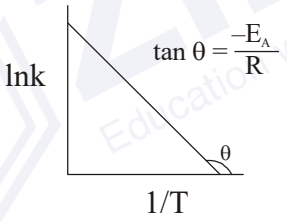
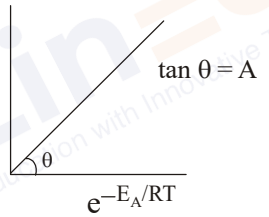
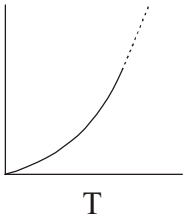
# SECTION -3
# PART-A
## [SINGLE CORRECT CHOICE TYPE]

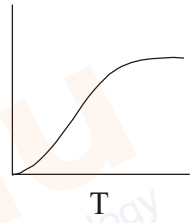
**Q.1 to Q.7** has four choices (A), (B), (C), (D) out of which **ONLY ONE** is correct.

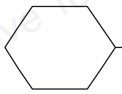
Q.1 Which of the following graphs is **incorrect** regarding rate constant (k) and absolute temperature? [Symbols have usual meaning]

(A) 


(B) 


(C) 

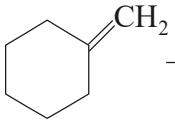

(D) 


Q.2 Prof. **S**andy **R**oberston gave a task to synthesize  $-CH_2-CH_3$ to three of his students **Dipti**, **Anmol** and **Priyanshu**. Different routes were adopted by them-

**Dipti's Method**

$$Me-Br \xrightarrow{Mg\ /\ ether} (A) \xrightarrow{CH_3-Br} (B) \xrightarrow{Br_2/h\nu} (C) \xrightarrow{Mg/ether} (D) \xrightarrow{Br-\bigcirc} (E)$$

**Anmol's Method**

 $\xrightarrow{HBr}$ (A) $\xrightarrow{Mg/ether}$ (B) $\xrightarrow{CH_3-Br}$ (C)

**Priyanshu's Method**

 $\xrightarrow{HCl}$ (A) $\xrightarrow{Mg/ether}$ (B) $\xrightarrow{CH_3-CH_2-Cl}$ (C)

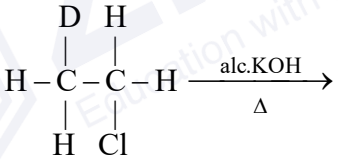
Which of the following statement is correct :-
(A) Dipti and Anmol will get desired product but yield will be better in Anmol's method.
(B) Dipti and Priyanshu will get desired product but yield will be better in Priyanshu's method
(C) Only Priyanshu will get desired product.
(D) All of them will get desired product.

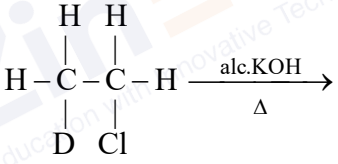
Q.3 Which of the following does not exist ?

(A) $SCl_6$ (B) $IF_7$ (C) $FeI_2$ (D) $H_2S$

Q.4 Calculate change in enthalpy when 2 moles of liquid water at 1 bar and 100°C is converted into steam at 2 bar and 300°C. Assume $H_2O$ vapours to behave ideally.
*[Latent heat of vaporisation of $H_2O$ (l) at 1 bar and 100°C is 10.8 Kcal per mole]*
**[R = 2 Cal / mol K]**
(A) 21.6 Kcal (B) 11.8 Kcal (C) 24.8 Kcal (D) 23.6 Kcal

Q.5 Organic product of which of the following reactions will have duterium in it?

(a) 

(b) 

(A) only (a) (B) only (b) (C) both (a) & (b) (D) none

Q.6 Consider the following compounds / molecules?
(I) $N \equiv N$ (II) $HN = NH$ (III) $H_2N - NH_2$ (IV) $F_2N - NF_2$
The correct order of N–N bond length is
(A) I < III < II < IV (B) I < II < III < IV
(C) I < IV < II < III (D) I < II < IV < III

Q.7 Which of the following overlaps of atomic orbitals does not form π-bond if z-axis is the internuclear axis?
(A) $d_{zx} - p_x$ (B) $p_y - p_y$ (C) $d_{yz} - p_y$ (D) $d_{z^2} - d_{z^2}$

## [PARAGRAPH TYPE]

**Q.8 to Q.11** has four choices (A), (B), (C), (D) out of which **ONLY ONE** is correct.

### Paragraph for question nos. 8 to 9

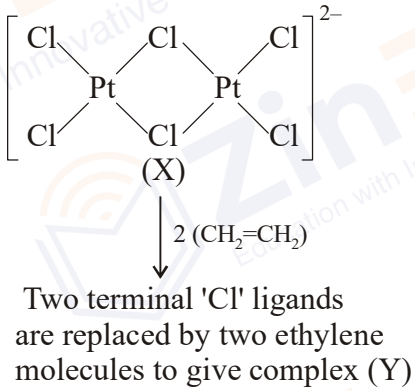
Out of different state parameters like E, H, G, A and S, only entropy(s) is the parameter whose absolute value can be determined, by using third law of thermodynamics. While perfect crystals have zero entropy at 0 K, non perfect crystals have some residual entropy at 0 K. From this info and the following data chart, answer the questions that follow.

| Substance | $C_P$(solid) (J/mole K) | Standard Melting point | $\Delta H^\circ_{fusion}$ (kJ/mole) | $S^\circ_{m,100K}$ (J/K mole) |
|---|---|---|---|---|
| P | (0.35 T) | 200 K | 27 | 35 |
| Q | (0.25 T) | 250 K | 29 | 30 |
| R | (0.15 T) | 300 K | 30 | 20 |
| S | (0.45 T) | 350 K | 40 | 50 |

Q.8 Which of the substances will have residual entropy at 0 K?
(A) Only R (B) Only P (C) Q,R & S all three (D) Q & P only

Q.9 What will be molar entropy of **liquid R** at 300 K?
(A) 150 J/K mole (B) 145 J/K mole (C) 45 J/K mole (D) 50 J/k mole

**Paragraph for question nos. 10 to 11**




Both (X) and (Y) are square planar complexes about $Pt^{II}$

Q.10 Which of the following is / are correct?
(A) Effective atomic number of both (X) and (Y) would remain same
(B) Ethene acts as 2 electrons donor
(C) Bridging 'Cl' ligand is 4 electrons donor
(D) All of these

Q.11 Which of the following isomerism(s) is / are exhibited by the complex (Y)?
(A) Coordination isomerism (B) Geometrical isomerism
(C) Optical isomerism (D) Linkage isomerism

## [MULTIPLE CORRECT CHOICE TYPE]

**Q.12 to Q.15** has four choices (A), (B), (C), (D) out of which **ONE OR MORE** may be correct.

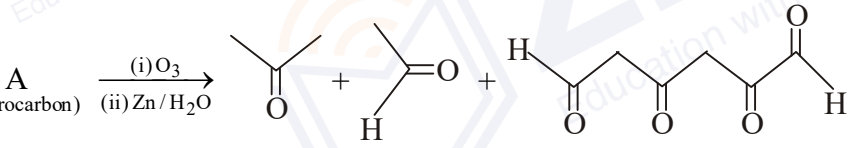
Q.12 Which of the following statements is / are **true**?

(A) For any substance $\Delta S^{o}_{vap} > \Delta S^{o}_{fusion}$

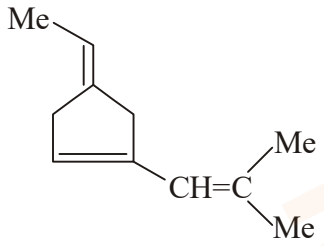
(B) Greater amount of heat will be required to dissociate ammonia gas into nitrogen and hydrogen gas at constant pressure condition as compared to constant volume condition at same temperature.

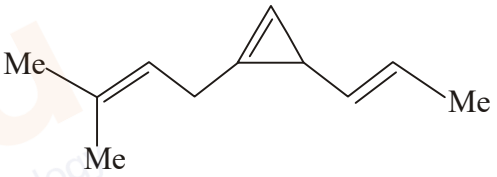
(C) The reaction having rate law = $K[A]^2[B]^1$ will follow first order kinetics if concentration of [B] is kept constant.

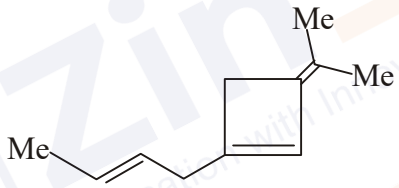
(D) Normality of $KMnO_4$ in alkaline medium may be either equal to molarity or may be three times molarity.

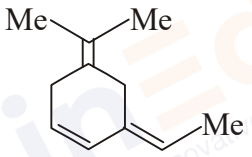
Q.13 


Structure of A can be:

(A) 

(B) 

(C) 

(D) 

Q.14 Which of the following complexes or molecule has / have N – N bond length greater than that in free $N_2$ molecule?

(A) $[Ru(NH_3)_5(N_2)]^+$ (B) $[Ni(PMe_3)_3(N_2)]$

(C) $[CoH(PPh_3)_3(N_2)]$ (D) $N_2O$

Q.15 Which of the following statements is / are **true** :

(A) Major part of energy needed for the heterolysis of C–X bond in $S_N1$ reaction mechanism is obtained by the solvation of $X^-$ by the polar protic solvent.

(B) 1-pentene gives two bromoalkenes with NBS.

(C) Increase in the no. of phenyl ring at C of C–X causes a shift in mechanism from $S_N2$ to $S_N1$.

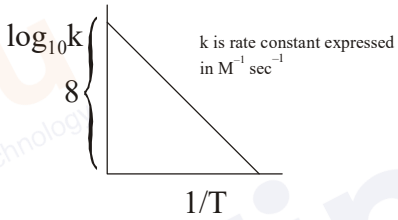
(D) $\dot{Cl} + \dot{H} \longrightarrow HCl$, is not the chain termination step during photochlorination of ethane.

# PART–C

## [INTEGER TYPE]

**Q.1 to Q.5** are "Integer Type" questions. (The answer to each of the questions **are upto 4 digits**)

Q.1 For a simple bimolecular reaction involving only one reactant graph of $\log_{10}k$ v/s $\frac{1}{T}$ is plotted as shown.




If % of activated molecules is 0.0004 % at a particular temperature then calculate rate of disappearance of reactant at that temperature and a concentration of 0.1 M. **[Express answer in M / sec.]**

Q.2  $\xrightarrow{\text{Monochlorination}}$ (A) $\xrightarrow[Et_2O]{Mg}$ (B) $\xrightarrow[(3.5\,gms)]{HOCH_2CH_2C\equiv CH}$ 

(70 gms)

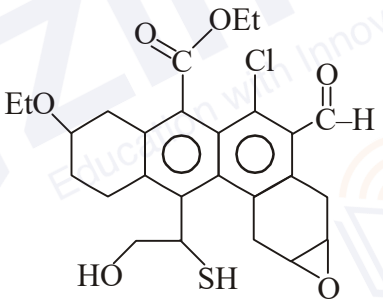
How many gms of cyclopentane will be formed in the above reaction (Consider the yield to be 100% in

each step)

***Round the answer to nearest integer like 2.4 will be 2 and 2.6 will be 3.***

Q.3 Calculate normality of a salt solution [of a metal sulphate] having concentration 21.6 % w/v if its superoxide has 16 % by mass of oxygen.

Q.4 How many moles of Grignard reagent are consumed in given compound.




Q.5 Find the total number of species having planar shape.

$I_3^+$, $XeF_4$ , $SF_4$, $C_2F_4$, $H_2O_2$, $BrF_4$, $SO_3$, NOCl, $ClF_3$, $F_2CO$, $XeF_5^-$

ROUGH WORK