

Test Date: 29/07/2020



**A**  
CODE

Regd. Office: Aakash Tower, 8, Pusa Road, New Delhi-110005, Ph.011-47623456

Time : 3 hrs

**Mock Test\_CoE\_XII**  
**for JEE (Advanced) - 2020**

MM : 180

**Test - 3A (Paper - I)\_Actual Pattern-2018**

**Topics covered:**

**PHYSICS** : MOCK TEST on Complete Syllabus

**CHEMISTRY** : MOCK TEST on Complete Syllabus

**MATHEMATICS** : MOCK TEST on Complete Syllabus

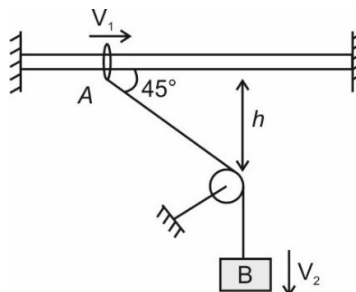
**General Instructions:**

1. Read each question carefully.
2. It is mandatory to use blue/black ballpoint pen to darken the appropriate circle in the answer sheet.
3. Mark should be dark and should completely fill the circle.
4. Rough work must not be done on the answer sheet.
5. Do not use white-fluid or any other rubbing material on answer sheet.
6. Student cannot use log table and calculator or any other material in the examination hall.
7. Before attempting the question paper, student should ensure that the test paper contains all pages and no page is missing.
8. Before handing over the answer sheet to the invigilator, candidate should check that Roll No., Centre Code and Date of Birth have been filled and marked correctly.
9. Immediately after the prescribed examination time is over, the answer sheet is to be returned to the invigilator.
10. **Pattern of the questions are as under :**
  - (i) The question paper consists of 3 parts (Physics, Chemistry and Mathematics). Each part has 3 sections.
  - (ii) **Section-1:** This section contains **6** multiple choice questions which have one or more correct answer(s). Each question carries **+4 marks** for correct answer and **-2 marks** for wrong answer. Partial **+1 mark** is given for darkening a bubble corresponding to each correct option, provided NO incorrect option is darkened
  - (iii) **Section-2:** This section contains **8** questions. The answer to each of the question is a **double-digit integer**, ranging from 00 to 99 (both inclusive) without being given any option. Each question carries **+3 marks** for correct answer and there is **no negative mark** for wrong answer.
  - (iv) **Section-3:** This section contains **2** paragraphs. Based upon each paragraph, **2** multiple choice questions have to be answered. Each question has **only one** correct answer and carries **+3 marks** for correct answer and **-1 mark** for wrong answer.

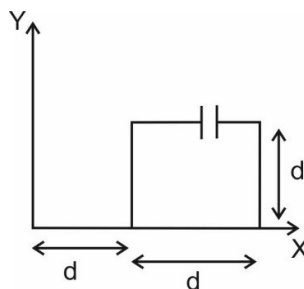
**PART – I: PHYSICS****SECTION - 1****One or More than One Option Correct Type**

This section contains **6** 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).

1. Ring A can slide on a smooth horizontal rod and block B can move vertically. Both are attached by an inextensible string. At a certain instant velocity of ring is  $V_1$  and that of block is  $V_2$ . Then

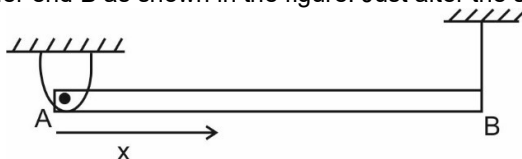


- (A)  $V_1 = \sqrt{2}V_2$   
 (B)  $\sqrt{2}V_1 = V_2$   
 (C) Angular velocity of ring with respect to an observer on pulley is  $\frac{2V_1}{h}$   
 (D) Angular velocity of ring with respect to an observer on pulley is  $\frac{V_1}{2h}$
2. The position vector of a particle moving in space, is  $\vec{r} = (4\cos^2\omega t - 1)\hat{i} + 3\sin^2\omega t\hat{j}$ . All the unit are in SI. Choose the correct statement.
- (A) Amplitude of the SHM of the particle is  $\frac{5}{3}$  m  
 (B) Amplitude of the SHM of the particle is  $\frac{5}{2}$  m  
 (C) Line of SHM of the particle is parallel to the vector  $\left(\frac{4}{5}\hat{i} - \frac{3}{5}\hat{j}\right)$   
 (D) Line of SHM of the particle is parallel to the vector  $\left(\frac{4}{5}\hat{i} + \frac{3}{5}\hat{j}\right)$
3. A square frame of wire connected to a capacitor C is kept in a magnetic field which varies with position as well as time ( $t$ ) and is given as  $B = \alpha x t(-\hat{k})$ , where  $\alpha$  is constant, then

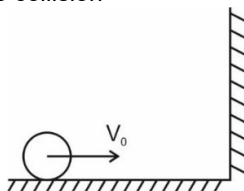


- (A) Flux through loop is  $\frac{3}{2}\alpha d^3 t$   
 (B) Flux through loop is  $\frac{5}{2}\alpha d^3 t$   
 (C) Charge on capacitor is  $\frac{3}{2}C\alpha d^3$   
 (D) Charge on capacitor is  $\frac{5}{2}C\alpha d^3$

4. A non-uniform rod AB of mass  $m$  and linear density  $\lambda = \lambda_0 x$  and length  $L$  is suspended from ceiling at one end A and is hinged at other end B as shown in the figure. Just after the string is cut



- (A) Angular acceleration of rod is  $\frac{4g}{3L}$  (B) Angular acceleration of rod is  $\frac{g}{L}$
- (C) Hinge reaction at A is  $\frac{mg}{9}$  (D) Hinge reaction at A is  $\frac{mg}{6}$
5. One mole of oxygen is contained in a rigid container with total walls of inner surface are  $A$ , thickness  $d$  and thermal conductivity  $k$ . Initial temperature of gas is  $T_0$  and surrounding temperature is  $2T_0$ . If temperature of gas at time  $t$ , is  $T(t)$  then
- (A)  $T(t) = T_0 \left( 2 - e^{-\frac{2kA}{5Rd}t} \right)$  (B)  $T(t) = T_0 \left( 1 + e^{-\frac{2kA}{5dR}t} \right)$
- (C) Final temperature if gas is  $2T_0$  (D) Final temperature of gas is  $\frac{3T_0}{2}$
6. A solid sphere of mass  $m$  rolling without slipping on a horizontal surface strikes a rough vertical wall in such a way that it rebound with half of speed of which it strikes. Coefficient of friction between the sphere and all the surfaces is  $\mu = 1/2$ . After the collision



- (A) Kinetic energy just after collision of sphere is  $\frac{49}{320}mv_0^2$
- (B) Kinetic energy just after collision of sphere is  $\frac{89}{320}mv_0^2$
- (C) After collision velocity of point of contact with ground is  $\frac{3v_0}{8}$
- (D) After collision velocity of point of contact with ground is  $\frac{5v_0}{8}$

## SECTION - 2

### Integer Value Type

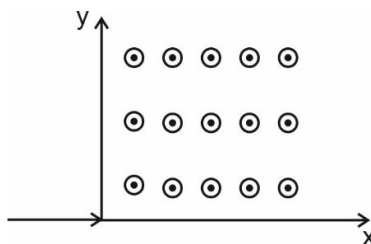
This section contains 8 questions. The answer to each of the question is a **Double-digit integer**, ranging from 00 to 99. The answer will have to be appropriately bubbled in the OMR as per the instructions as follows.

**Examples-** If the correct answer to question numbers X, Y and Z (say) are 76, 0 and 9 respectively, then mark 76, 00 and 09 in OMR respectively

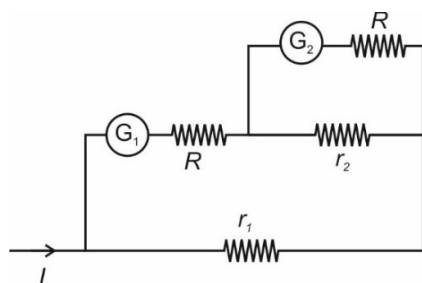
X	<div> <div>0</div><div>1</div><div>2</div><div>3</div><div>4</div><div>5</div><div>6</div><div>7</div><div>8</div><div>9</div> </div> <div> <div>0</div><div>1</div><div>2</div><div>3</div><div>4</div><div>5</div><div>6</div><div>7</div><div>8</div><div>9</div> </div>
Y	<div> <div>0</div><div>1</div><div>2</div><div>3</div><div>4</div><div>5</div><div>6</div><div>7</div><div>8</div><div>9</div> </div> <div> <div>0</div><div>1</div><div>2</div><div>3</div><div>4</div><div>5</div><div>6</div><div>7</div><div>8</div><div>9</div> </div>
Z	<div> <div>0</div><div>1</div><div>2</div><div>3</div><div>4</div><div>5</div><div>6</div><div>7</div><div>8</div><div>9</div> </div> <div> <div>0</div><div>1</div><div>2</div><div>3</div><div>4</div><div>5</div><div>6</div><div>7</div><div>8</div><div>9</div> </div>

7. A metal sphere of radius  $a$  is surrounded by a concentric metal spherical shell of radius  $b$  ( $b > a$ ). The space between the sphere is filled with material whose electrical conductivity  $\sigma$  varies with the electric field strength  $E$  according to the relation  $\sigma = KE$ , where  $K$  is constant. A potential difference 20 volts is maintained between inner sphere and outer shell. If the current between the inner sphere and outer shell is  $i$  A. Value of  $i$ , is  $\left[ k = \frac{1}{\pi} \times 10^{-2} \text{ ohm}^{-1} \text{ volt}^{-1}, b = ea \text{ and } \pi = \frac{22}{7} \right]$

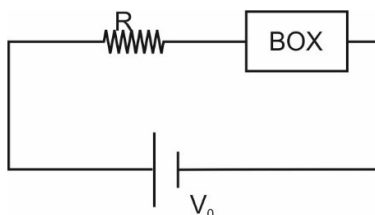
8. In the diagram shown a non uniform magnetic field  $B = B_0 x \hat{k}$  has been applied in the direction shown. A particle of mass  $m$ , and charge  $-q$  is projected with velocity  $\hat{v}$  from origin. The maximum displacement of charged particle along x-direction is  $\sqrt{\frac{nmv}{qB_0}}$ . Value of  $n$  is



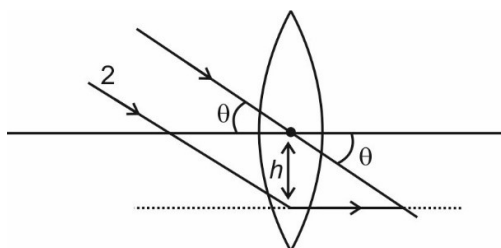
9. For the circuit shown in figure full scale deflection of galvanometers  $G_1$  and  $G_2$  are 10 mA and 1 mA respectively. For  $I = 1$  A both of the galvanometers gives full scale deflection. If resistance of  $G_1$  and  $G_2$  are negligible then value of  $\frac{r_2}{r_1}$  is (closest integer)



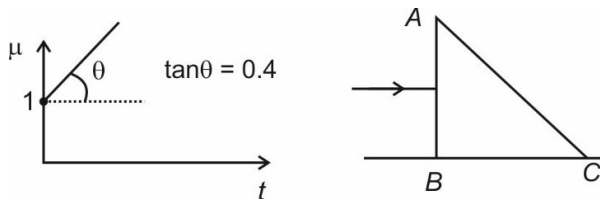
10. A neutron makes a head on collision with hydrogen atom in ground state at rest. The coefficient of restitution for the collision is  $e = \frac{1}{2}$ . After the collision hydrogen atom is excited to level such that total energy is  $\frac{1}{16}$  of ground state energy. The kinetic energy of colliding neutron (in eV) is
11. The velocity of a particle at any time  $t$  is given by  $\vec{V} = 4 \sin 2t \hat{i} + 4(1 - \cos 2t) \hat{j}$ . Distance travelled by the particle in  $t = 0$  to  $t = \pi$ , is  $n$ . Value of  $n$  is
12. In a circuit we have battery with negligible internal resistance a resistor  $R$  and a box. Potential across box varies with current  $I$  as  $V = 3.8 I + 1.2 I^2$ . If  $R = 2.2 \Omega$ , then for what value of  $V_0$  current in circuit is 5A.



13. For a convex lens ray diagram as shown. If focus length of lens is  $f$ , then value of  $h$  is  $\frac{nf\theta}{8}$ , Value of  $n$  is (Assume  $\theta$  is small value)



14. In an isosceles right angled prism a ray is incident on it as shown. Refractive index  $\mu$  of prism varies with time as shown in graph. The angular velocity (in rad/s) of emergent ray at  $t = 1$  s, is  $n$ . Value of  $n$  is



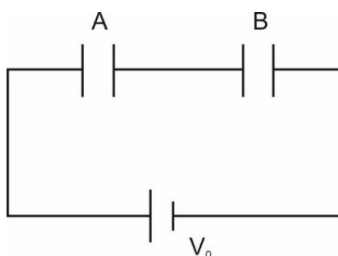
## SECTION - 3

## Paragraph Based Questions

This section contains 2 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.

## Paragraph For Question Nos. 15 and 16

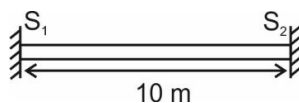
Two identical parallel plate capacitor A and B are connected in series through a battery of potential difference,  $V_0$ . Area of each plate is  $A$  and initial separation is  $d$ . Separation between plates of capacitor B starts increasing at constant velocity  $v$ , at  $t = 0$



15. Current in the circuit at the instant separation between plates of capacitor B is  $2d$ , is
- (A)  $\frac{\epsilon_0 AV_0 v}{2d^2}$  (B)  $\frac{\epsilon_0 AV_0 v}{4d^2}$
- (C)  $\frac{\epsilon_0 AV_0 v}{3d^2}$  (D)  $\frac{\epsilon_0 AV_0 v}{9d^2}$
16. Rate of change of energy stored in capacitor A at instant separation between plates of capacitor B is  $2d$ , is
- (A)  $\frac{\epsilon_0 AV_0^2 v}{16d^2}$  (B)  $\frac{\epsilon_0 AV_0^2 v}{27d^2}$
- (C)  $\frac{\epsilon_0 AV_0^2 v}{14d^2}$  (D)  $\frac{\epsilon_0 AV_0^2 v}{18d^2}$

## Paragraph For Question Nos. 17 and 18

Two sources  $S_1$  and  $S_2$  placed at the ends of a uniform rod of length 10 m vibrate according to the equation  $y_1 = \sqrt{3} \sin(\pi t)$  m and  $y_2 = \sin(\pi t)$  m respectively. The sources send the wave along the rod at a speed of 4 m/s. Consider a point P located at distance 6 m from source  $S_1$



17. Magnitude of displacement of point P is maximum at minimum time,  $t$  where  $t$  is
- (A)  $\frac{5}{6}$  s (B)  $\frac{1}{6}$  s
- (C)  $\frac{1}{3}$  s (D)  $\frac{2}{3}$  s

18. Maximum displacement at point 'P' is

- (A) 2m (B)  $(1 + \sqrt{3})$  m  
(C)  $\frac{4}{\sqrt{3}}$  m (D)  $(\sqrt{3} - 1)$  m

## PART – II: CHEMISTRY

### SECTION - 1

#### One or More than One Option Correct Type

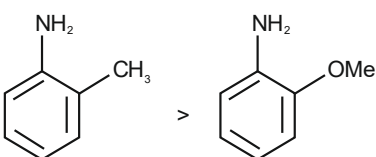
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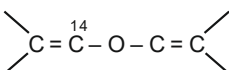
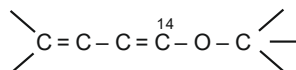
19. Which of the following compound(s) of nitrogen will decolourise  $\text{KMnO}_4$  in the acidic medium?

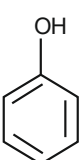
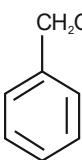
- (A)  $\text{HNO}_3$  (B)  $\text{NO}$   
(C)  $\text{HNO}_2$  (D)  $\text{NO}_2$

20. Select the incorrect statements.

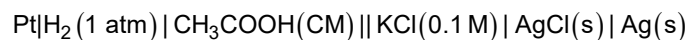
(A) Cyclooctatrienyl cation is anti-aromatic

(B) Order of basic strength 

(C)  has shorter  $^{14}\text{C}-\text{O}$  bond than 

(D)  and  are homologues

21. If EMF of the given cell is 0.44 V



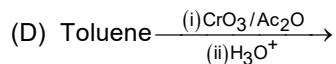
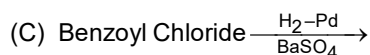
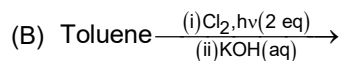
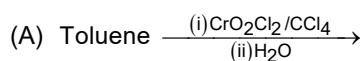
Given:  $K_a(\text{CH}_3\text{COOH}) = 2 \times 10^{-5}$ ;  $E^\circ_{\text{Ag}^+/\text{Ag}} = 0.8 \text{ V}$

$$K_{\text{SP}}(\text{AgCl}) = 1 \times 10^{-10}; \frac{2.303 RT}{F} = 0.06$$

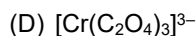
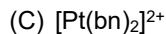
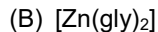
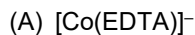
Select the correct option(s)

- (A) Concentration of  $\text{CH}_3\text{COOH}$  solution at anode is 0.05 M  
(B)  $E_{\text{cell}}$  increases with increase in pressure of  $\text{H}_2(\text{g})$   
(C)  $E_{\text{cell}}$  increases on addition of  $\text{NaOH}$  to anode  
(D)  $E_{\text{cell}}$  increases by increasing the amount of  $\text{AgCl}$
22. 1 M solution of a dibasic acid  $\text{H}_2\text{A}$  ( $\text{p}K_{a1} = 6$  and  $\text{p}K_{a2} = 10$ ) is titrated against 1 M  $\text{NaOH}$  solution. Choose the correct statement(s) regarding the **relative concentrations of  $\text{H}_2\text{A}$ ,  $\text{HA}^-$  and  $\text{A}^{2-}$**  at various pH during titration in the solution
- (A) At pH = 3,  $[\text{H}_2\text{A}]$  is maximum  
(B) At pH = 6.5,  $[\text{HA}^-]$  is maximum  
(C) At pH = 10,  $[\text{H}_2\text{A}]$  is minimum  
(D) At pH = 8,  $[\text{A}^{2-}]$  is maximum

23. Which of the following reaction(s) will give benzaldehyde as product?



24. Identify the complex(es) that show stereoisomerism.



## SECTION - 2

### Integer Value Type

This section contains 8 questions. The answer to each of the question is a **Double-digit integer**, ranging from 00 to 99. The answer will have to be appropriately bubbled in the OMR as per the instructions as follows.

**Examples-** If the correct answer to question numbers X, Y and Z (say) are 76, 0 and 9 respectively, then mark 76, 00 and 09 in OMR respectively

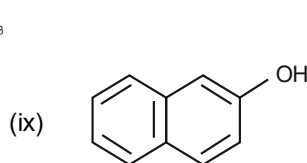
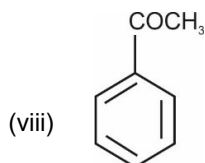
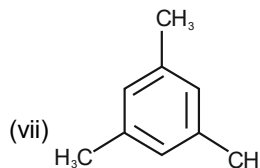
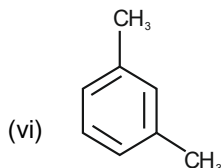
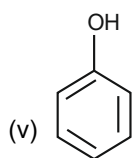
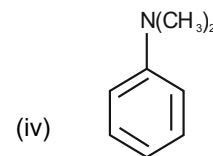
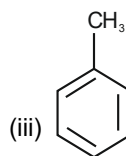
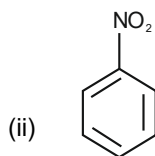
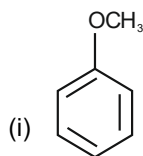
X	0 1 2 3 4 5 6 7 8 9
	0 1 2 3 4 5 6 7 8 9
Y	0 1 2 3 4 5 6 7 8 9
	0 1 2 3 4 5 6 7 8 9
Z	0 1 2 3 4 5 6 7 8 9
	0 1 2 3 4 5 6 7 8 9

25. The energy of activation of a first order reaction (A)  $\longrightarrow$  Products is  $11.454 \text{ kJ mol}^{-1}$ . At 100 K, the product is formed at a rate of  $3.1 \text{ mol L}^{-1} \text{ hr}^{-1}$ . Find the rate of formation of product at 120 K in  $\text{mol L}^{-1} \text{ hr}^{-1}$  if other factors are assumed to be uniform. [Use  $\ln X = 2.3 \log X$ ;  $R = 8.3 \text{ J mol}^{-1}$ ]

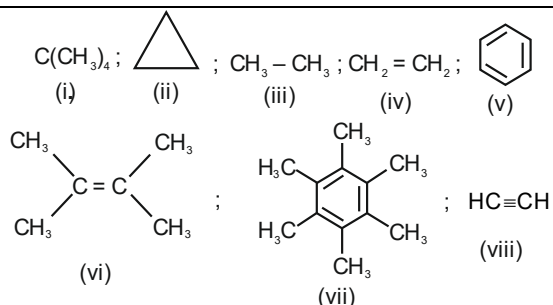
26. Find the highest excited state where unexcited  $\text{He}^+$  can reach when their sample is bombarded with 53.55 eV photons

27. How many of the following elements are of f-Block Ta, Pa, Pd, Gd, Tm, Fm, Pb, Yb, Ce, Se, Po, Ho?

28. How many of the following compounds will show coupling reaction with 2,4,6-trinitrobenzene diazonium cation under appropriate reaction conditions



29. How many of the following compounds contain higher C – H bond energy than C – H bond energy in cyclohexane?



30. 10.7 gm of  $\text{KIO}_3$  is dissolved in 1 L water. 50 ml of the solution is treated with excess of KI. The iodine thus liberated in the reaction is titrated with 0.6 M- $\text{Na}_2\text{S}_2\text{O}_3$  solution. What volume of  $\text{Na}_2\text{S}_2\text{O}_3$  solution in ml is required to reach the equivalence point? [M.W. of I = 127g mol<sup>-1</sup>]
31. Hypophosphoric acid and Isohypophosphoric acid have same molecular formula  $\text{H}_4\text{P}_2\text{O}_6$ . If 'a' and 'b' be their basicities, 'c' and 'd' be the number of P – P bonds in them and 'e' and 'f' be the number of P – O – P bonds in them, find the value of (a + b + c + d + e + f).
32. In the balanced reaction  $x\text{S} + y\text{HNO}_3 \rightarrow z\text{H}_2\text{SO}_4 + m\text{NO}_2 + n\text{H}_2\text{O}$ . The value of  $\frac{y^2 - x^2}{z + m - n}$  is \_\_\_\_

## SECTION - 3

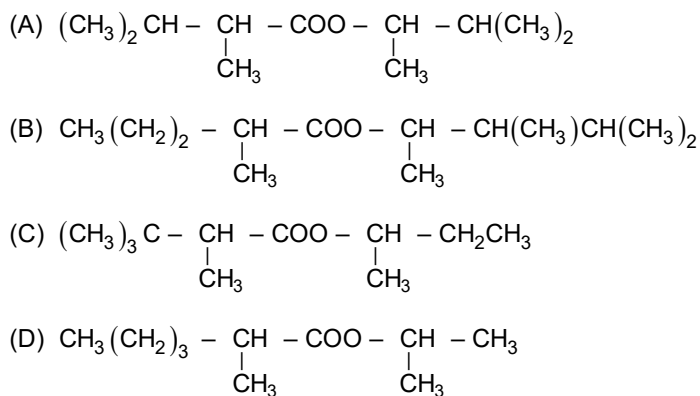
## Paragraph Based Questions

This section contains 2 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.

## Paragraph For Question Nos. 33 and 34

A pleasant smelling optically active ester (A) has molar mass 186. It doesn't react with  $\text{Br}_2$  ( $\text{CCl}_4$ ). Hydrolysis of (A) gives two optically active compounds (B) which is soluble in NaOH and (C). Compound (C) gives a positive iodoform test and on warming with conc.  $\text{H}_2\text{SO}_4$  gives D (Saytzeff's product) with no geometrical isomers. (C) on treatment with benzene sulphonyl chloride gives (E) which on treatment with NaBr gives optically active (F). When silver salt of (B) is treated with  $\text{Br}_2$  racemic (F) is formed.

33. Structure of (A) is



34. Compound (F) is

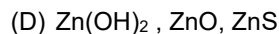
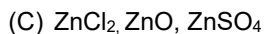
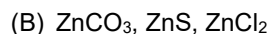




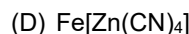
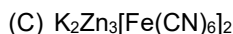
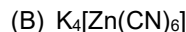
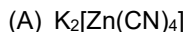
## Paragraph For Question Nos. 35 and 36

A white substance (X) when heated in a test tube produces a colourless odourless gas leaving a residue which is yellow when hot and white when cold. The residue was dissolved in dil HCl made alkaline with  $\text{NH}_4\text{Cl}$  and  $\text{NH}_4\text{OH}$ .  $\text{H}_2\text{S}$  gas was passed through it and a white precipitate (Y) was formed. It was dissolved in dil HCl to give (Z) which on treatment with  $\text{K}_3[\text{Fe}(\text{CN})_6]$  in excess gave bluish white precipitate

35. (X), (Y) and (Z) are respectively



36. Bluish white precipitate formed is



## PART – III: MATHEMATICS

## SECTION - 1

## One or More than One Option Correct Type

This section contains 6 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).

37. Sum of the series  $\sum_{r=1}^n \sin^{-1} \left[ \frac{2r+1}{r(r+1)(\sqrt{r^2+2r} + \sqrt{r^2-1})} \right]$  is

(A)  $\frac{\pi}{2} - \sin^{-1} \left( \frac{1}{n+1} \right)$

(B)  $\cos^{-1} \left( \frac{1}{n+1} \right)$

(C)  $\cos^{-1} \left( \frac{1}{n+2} \right)$

(D)  $\frac{\pi}{2} - \sin^{-1} \left( \frac{1}{n+2} \right)$

38. If  $S_n = 1 + \frac{1}{2} + \frac{1}{3} + \dots + \frac{1}{n}$ , then  $S_1 + S_2 + S_3 + \dots + S_{n-1}$  is equal to

(A)  $nS_n - n$

(B)  $nS_n - 1$

(C)  $(n-1)S_{n-1} - n$

(D)  $nS_{n-1} - n + 1$

39. Consider the equation  $(z+i)^{90} + (z-i)^{90} = 0$ , where  $i = \sqrt{-1}$ . Then

(A) Roots of equation are of the form  $\cot(2K+1)^\circ$ ,  $K \in \mathbb{Z}$

(B) Roots of equation are of the form  $\cot(2K)^\circ$

(C) Product of Roots is equal to 1

(D) Sum of roots is equal to zero

40.  $\int_0^{16} \frac{x^{1/4}}{1+x^{1/2}} dx =$

(A)  $\frac{8}{3} + 4 \tan^{-1} 2$

(B)  $\frac{8}{3} - 2 \tan^{-1} \left( \frac{4}{3} \right)$

(C)  $2\pi + \frac{8}{3} - 2 \tan^{-1} \left( \frac{4}{3} \right)$

(D)  $\pi + \frac{8}{3} + \tan^{-1} \left( \frac{24}{7} \right)$

41. Consider  $(2+x)(2+2x)(2+3x) \dots (2+kx) = a_0 + a_1x + a_2x^2 + \dots + a_kx^k$ . If the minimum value of k for which  $a_0 + a_1 + \dots + a_{k-1}$  is divisible by 2020, 2021 and 2022 respectively is a, b and c then

(A)  $\frac{c+b}{a-b} = 7$

(B)  $\frac{c+b}{a-b} = \frac{1}{7}$

(C)  $\frac{b+c-a}{c-6b} = 4$

(D)  $\frac{b+c-a}{c-6b} = \frac{1}{4}$

42. Equation of the line that touches the curves  $|x| = y^2$  and  $(x-2)^2 + y^2 = 4$  is/are

- (A)  $x - 4\sqrt{3}y + 12 = 0$   
 (B)  $x + 4\sqrt{3}y + 12 = 0$   
 (C)  $x + 4\sqrt{5}y - 20 = 0$   
 (D)  $x - 4\sqrt{5}y - 20 = 0$

## SECTION - 2

### Integer Value Type

This section contains 8 questions. The answer to each of the question is a **Double-digit integer**, ranging from 00 to 99. The answer will have to be appropriately bubbled in the OMR as per the instructions as follows.

**Examples-** If the correct answer to question numbers X, Y and Z (say) are 76, 0 and 9 respectively, then mark 76, 00 and 09 in OMR respectively

X	0 1 2 3 4 5 6 7 8 9
	0 1 2 3 4 5 6 7 8 9
Y	0 1 2 3 4 5 6 7 8 9
	0 1 2 3 4 5 6 7 8 9
Z	0 1 2 3 4 5 6 7 8 9
	0 1 2 3 4 5 6 7 8 9

43. If  $S = \lim_{n \rightarrow \infty} \sum_{r=2}^n \frac{{}^r C_2}{3^r}$ . Then value of 48 S is

44. If  $f(x) = ([a] - 7)([a] - 4)x^3 - (4\{a\} - 1)(2\{a\} - 1)x + \sin x \cdot \text{sgn}(x)$ . Where  $[a]$  denotes greatest integer less than or equal to  $a$  and  $\{a\}$  denotes fractional part of  $a$ . If  $f(x)$  is even function and sum of possible values of  $a$  is  $S$ , then  $[S]$  equals

45. If  $\sin A, \cos A, \sec A$  are in G.P where  $0 < A < \frac{\pi}{2}$  then the value of  $\cos^6 A + \sec A \sin A$  is

46. If  $\prod_{n=2}^{\infty} \frac{1}{1 - \tan^2(2^{-n})} = a \tan\left(\frac{1}{b}\right)$ , where  $a, b \in \mathbb{N}$ , then  $(a^2 + b^2)$  is equal to

47. For the function  $f(x) = \left(3 - \sqrt{4 - x^2}\right)^2 + \left(1 + \sqrt{4 - x^2}\right)^3$  if the least value of  $f(x)$  is 'p' then the value of  $[p]$  is (where  $[.]$  denotes the greatest integer function)

48.  $\lim_{n \rightarrow \infty} \sum_{r=1}^n \frac{8r^{1/a} \left[ n^{\frac{a-1}{a}} + r^{\frac{a-1}{a}} \right]}{n^{a+1}}$  equals, (where  $a \in \mathbb{Q}$ )

49. If  $\alpha, \beta$  are two roots of the equation  $1! + 2! + 3! + \dots + (x-1)! + x! = k^2$ ,  $k \in \mathbb{I}^+$ . Where  $\alpha < \beta$  and if  $\alpha_1, \alpha_2, \alpha_3, \alpha_4$  are roots of equation  $(a + \sqrt{b})^{x^2 - (a+3\alpha+5\alpha^2)} + (a - \sqrt{b})^{x^2 - 3\beta} = 2a$ , where  $a^2 - b = 1$ . Then the value of  $|\alpha_1 + \alpha_2 + \alpha_3 + \alpha_4 + \alpha_1\alpha_2\alpha_3\alpha_4|$  is equal to

50. The real value of  $x$  satisfying  $\sqrt[3]{20x} + \sqrt[3]{20x+13} = 13$  can be expressed as  $\frac{a}{b}$  where  $a$  and  $b$  are relatively prime positive integers. Then the value of  $(a - 100b)$  is

## SECTION - 3

## Paragraph Based Questions

This section contains 2 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.

## Paragraph For Question Nos. 51 and 52

The equation  $x^4 - 2x^3 - 3x^2 + 4x - 1 = 0$  has four distinct real roots  $x_1, x_2, x_3, x_4$  such that  $x_1 < x_2 < x_3 < x_4$  and product of two roots is unity then:

51.  $x_1x_2 + x_1x_3 + x_2x_4 + x_3x_4 =$

(A) 0

(B) 1

(C)  $\sqrt{5}$

(D)  $-1$

52.  $x_2^3 + x_4^3 =$

(A)  $\frac{2+5\sqrt{5}}{8}$

(B)  $-4$

(C)  $\frac{27\sqrt{5}+5}{4}$

(D) 18

## Paragraph For Question Nos. 53 and 54

Let  $n_1$  and  $n_2$  be the number of red and black balls respectively in a box I similarly  $n_3$  and  $n_4$  be the number of red and black balls in box II

53. One of the boxes are selected at random and a ball was drawn randomly from the box, the ball was found to red. If the probability that this red ball was drawn from box II is  $\frac{1}{3}$  then the correct option(s) for possible values of  $n_1, n_2, n_3$  and  $n_4$  is

(A)  $n_1 = 3, n_2 = 3, n_3 = 5, n_4 = 15$

(B)  $n_1 = 3, n_2 = 5, n_3 = 9, n_4 = 50$

(C)  $n_1 = 8, n_2 = 6, n_3 = 5, n_4 = 20$

(D)  $n_1 = 6, n_2 = 12, n_3 = 5, n_4 = 20$

54. A ball is drawn at random from box I and transferred to box II. If the probability of drawing a red ball from the box I after this transfer is  $\frac{1}{3}$ , Then which of the following are possible

(A)  $n_1 = 4, n_2 = 6$

(B)  $n_1 = 2, n_2 = 3$

(C)  $n_1 = 10, n_2 = 20$

(D)  $n_1 = 3, n_2 = 5$

