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**JEE**  
**(Advanced)**

**PAPER-1**

**2021**

**COMPUTER BASED TEST (CBT)**  
**Questions**

**Date: 03 October, 2021**

**(Paper 1 - 9:00 am – 12:00 pm | Paper 2 – 2:30 pm to 5:30 pm)**

**Duration : 3 Hrs. | Total Marks : 180**






**SUBJECT: CHEMISTRY**

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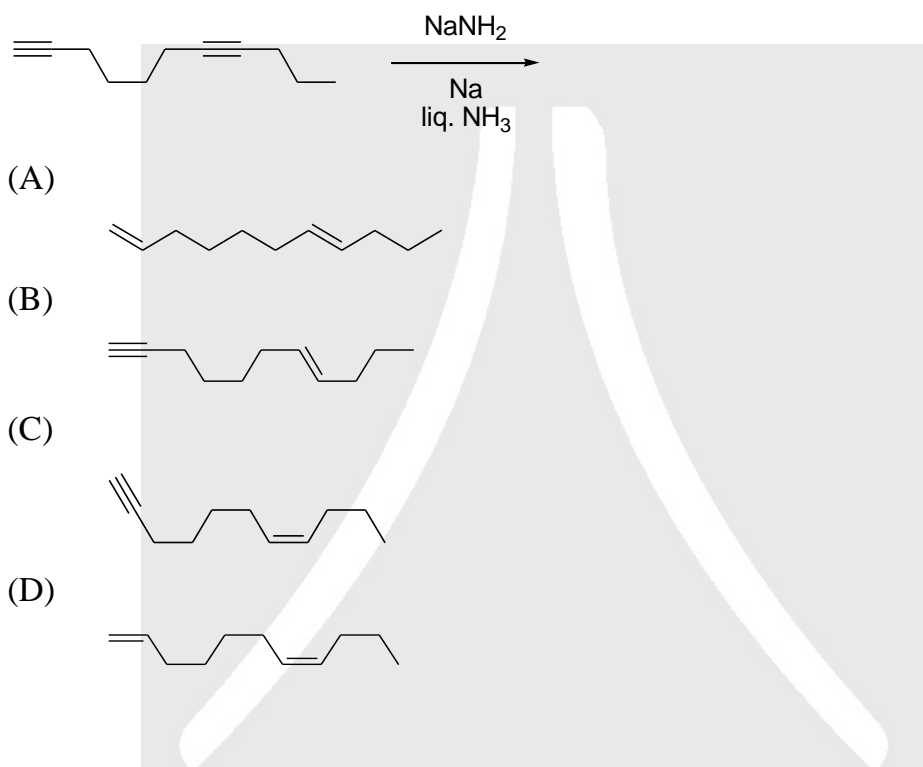
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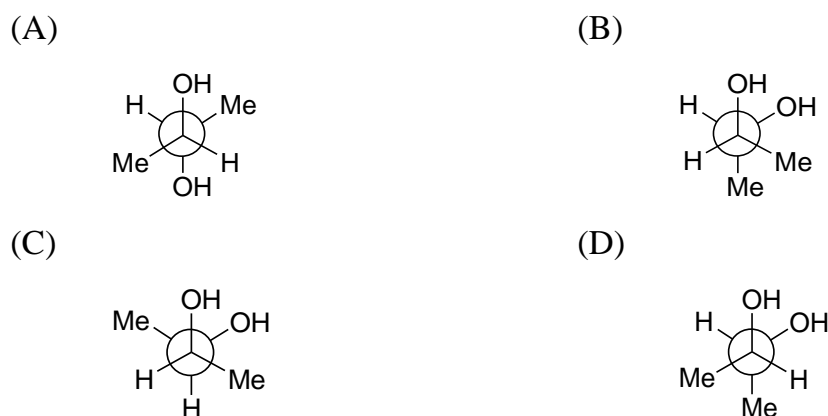
## SECTION 1

- This section contains **FOUR (04)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is 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.

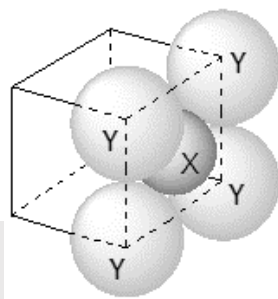
Q.1 The major product formed in the following reaction is



Q.2 Among the following, the conformation that corresponds to the most stable conformation of *meso*-butane-2,3-diol is



- Q.3 For the given close packed structure of a salt made of cation **X** and anion **Y** shown below (ions of only one face are shown for clarity), the packing fraction is approximately (packing fraction =  $\frac{\text{packing efficiency}}{100}$ )



- (A) 0.74                      (B) 0.63                      (C) 0.52                      (D) 0.48
- Q.4 The calculated spin only magnetic moments of  $[\text{Cr}(\text{NH}_3)_6]^{3+}$  and  $[\text{CuF}_6]^{3-}$  in BM, respectively, are  
(Atomic numbers of Cr and Cu are 24 and 29, respectively)
- (A) 3.87 and 2.84                      (B) 4.90 and 1.73  
(C) 3.87 and 1.73                      (D) 4.90 and 2.84

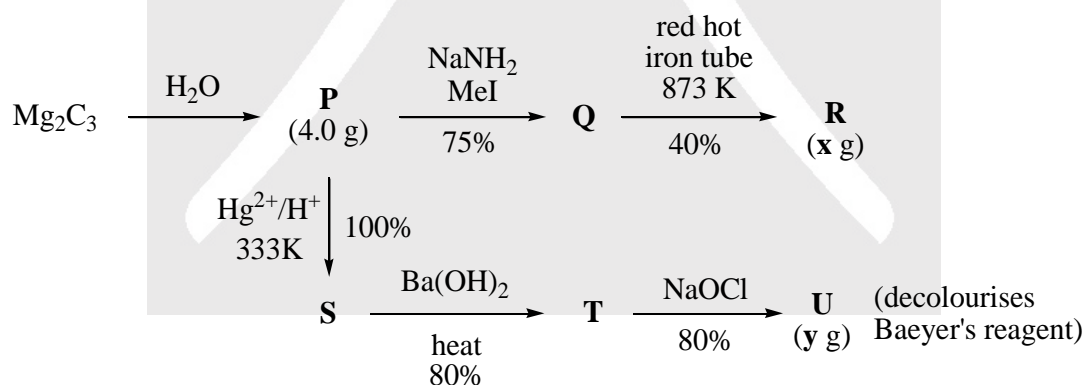
## SECTION 2

- This section contains **THREE (03)** question stems.
- There are **TWO (02)** questions corresponding to each question stem.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value corresponding to the answer in the designated place using the mouse and the on-screen virtual numeric keypad.
- If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.
- Answer to each question will be evaluated according to the following marking scheme:  
*Full Marks* : +2 If ONLY the correct numerical value is entered at the designated place;  
*Zero Marks* : 0 In all other cases.

## Question Stem for Question Nos. 5 and 6

## Question Stem

For the following reaction scheme, percentage yields are given along the arrow:



**x g** and **y g** are mass of **R** and **U**, respectively.

(Use: Molar mass (in  $\text{g mol}^{-1}$ ) of H, C and O as 1, 12 and 16, respectively)

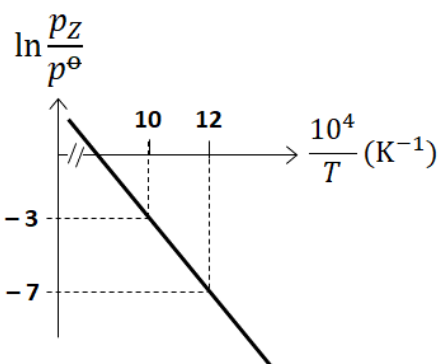
Q.5 The value of **x** is \_\_\_\_.

Q.6 The value of **y** is \_\_\_\_.

### Question Stem for Question Nos. 7 and 8

#### Question Stem

For the reaction,  $\text{X}(s) \rightleftharpoons \text{Y}(s) + \text{Z}(g)$ , the plot of  $\ln \frac{p_{\text{Z}}}{p^{\ominus}}$  versus  $\frac{10^4}{T}$  is given below (in solid line), where  $p_{\text{Z}}$  is the pressure (in bar) of the gas **Z** at temperature  $T$  and  $p^{\ominus} = 1$  bar.



(Given,  $\frac{d(\ln K)}{d(\frac{1}{T})} = -\frac{\Delta H^{\ominus}}{R}$ , where the equilibrium constant,  $K = \frac{p_{\text{Z}}}{p^{\ominus}}$  and the gas constant,  $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ )

- Q.7 The value of standard enthalpy,  $\Delta H^{\ominus}$  (in  $\text{kJ mol}^{-1}$ ) for the given reaction is \_\_\_\_.
- Q.8 The value of  $\Delta S^{\ominus}$  (in  $\text{J K}^{-1} \text{ mol}^{-1}$ ) for the given reaction, at 1000 K is \_\_\_\_.

### Question Stem for Question Nos. 9 and 10

#### Question Stem

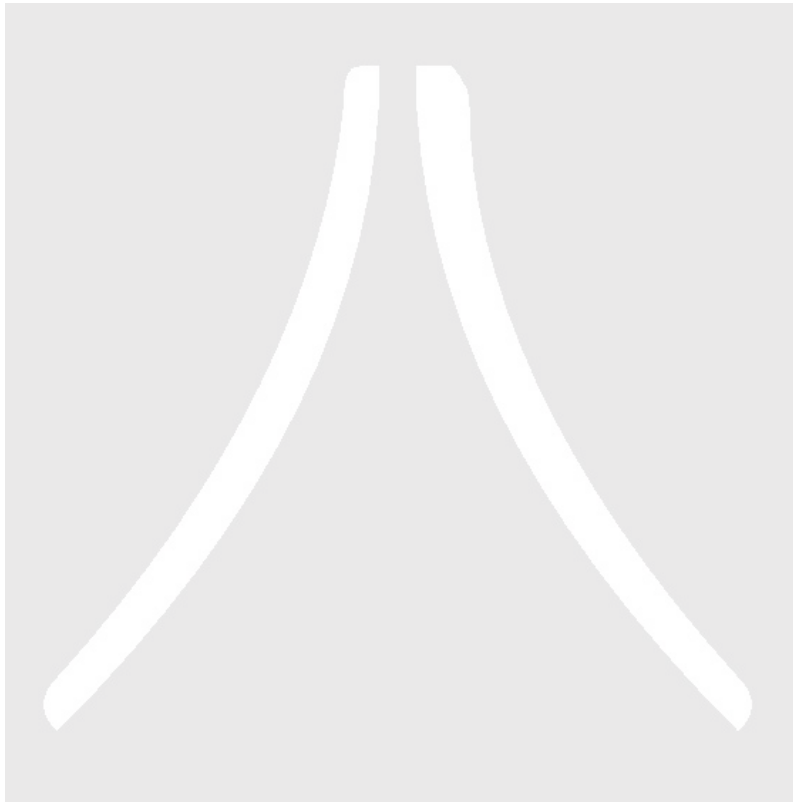
The boiling point of water in a 0.1 molal silver nitrate solution (solution **A**) is  $x$  °C. To this solution **A**, an equal volume of 0.1 molal aqueous barium chloride solution is added to make a new solution **B**. The difference in the boiling points of water in the two solutions **A** and **B** is  $y \times 10^{-2}$  °C.

(Assume: Densities of the solutions **A** and **B** are the same as that of water and the soluble salts dissociate completely.

Use: Molal elevation constant (Ebullioscopic Constant),  $K_b = 0.5 \text{ K kg mol}^{-1}$ ; Boiling point of pure water as 100 °C.)

Q.9 The value of  $x$  is \_\_\_\_.

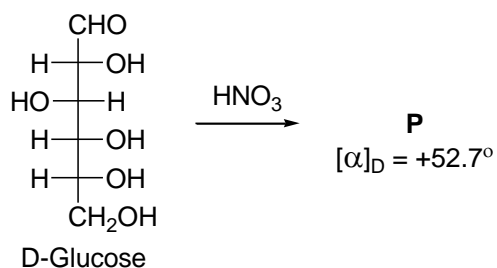
Q.10 The value of  $|y|$  is \_\_\_\_.



**SECTION 3**

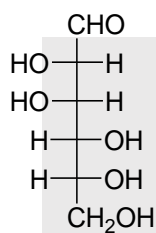
- This section contains **SIX (06)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).
- For each question, choose the option(s) corresponding to (all) the correct answer(s).
- Answer to each question will 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;
  - 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 unanswered;
  - Negative Marks* : -2 In all other cases.
- For example, in a question, if (A), (B) and (D) are the **ONLY** three options corresponding to correct answers, then
  - choosing **ONLY** (A), (B) and (D) will get +4 marks;
  - choosing **ONLY** (A) and (B) will get +2 marks;
  - choosing **ONLY** (A) and (D) will get +2 marks;
  - choosing **ONLY** (B) and (D) will get +2 marks;
  - choosing **ONLY** (A) will get +1 mark;
  - choosing **ONLY** (B) will get +1 mark;
  - choosing **ONLY** (D) will get +1 mark;
  - choosing no option(s) (i.e. the question is unanswered) will get 0 marks and
  - choosing any other option(s) will get -2 marks.

Q.11 Given:

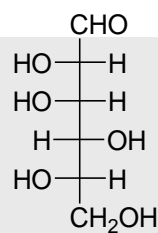


The compound(s), which on reaction with  $\text{HNO}_3$  will give the product having degree of rotation,  $[\alpha]_{\text{D}} = -52.7^\circ$  is(are)

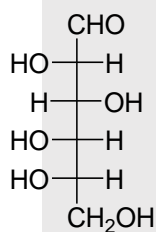
(A)



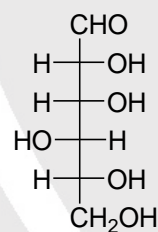
(B)



(C)

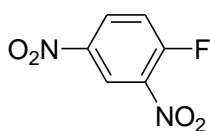


(D)

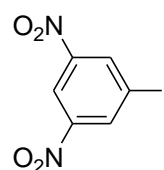


Q.12 The reaction of **Q** with  $\text{PhSNa}$  yields an organic compound (major product) that gives positive Carius test on treatment with  $\text{Na}_2\text{O}_2$  followed by addition of  $\text{BaCl}_2$ . The correct option(s) for **Q** is(are)

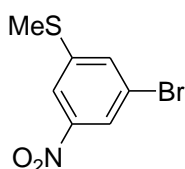
(A)



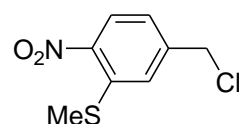
(B)



(C)



(D)





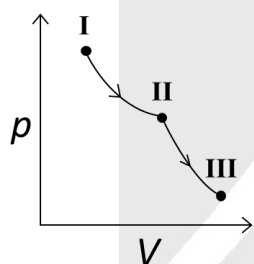
Q.13 The correct statement(s) related to colloids is(are)

- (A) The process of precipitating colloidal sol by an electrolyte is called peptization.
- (B) Colloidal solution freezes at higher temperature than the true solution at the same concentration.
- (C) Surfactants form micelle above critical micelle concentration (CMC). CMC depends on temperature.
- (D) Micelles are macromolecular colloids.

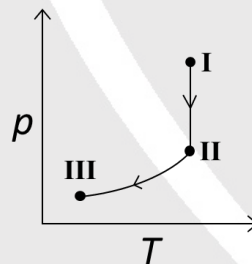
Q.14 An ideal gas undergoes a reversible isothermal expansion from state **I** to state **II** followed by a reversible adiabatic expansion from state **II** to state **III**. The correct plot(s) representing the changes from state **I** to state **III** is(are)

( $p$ : pressure,  $V$ : volume,  $T$ : temperature,  $H$ : enthalpy,  $S$ : entropy)

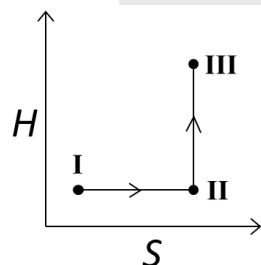
(A)



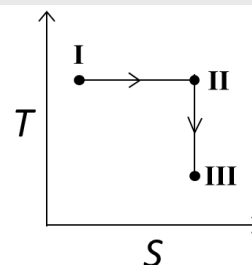
(B)



(C)



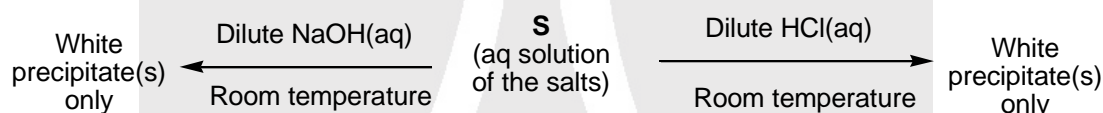
(D)



Q.15 The correct statement(s) related to the metal extraction processes is(are)

- (A) A mixture of PbS and PbO undergoes self-reduction to produce Pb and SO<sub>2</sub>.
- (B) In the extraction process of copper from copper pyrites, silica is added to produce copper silicate.
- (C) Partial oxidation of sulphide ore of copper by roasting, followed by self-reduction produces blister copper.
- (D) In cyanide process, zinc powder is utilized to precipitate gold from Na[Au(CN)<sub>2</sub>].

Q.16 A mixture of two salts is used to prepare a solution **S**, which gives the following results:



The correct option(s) for the salt mixture is(are)

- (A) Pb(NO<sub>3</sub>)<sub>2</sub> and Zn(NO<sub>3</sub>)<sub>2</sub>                      (B) Pb(NO<sub>3</sub>)<sub>2</sub> and Bi(NO<sub>3</sub>)<sub>3</sub>
- (C) AgNO<sub>3</sub> and Bi(NO<sub>3</sub>)<sub>3</sub>                      (D) Pb(NO<sub>3</sub>)<sub>2</sub> and Hg(NO<sub>3</sub>)<sub>2</sub>

#### SECTION 4

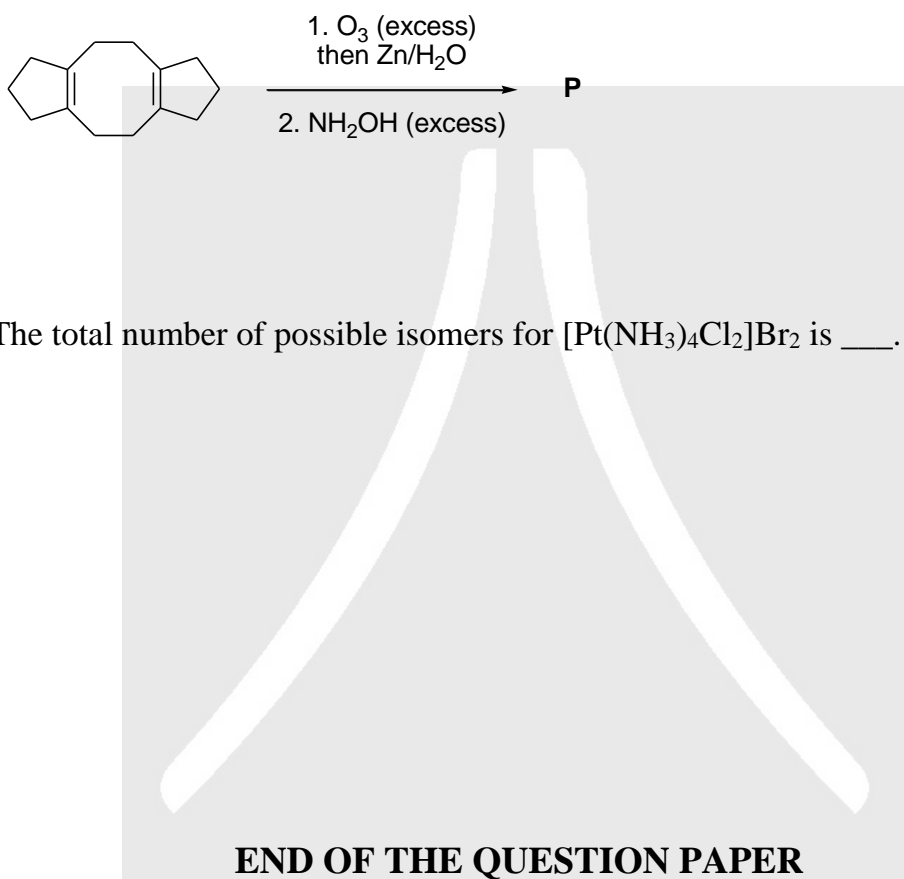
- This section contains **THREE (03)** questions.
- The answer to each question is a **NON-NEGATIVE INTEGER**.
- For each question, enter the correct integer corresponding to the answer using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme:

*Full Marks* : +4 If **ONLY** the correct integer is entered;

*Zero Marks* : 0 In all other cases.

Q.17 The maximum number of possible isomers (including stereoisomers) which may be formed on *mono*-bromination of 1-methylcyclohex-1-ene using  $\text{Br}_2$  and UV light is \_\_\_\_.

Q.18 In the reaction given below, the total number of atoms having  $sp^2$  hybridization in the major product **P** is \_\_\_\_.



Q.19 The total number of possible isomers for  $[\text{Pt}(\text{NH}_3)_4\text{Cl}_2]\text{Br}_2$  is \_\_\_\_.

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