "X"**

Treatment of benzene with  $\text{CO}/\text{HCl}$  in the presence of anhydrous  $\text{AlCl}_3/\text{CuCl}$  followed by reaction with  $\text{Ac}_2\text{O}/\text{NaOAc}$  gives compound  $X$  as the major product. Compound  $X$  upon reaction with  $\text{Br}_2/\text{Na}_2\text{CO}_3$ , followed by heating at 473 K with moist  $\text{KOH}$  furnishes  $Y$  as the major product. Reaction of  $X$  with  $\text{H}_2/\text{Pd-C}$ , followed by  $\text{H}_3\text{PO}_4$  treatment gives  $Z$  as the major product.

*(There are two questions based on PARAGRAPH "X", the question given below is one of them)*

15. The compound  $Y$  is

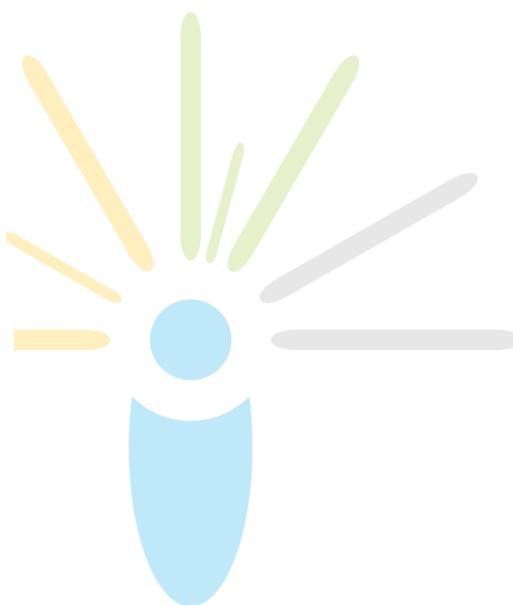
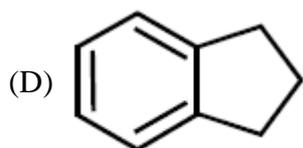
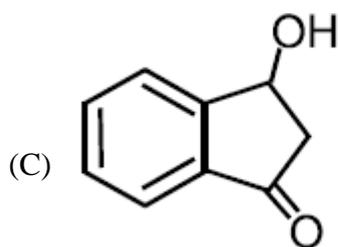
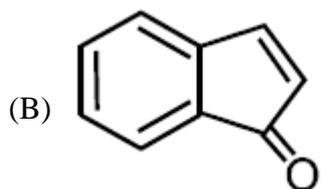
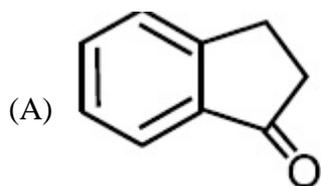


**PARAGRAPH "X"**

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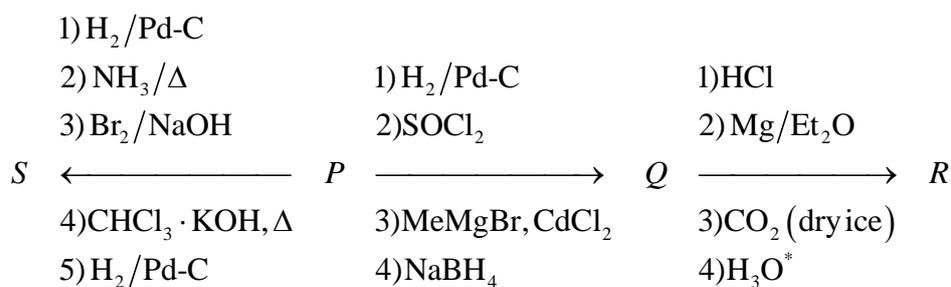
*(There are two questions based on PARAGRAPH "X", the question given below is one of them)*

16. The compound  $Z$  is



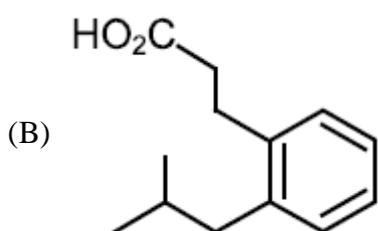
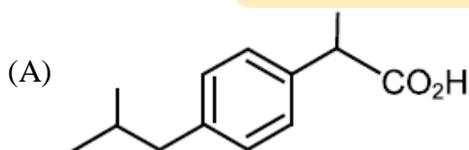
**PARAGRAPH "A"**

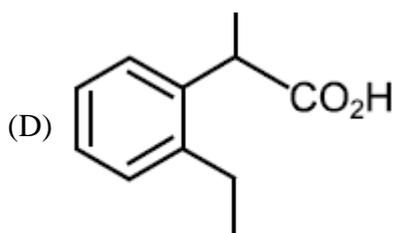
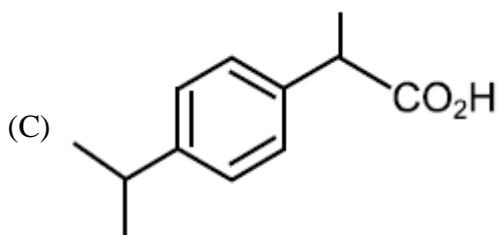
An organic acid  $P(C_{11}H_{12}O_2)$  can easily be oxidized to a dibasic acid which reacts with ethyleneglycol to produce a polymer dacron. Upon ozonolysis,  $P$  gives an aliphatic ketone as one of the products.  $P$  undergoes the following reaction sequences to furnish  $R$  via  $Q$ . The compound  $P$  also undergoes another set of reactions to produce  $S$ .



(There are two questions based on PARAGRAPH "A", the question given below is one of them)

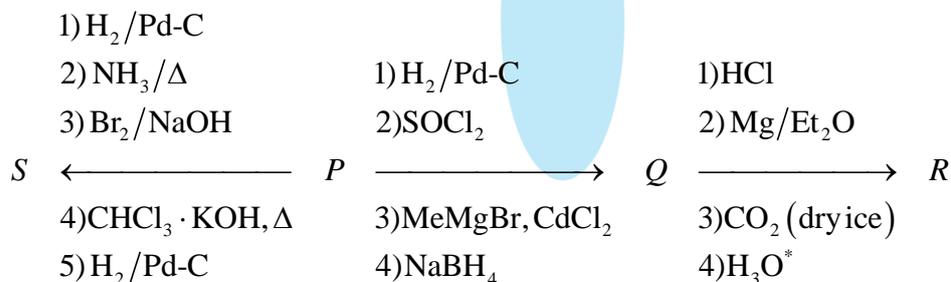
17. The compound  $R$  is





### PARAGRAPH "A"

An organic acid  $P(C_{11}H_{12}O_2)$  can easily be oxidized to a dibasic acid which reacts with ethyleneglycol to produce a polymer dacron. Upon ozonolysis,  $P$  gives an aliphatic ketone as one of the products.  $P$  undergoes the following reaction sequences to furnish  $R$  via  $Q$ . The compound  $P$  also undergoes another set of reactions to produce  $S$ .



(There are two questions based on PARAGRAPH "A", the question given below is one of them)

18. The compound *S* is

