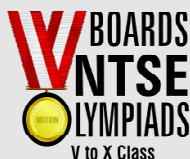हमारा विश्वास... हर एक विद्यार्थी है ख़ास

# JEE MAIN Sept. 2020

## QUESTION PAPER WITH SOLUTION

CHEMISTRY _ 2 Sep. _ SHIFT - 2

1. Cast iron is used for the manufacture of :
   (1) Wrought iron and steel          (2) Wrought iron and pig iron
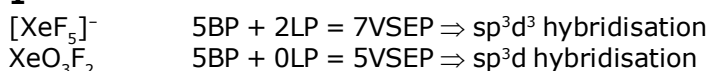   (3) Wrougth iron, pig iron and steel    (4) Pig iron, scrap iron and steel

**Sol.** 1
Refer topic metallurgy

2. The shape/structure of $[XeF_5]^-$ and $XeO_3F_2$, respectively, are :
   (1) Pentagonal planar and trigonal bipyramidal
   (2) Trigonal bipyramidal and trigonal bipyramidal
   (3) Octahedral and square pyramidal
   (4) Trigonal bipyramidal and pentagonal planar

**Sol.** 1
$[XeF_5]^-$       5BP + 2LP = 7VSEP $\Rightarrow$ $sp^3d^3$ hybridisation
$XeO_3F_2$       5BP + 0LP = 5VSEP $\Rightarrow$ $sp^3d$ hybridisation

3. Simplified absorption spectra of three complexes ((i), (ii) and (iii)) of $M^{n+}$ ion are provided below; their $\lambda_{max}$ values are marked as A, B and C respectively. The correct match between the complexes and their $\lambda_{max}$ values is :
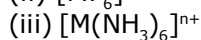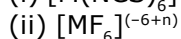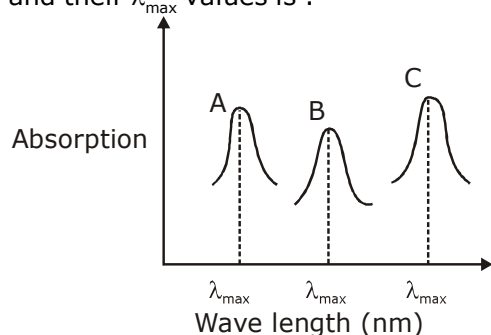


   (i) $[M(NCS)_6]^{(-6+n)}$
   (ii) $[MF_6]^{(-6+n)}$
   (iii) $[M(NH_3)_6]^{n+}$
   (1) A-(i), B-(ii), C-(iii)          (2) A-(iii), B-(i), C-(ii)
   (3) A-(ii), B-(iii), C-(i)          (4) A-(ii), B-(i), C-(iii)

**Sol.** 2

$$\Delta = \frac{hc}{\lambda_{absorbedf(max)}}$$

A $\rightarrow$ $NH_3$ comp (iii)
B $\rightarrow$ NCS comp (i)
C $\rightarrow$ $F^-$ comp (ii)
using spectrochemical series of ligand
$F^- < NCS^- < NH_3$ order of $\Delta$+e
crystal field spliting energy
So. $NH_3$ complex $\rightarrow$ A
$F^-$ complex – C
$NCS^-$ complex $\rightarrow$ B

**4.** The correct observation in the following reactions is :

$$\text{Sucrose} \xrightarrow[\substack{\text{Cleavage} \\ \text{(Hydrolysis)}}]{\text{Gly cos idic bond}} A + B \xrightarrow[\text{reagent}]{\text{Seliwanoff's}} ?$$
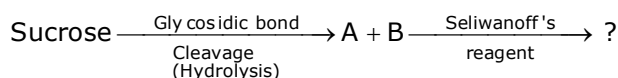
(1) Formation of red colour        (2) Formation of blue colour
(3) Formation of violet colour      (4) Gives no colour

**Sol.** **1**

$$\text{Sucrose} \xrightarrow[\substack{\text{Cleavage} \\ \text{(Hydrolysis)}}]{\text{Gly cos idic bond}} \text{Glucose} + \text{Fructose} \xrightarrow[\text{reagent}]{\text{Seliwanoff's}} \text{Red Colour}$$
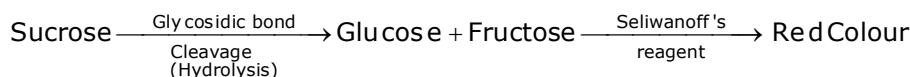
**5.** The results given in the below table were obtained during kinetic studies of the following reaction :
$2A + B \rightarrow C + D$

| Experiment | [A]/ $molL^{-1}$ | [B]/ $molL^{-1}$ | Initial rate/ $molL^{-1} min^{-1}$ |
|---|---|---|---|
| I | 0.1 | 0.1 | $6.00 \times 10^{-3}$ |
| II | 0.1 | 0.2 | $2.40 \times 10^{-2}$ |
| III | 0.2 | 0.1 | $1.20 \times 10^{-2}$ |
| IV | X | 0.2 | $7.20 \times 10^{-2}$ |
| V | 0.3 | Y | $2.88 \times 10^{-1}$ |

X and Y in the given table are respectively :
(1) 0.4, 0.4     (2) 0.3, 0.4     (3) 0.4, 0.3     (4) 0.3, 0.3

**Sol.** **2**

$2A + B \longrightarrow C + D$
Exp.   (I)     $6 \times 10^{-3} = K (0.1)^p (0.1)^q$
     (II)    $2.4 \times 10^{-2} = K (0.1)^p (0.2)^q$
    (III)   $1.2 \times 10^{-2} = K (0.2)^p (0.1)^q$

$$\frac{\exp(I)}{\exp(II)} \qquad \frac{1}{4} = \left(\frac{1}{2}\right)^q \Rightarrow q = 2$$

$$\frac{\text{Exp.(I)}}{\text{Exp.(III)}} \qquad \frac{1}{2} = \left(\frac{1}{2}\right)^p \Rightarrow p = 1$$

exp. (I) ÷ exp (IV)

$$\frac{0.6 \times 10^{-2}}{7.2 \times 10^{-2}} = \left(\frac{0.1}{x}\right)^1 \cdot \left[\frac{0.1}{0.2}\right]^2$$

$$\frac{1}{12} = \frac{0.1}{x} - \frac{1}{4}$$
[x] = 0.3
exp (I) ÷ exp(V)

$$\frac{0.6 \times 10^{-2}}{2.88 \times 10^{-1}} = \left(\frac{0.1}{0.3}\right)^1 \times \left(\frac{0.1}{y}\right)^2$$

$$\frac{1}{48} = \frac{1}{3} \times \frac{10^{-2}}{y^2} \Rightarrow y^2 = 0.16$$
y = 0.4
Ans(2)

**6.** Match the type of interaction in column A with the distance dependence of their interaction energy in column B :

| | A | | B |
|---|---|---|---|
| (I) | ion-ion | (a) | $\dfrac{1}{r}$ |
| (II) | dipole-dipole | (b) | $\dfrac{1}{r^2}$ |
| (III) | London dispersion | (c) | $\dfrac{1}{r^3}$ |
| | | (d) | $\dfrac{1}{r^6}$ |

(1) (I)-(a), (II)-(b), (III)-(d)   (2) (I)-(a), (II)-(b), (III)-(c)
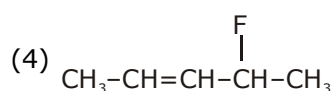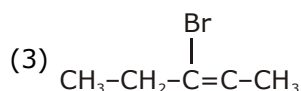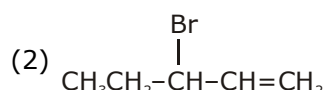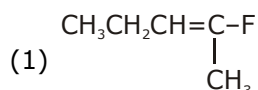(3) (I)-(b), (II)-(d), (III)-(c)   (4) (I)-(a), (II)-(c), (III)-(d)

**Sol.** **4**

ion - ion $\alpha \dfrac{1}{r}$

dipole – dipole $\alpha \dfrac{1}{r^3}$

Londong dispersion $\alpha \dfrac{1}{r^6}$

**7.** The major product obtained from $E_2$– elimination of 3-bromo-2-fluoropentane is :
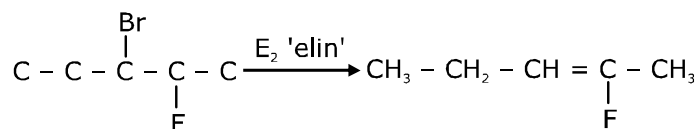
(1) $CH_3CH_2CH=C-F$ with $CH_3$ branch

(2) $CH_3CH_2-CH(Br)-CH=CH_2$

(3) $CH_3-CH_2-C(Br)=C-CH_3$

(4) $CH_3-CH=CH-CH(F)-CH_3$

**Sol.** **1**

$$C - C - \underset{\underset{F}{|}}{\overset{\overset{Br}{|}}{C}} - C - C \xrightarrow{E_2 \text{ 'elin'}} CH_3 - CH_2 - CH = \underset{\underset{F}{|}}{C} - CH_3$$

**8.** Consider the reaction sequence given below :
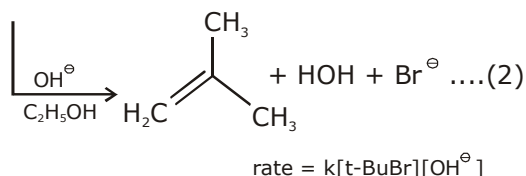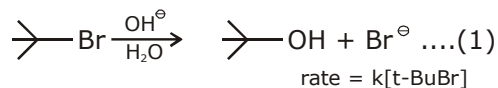


Which of the following statements is true :
(1) Changing the concentration of base will have no effect on reaction (1).
(2) Doubling the concentration of base will double the rate of both the reactions.
(3) Changing the base from $OH^{\ominus}$ to $^{\ominus}OR$ will have no effect on reaction (2).
(4) Changing the concentration of base will have no effect on reaction (2).

**Sol.** **1**
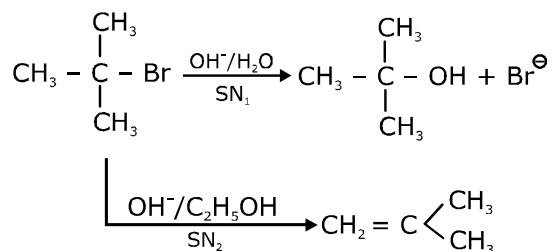


**9.** The size of a raw mango shrinks to a much smaller size when kept in a concentrated salt solution. Which one of the following process can explain this ?
(1) Diffusion                                   (2) Osmosis
(3) Reverse osmosis                        (4) Dialysis

**Sol.** **2**
Theoritical
Ans. Osmosis
Option (2)

**10.** If you spill a chemical toiled cleaning liquid on your hand, your first aid would be :
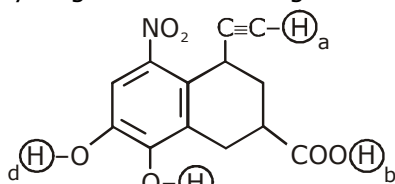(1) Aqueous $NH_3$                        (2) Aqueous $NaHCO_3$
(3) Aqueous NaOH                          (4) Vinegar

**Sol.** **2**
Fact

**11.** Arrange the followig labelled hydrogens in decreasing order of acidity :



(1) b > a > c > d (2) b > c > d > a
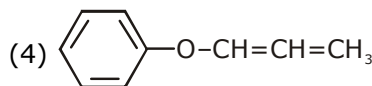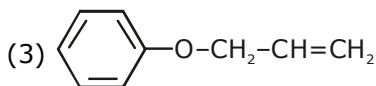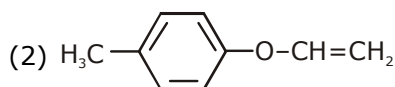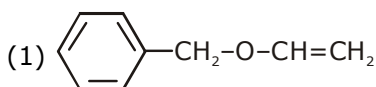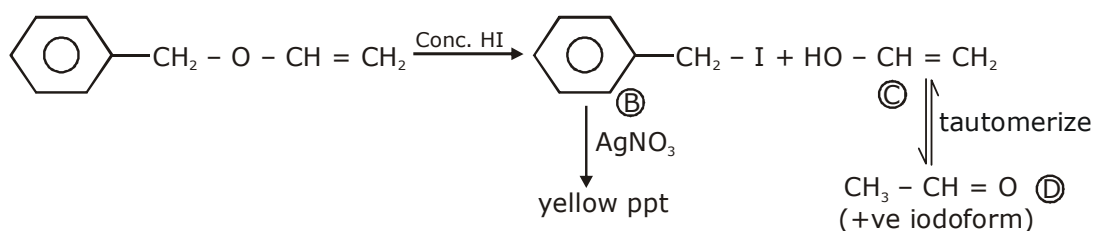(3) c > b > d > a (4) c > b > a > d

**Sol. 2**
Order of acidic strength
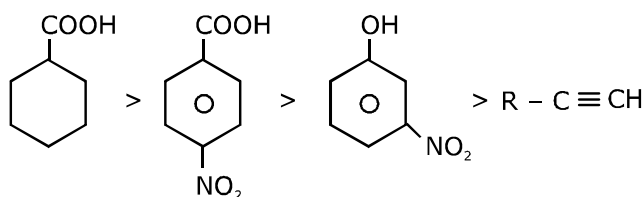


**12.** An organic compound 'A' ($C_9H_{10}O$) when treated with conc. HI undergoes cleavage to yield compounds 'B' and 'C'. 'B' gives yellow precipitate with $AgNO_3$ where as 'C' tautomerizes to 'D'. 'D' gives positive iodoform test. 'A' could be :

(1) —$CH_2$–O–CH=$CH_2$

(2) $H_3C$——O–CH=$CH_2$

(3) —O–$CH_2$–CH=$CH_2$

(4) —O–CH=CH=$CH_3$

**Sol. 1**



**13.** Two elements A and B have similar chemical properties. They don't form solid hydrogencarbonates, but react with nitrogen to form nitrides. A and B, respectively, are :
(1) Na and Ca (2) Cs and Ba
(3) Na and Rb (4) Li and Mg

**Sol. 4**
$LiHCO_3$ & $Mg(HCO_3)_2$ does not exist in solid form but both forms nitrides with nitrogen gas

**14.** The number of subshells associated with n = 4 and m = −2 quantum numbers is :

(1) 4          (2) 8          (3) 2          (4) 16

**Sol.** **3**

$n = 4$

$\ell = 0$          $m = 0$

$\ell = 1$          $m = -1, 0, +1$
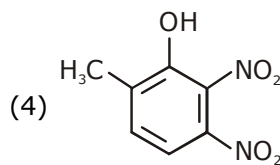
$\ell = 2$          $m = -2, +2, -1, +1, 0$

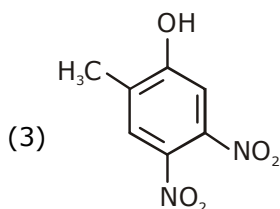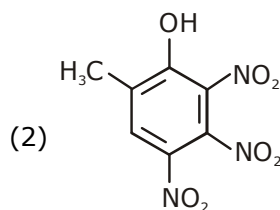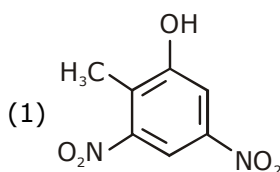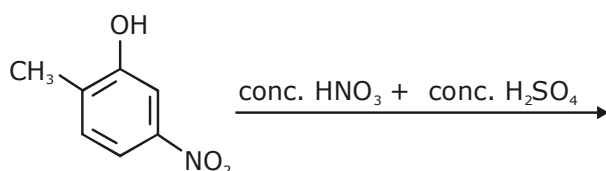$\ell = 3$          $m = \pm 3, \pm 2, \pm 1, 0$

Ans.     '2' Subshells

Option (3)

**15.** The major product of the following reaction is :





**Sol.** **3**
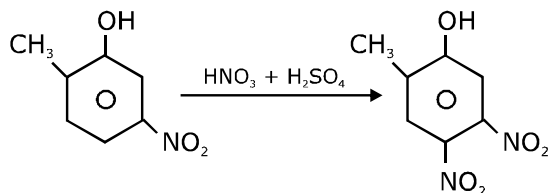
**16.** Two compounds A and B with same molecular formula ($C_3H_6O$) undergo Grignard's reaction with methylmagnesium bromide to give products C and D. Products C and D show following chemical tests.

| Test | C | D |
|---|---|---|
| Ceric ammonium nitrate Test | Positive | Positive |
| Lucas Test | Turbidity obtained after five minutes | Turbidity obtained immediately |
| Iodoform Test | Positive | Negative |

C and D respectively are :
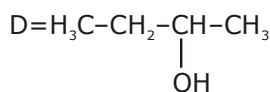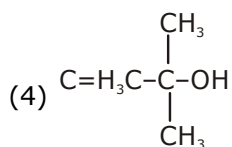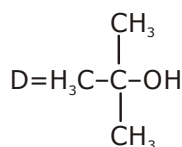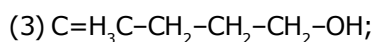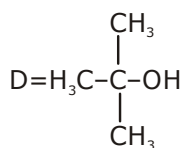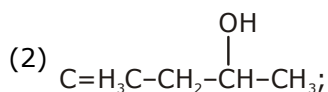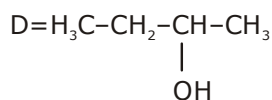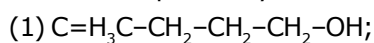
(1) C=$H_3C–CH_2–CH_2–CH_2–OH$;

D=$H_3C–CH_2–CH–CH_3$
               |
               $OH$

(2) C=$H_3C–CH_2–\overset{\overset{\displaystyle OH}{|}}{CH}–CH_3$;

D=$H_3C–\overset{\overset{\displaystyle CH_3}{|}}{\underset{\underset{\displaystyle CH_3}{|}}{C}}–OH$

(3) C=$H_3C–CH_2–CH_2–CH_2–OH$;

D=$H_3C–\overset{\overset{\displaystyle CH_3}{|}}{\underset{\underset{\displaystyle CH_3}{|}}{C}}–OH$

(4) C=$H_3C–\overset{\overset{\displaystyle CH_3}{|}}{\underset{\underset{\displaystyle CH_3}{|}}{C}}–OH$

D=$H_3C–CH_2–CH–CH_3$
               |
               $OH$

**Sol.** 2
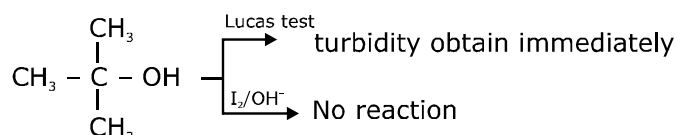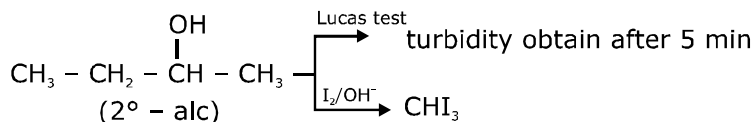


**17.** Three elements X, Y and Z are in the 3rd peroid of the periodic table. The oxides of X, Y and Z, respectively, are basic, amphoteric and acidic, The correct order of the atomic numbers of X, Y and Z is :
(1) X < Y < Z          (2) Y < X < Z
(3) Z < Y < X          (4) X < Z < Y

**Sol.** 1

| x | < | y | < | z |
|---|---|---|---|---|
| Mg | | Al | | Si |
| Basic | | amphoteric | | acidic |
| oxide | | | | oxide |

**18.** The one that is not expected to show isomerism is :
(1) $[Ni(NH_3)_4(H_2O)_2]^{2+}$          (2) $[Ni(en)_3]^{2+}$
(3) $[Pt(NH_3)_2Cl_2]$          (4) $[Ni(NH_3)_2Cl_2]$

**Sol.** 4
$[Ni(NH_3)_2Cl_2]$ $Ni^{2+}$ is $sp^3$ hybridised & such tetrahedral complex does not show either of geometrical or optical isomerism
$[Ni(en)_3]^{2+}$ shows only optical isomers while other three shows geometrical isomerism

**19.** Amongst the following statements regarding adsorption, those that are valid are :
(a) $\Delta H$ becomes less negative as adsorption proceeds.
(b) On a given adsorbent, ammonia is adsorbed more than nitrogen gas.
(c) On adsorption, the residual force acting along the surface of the adsorbent increases.
(d) With increase in temperature, the equilibrium concentration of adsorbate increases.
(1) (b) and (c)          (2) (c) and (d)
(3) (a) and (b)          (4) (d) and (a)

**Sol.** Statement 'a' & 'b'
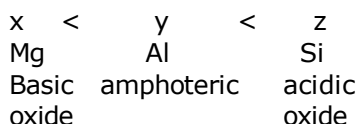
**20.** The molecular geometry of $SF_6$ is octahdral. What is the geometry of $SF_4$ (including lone pair(s) of electrons, if any) ?
(1) Pyramidal          (2) Trigonal bipyramidal
(3) Tetrahedral          (4) Square planar

**Sol.** 2
$SF_4$ is $Sp^3d$ hybridised in which hybrid orbitals have TBP arrangement but its shape is sea-saw

**21.** The ratio of the mass percentages of 'C & H' and 'C & O' of a saturated acyclic organic compound 'X' are 4 : 1 and 3 : 4 respectively. Then, the moles of oxygen gas required for complete combustion of two moles of organic compound 'X' is _____.

**Sol.** Mass ratio of C : H is 4 : 1 $\Rightarrow$ 12 : 3
& C : O is 3 : 4 $\Rightarrow$ 12 : 16
So,

|   | mass | mole | mole ratio |
|---|------|------|------------|
| C | 12   | 1    | 1          |
| H | 3    | 3    | 3          |
| O | 16   | 1    | 1          |

Empirical formula $\Rightarrow CH_3O$
as compound is satured a cyclic so, molecular formula is $C_2H_6O_2$.

$$\underset{2\,mole}{C_2H_6O_2} + \underset{5\,mole}{\frac{5}{2}O_{2(g)}} \longrightarrow 2CO_{2(g)} + 3H_2O_{(g)}$$
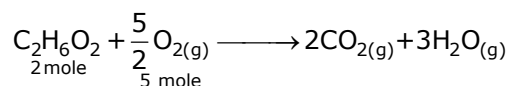
So, required moles of $O_2$ is $\Rightarrow$ 5

**22.** For the disproportionation reaction $2Cu^+(aq) \rightleftharpoons Cu(s) + Cu^{2+}(aq)$ at K, ln K (where K is the equilibrium constant) is _____ $\times 10^{-1}$.

Given :

$(E^0_{Cu^{2+}/Cu^+} = 0.16\,V$

$E^0_{Cu^+/Cu} = 0.52\,V$

$\frac{RT}{F} = 0.025)$

**Sol.** **144**

$2Cu^+ \rightleftharpoons Cu(s) + Cu^{+2}$
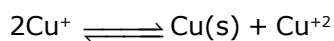
$E^0 = 0.52 - 0.16$
$\quad = 0.36$

$E^0 = \frac{RT}{nF} \ln(k_{eq})$

$\ln(k_{eq}) = \frac{0.36}{0.025} \times \frac{1}{1}$

$\qquad = \frac{360}{25} = 14.4$

$\qquad = 144 \times 10^{-1}$

Ans. 144

**23.** The work function of sodium metal is $4.41 \times 10^{-19}$ J. If photons of wavelength 300 nm are incident on the metal, the kinetic energy of the ejected electrons will be (h = $6.63 \times 10^{-34}$ J s; c = $3 \times 10^8$ m/s) _____ $\times 10^{-21}$ J.

**Sol.** **222**

$\phi = 4.41 \times 10^{-19}$ J

$\lambda = 300$ nm

$$KE_{max} = \frac{hc}{\lambda} - \phi$$

$$= \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{300 \times 10^{-9}} - 4.41 \times 10^{-19}$$

$= 6.63 \times 10^{-19} - 4.41 \times 10^{-19}$

$= 222 \times 10^{-21}$

Ans. 222

**24.** The oxidation states of transition metal atoms in $K_2Cr_2O_7$, $KMnO_4$ and $K_2FeO_4$, respectively, are x, y and z. The sum of x, y and z is _____.

**Sol.** **19**

$$K_2\overset{+6}{Cr_2}O_7 \qquad K\overset{+7}{Mn}O_4 \qquad K_2[\overset{+6}{Fe}O_4]$$
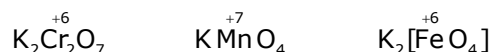
**25.** The heat of combustion of ethanol into carbon dioxide and water is −327 kcal at constant pressure. The heat evolved (in cal) at constant volume and 27ºC (if all gases behave ideally) is (R = 2 cal $mol^{-1}$ $K^{-1}$) _____.

**Sol.** $\Delta H_c^0 [C_2H_5OH] = -327$ kcal

$$C_2H_5OH(l) + 3O_2(g) \longrightarrow 2CO_2(g) + 3(H_2O)(l)$$

$\Delta E_c^0 \quad = \Delta H_c^0 - \Delta ngRT$

$\qquad = -327 \times 1000 - (-1) \times 2 \times 300$

$\qquad = -327000 + 600$

$\qquad = -326400$

# जब इन्होंने पूरा किया अपना सपना
# तो आप भी पा सकते है लक्ष्य अपना

## JEE MAIN RESULT 2019

| **Nitin Gupta** | **Shiv Modi** | **Ritik Bansal** | **Shubham Kumar** |
|---|---|---|---|
| Marks **335** 13th (2019) / Marks **149** 12th (2018) | Marks **318** 13th (2019) / Marks **153** 12th (2018) | Marks **308** 13th (2019) / Marks **218** 12th (2018) | Marks **300** 13th (2019) / Marks **153** 12th (2018) |
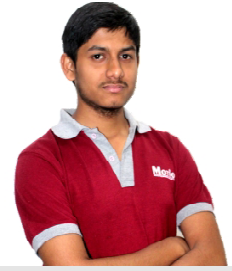
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| Complete access to all content | NA | | |
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| Exercise Sheets | NA | | |
| Recorded Video Solutions | NA | | |
| Online Test Series | NA | | |
| Revision Material | NA | | |
| **Upgrade to Regular Classroom program** | **Chargeable** | **Chargeable** | **Free** |
| Physical Classroom | NA | NA | |
| Computer Based Test | NA | NA | |
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