



# SAMPLE PAPERS

## JEE Advanced Paper-01

Time: 3 Hours

Maximum Marks: 183

### Topics Covered:

- Physics** : Properties of Solids, Properties of Liquids, Heat & Thermodynamics, Ray Optics, Wave Optics, Electromagnetic Waves
- Chemistry** : p-Block (13 & 14 Group), Thermodynamics, Thermochemistry, Solid State, Alkyl Halides & Haloalkane, Surface Chemistry, Metallurgy, Chemistry in Everyday Life
- Mathematics** : Sequence and Series, Permutation and Combination, Straight Lines, Definite Integrals, Indefinite Integrals

### Read the Important Instructions Carefully:

1. You are allowed to take away the Question Paper at the end of the examination.
2. Do not tamper with or mutilate the ORS. Do not use the OMR for rough work.
3. Use a **BLACK BALL POINT PEN** to darken the bubbles on the ORS.
4. The OMR is machine-gradable. Ensure that the bubbles are darkened in the correct way.
5. Darken the bubbles **ONLY IF** you are sure of the answer. There is **NO WAY** to erase or “un-darken” a darkened bubble.

NAME OF THE CANDIDATE .....

ROLL NO. ....

I have read all the instructions and shall abide by them.

I have verified the identity, name and roll number of the candidate, and that question paper and OMR codes are the same.

-----  
Signature of the Candidate

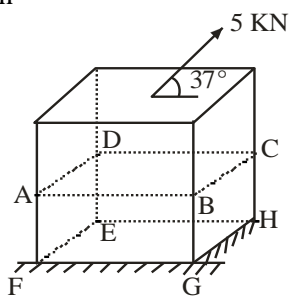
-----  
Signature of the Invigilator

## PART-I : PHYSICS

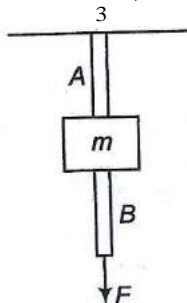
### SECTION-1 (MAXIMUM MARKS : 28)

- This section contains **SEVEN** questions
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct
- For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS
- For each question, marks will be awarded in one of the following categories:
  - Full Marks** : +4 If only the bubble(s) corresponding to all the correct option(s) is(are) darkened
  - Partial Marks** : +1 For darkening a bubble corresponding to each correct option, provided NO incorrect option is darkened
  - Zero Marks** : 0 If none of the bubbles is darkened
  - Negative Marks** : -2 In all other cases
- For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will result in +4 marks; darkening only (A) and (D) will result in +2 marks; and darkening (A) and (B) results in -2 marks, as a wrong option is also darkened

1. A uniform cubical block of side 2m and density 0.2 g/cc is fixed to the horizontal floor as shown in figure. A force 5 kN is applied on the top face of the cube, then



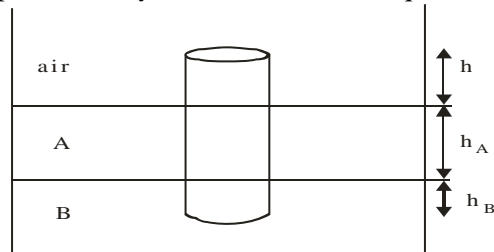
- (A) Normal stress at section ABCD is  $1.25 \text{ kN/m}^2$  (B) Shear stress at section ABCD is  $1 \text{ kN/m}^2$   
(C) Normal stress at section EFGH is  $0.75 \text{ kN/m}^2$  (D) Shear stress at section EFGH is  $1 \text{ kN/m}^2$
2. In a thermodynamic process helium gas obeys the law  $TP^{-2/5} = \text{constant}$ . If temperature of 2 moles of the gas is raised from T to 3T, then  
(A) heat given to the gas is 9RT (B) heat given to the gas is zero  
(C) increase in internal energy is 6RT (D) work done by the gas is -6RT
3. Two light wires A and B shown in the figure are made of the same material and have radii  $r_A$  and  $r_B$  respectively. The block between them has a mass m. When the force F is  $\frac{mg}{3}$ , one of the wires breaks.



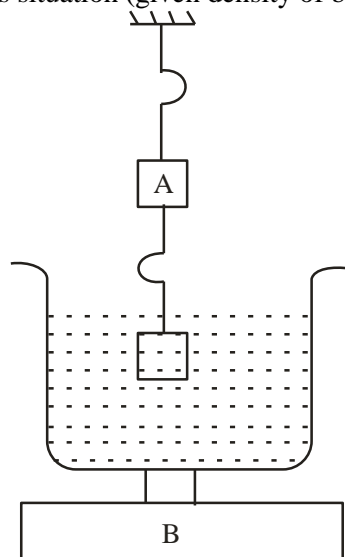
- (A) A breaks if  $r_A = r_B$   
(B) A breaks if  $r_A < r_B$   
(C) Either A or B may break if  $r_A = 2r_B$   
(D) The lengths of A and B must be known to predict which wire will break

Space for Rough Work

4. Two identical vessels contain helium and hydrogen at same temperature, then  
 (A) average kinetic energy per mole of hydrogen = average kinetic energy per mole of helium  
 (B) average translational kinetic energy per mole of hydrogen = average translational kinetic energy per mole of helium  
 (C) average kinetic energy per mole of hydrogen =  $\frac{3}{5}$  average kinetic energy per mole of helium  
 (D) average kinetic energy per mole of hydrogen =  $\frac{5}{3}$  average kinetic energy per mole of helium
5. A uniform solid cylinder of density  $0.8 \text{ g/cm}^3$  floats in equilibrium in a combination of two non-mixing liquids A and B with its axis vertical. The densities of the liquids A and B are  $0.7 \text{ g/cm}^3$  and  $1.2 \text{ g/cm}^3$  respectively. The height of liquid A is  $h_A = 1.2 \text{ cm}$ . The length of the part of the cylinder immersed in liquid B is  $h_B = 0.8 \text{ cm}$ .



- (A) Total force exerted by liquid A on the cylinder will be non-zero.  
 (B) Total force exerted by liquid A on the cylinder will be zero.  
 (C) If the cylinder was depressed so that its top surface comes just below upper surface of liquid A and then it is released then acceleration will be  $g/3$ .  
 (D) The length of the part of the cylinder in air will be  $0.25 \text{ cm}$ .
6. The spring balance A reads  $2 \text{ kg}$  with a block of mass  $m$  suspended from it. A balance B reads  $5 \text{ kg}$  when a beaker with liquid is put on the pan of the balance. The two balances are now so arranged that the hanging mass is inside the liquid in the beaker as shown in the figure, in this situation (given density of block  $>$  density of liquid)



- (A) The balance A will read more than  $2 \text{ kg}$   
 (B) The balance B will read more than  $5 \text{ kg}$   
 (C) The balance A will read less than  $2 \text{ kg}$  and B will read more than  $5 \text{ kg}$   
 (D) The balance A and B will read  $2 \text{ kg}$  and  $5 \text{ kg}$  respectively

**Space for Rough Work**

7. Two points on string are being observed as a travelling wave passes from them. The points are at  $x_1 = 0$  and  $x_2 = 1$  m, the transverse motions of two points are found to be as follows  $y_1 = A \sin(3\pi t)$  and  $y_2 = A \sin\left(3\pi t + \frac{\pi}{8}\right)$ ;  $t$  is in seconds and  $y$  in metre. Mark the correct option(s)
- (A) Frequency of wave is 3 Hz. (B) Frequency of wave is 1.5 Hz.  
 (C) Wavelength may be 16 m. (D) Wavelength may be 16/15 m.

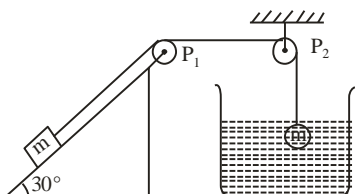
### SECTION-2 (MAXIMUM MARKS : 15)

- This section contains **FIVE** questions
- The answer to each question is a **SINGLE DIGIT INTEGER** ranging 0 to 9, both inclusive
- For each question, darken the bubble corresponding to the correct integer in the ORS
- For each question, marks will be awarded in one of the following categories:
 

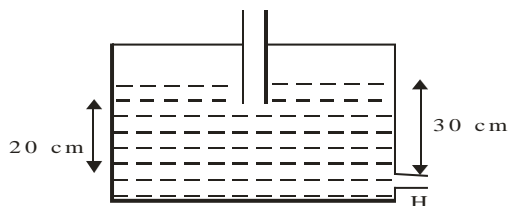
**Full Marks** : +3 If only the bubble corresponding to the correct answer is darkened

**Zero Marks** : 0 If all other cases

8. A block of mass 'm' is kept over a fixed smooth wedge. Block is attached to a sphere of same mass through fixed massless pulleys  $P_1$  and  $P_2$ . Sphere is dipped inside the water as shown. If specific gravity of sphere is 2, find the acceleration of sphere.



9. A brass rod of length 2 m and cross-sectional area  $2 \text{ cm}^2$  is attached end to end to a steel rod of length  $L$  and cross-sectional area  $1 \text{ cm}^2$ . The compound rod is subjected to equal and opposite pulls of magnitude  $5 \times 10^4 \text{ N}$  at its ends. If the elongations of the two rods are equal, then the length (in m) the steel rod( $L$ ) is:  
 [ $Y_B = 1 \times 10^{11} \text{ N/m}^2$  and  $Y_S = 2 \times 10^{11} \text{ N/m}^2$ ]
10. A tube is attached as shown in closed vessel containing water. Find the velocity of water (in m/s) coming out from a small hole.

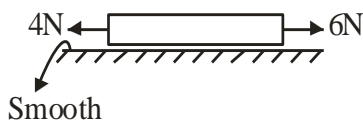


11. A monoatomic ideal gas follows the process:  
 $TV^{3/2} = \text{constant}$

The molar specific heat for this process is  $\left(\frac{5R}{y}\right)$ , where  $R$  is gas constant. Then the value of 'y' is:

**Space for Rough Work**

12. A uniform bar of length  $L$ ; cross-section area  $A$  and Young's modulus  $Y$  is acted upon by forces as shown. If elongation in the bar is  $\frac{NL}{AY}$ ; then  $N$  is



### SECTION-3 (MAXIMUM MARKS : 18)

- This section contains **SIX** questions of matching type
- This section contains **TWO** tables (each having 3 columns and 4 rows)
- Based on each table, there are **THREE** questions
- Each question has **FOUR** options (A), (B), (C), and (D). **ONLY ONE** of these four options is correct
- For each question, darken the bubble corresponding to the correct option in the ORS
- For each question, marks will be awarded in one of the following categories:
 

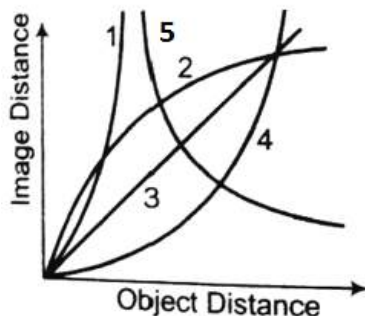
**Full Marks** : +3 If only the bubble corresponding to the correct option is darkened

**Zero Marks** : 0 If none of the bubbles is darkened

**Negative Marks** : -1 In all other cases

Answer Q.13, Q.14 and Q.15 by appropriately matching the information given in the three columns of the following table.

A small particle is placed at the pole of a concave mirror and then moved along the principal axis to a large distance. During the motion, the distance between the pole of the mirror and the image is measured. The procedure is then repeated with a convex mirror, a concave lens and a convex lens. The graph is plotted between image distance versus object distance. Match the curves shown in the graph with the mirror or lens that is corresponding to it. (Curve 1 has two segments)



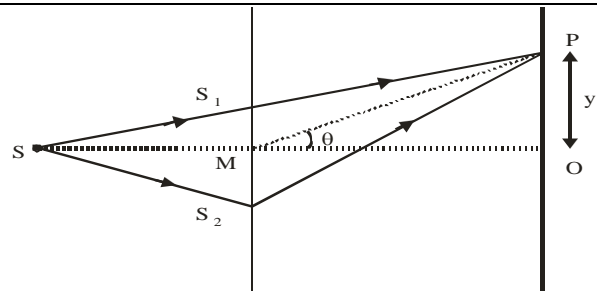
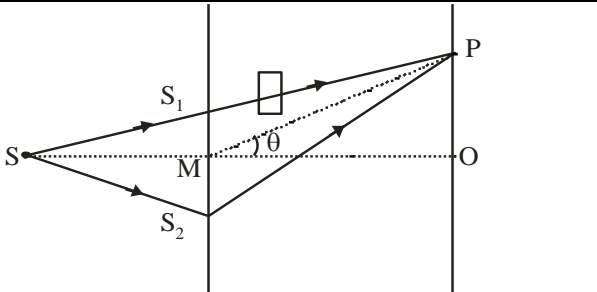
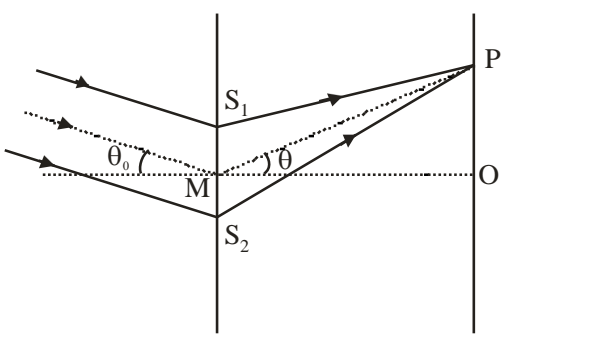
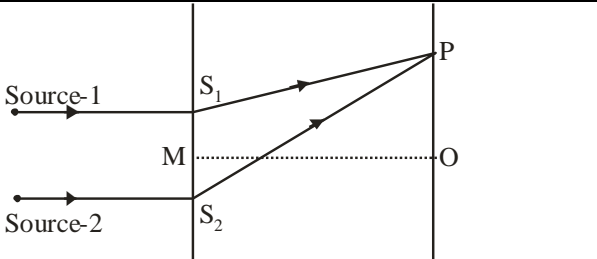
Column 1		Column 2 (Graph)		Column 3 (Power)	
(I)	Convex lens	(i)	1	(P)	Positive
(II)	Convex mirror	(ii)	2	(Q)	Zero
(III)	Concave lens	(iii)	3	(R)	Infinite
(IV)	Concave mirror	(iv)	5	(S)	Negative

Space for Rough Work

13. Which of the combination is correctly matches with shaving mirror?  
 (A) (IV), (iv), (R) (B) (IV), (i), (P) (C) (II), (ii), (S) (D) (IV), (ii), (S)
14. Which correctly matches with converging lens?  
 (A) (I), (ii), (S) (B) (I), (iv), (R) (C) (I), (i), (P) (D) (I), (iv), (P)
15. Which of the option correctly matches with convex mirror?  
 (A) (II), (ii), (S) (B) (II), (i), (R) (C) (II), (iv), (P) (D) (II), (iv), (S)

**Answer Q.16, Q.17 and Q.18 by appropriately matching the information given in the three columns of the following table.**

In column 1 different setup for Young's double slit experiment is given. Distance between two slits  $S_1$  and  $S_2$  is 'd' and between slits and screen is 'D' in every setup. In column 2 location of central maxima is given. In column 3 path difference  $\Delta P$  is given at point P which is  $\theta$  angle above MO line ( $d \ll D$ )

	Column 1	Column 2	Column 3
(I)		(i) Below 'O' point	(P) $\Delta P = d (\sin\theta - \sin\theta_0)$
(II)		(ii) On 'O' point	(Q) $\Delta P = d \sin\theta - t(\mu - 1)$
(III)		(iii) Above 'O' point	(R) $\Delta P = d \sin\theta$
(IV)		(iv) None of these	(S) None of these

16. Which of the following is correct, when a glass slab of thickness  $t$  and refractive index  $\mu$  is placed in front of  $S_1$ .  
(A) (II) (i) (S)                      (B) (II) (ii) (R)                      (C) (II) (iii) (Q)                      (D) (II) (i) (Q)
17. Which of the following is correct when light is incident at an angle  $\theta_0$ ?  
(A) (III) (i) (S)                      (B) (III) (i) (P)                      (C) (III) (ii) (R)                      (D) (III) (iii) (P)
18. Mark the correct combination  
(A) (II) (i) (Q)                      (B) (I) (ii) (R)                      (C) (IV) (ii) (R)                      (D) (IV) (iii) (R)

---

***Space for Rough Work***

## PART-II : CHEMISTRY

### SECTION-1 (MAXIMUM MARKS : 28)

- This section contains **SEVEN** questions
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct
- For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS
- For each question, marks will be awarded in one of the following categories:
 

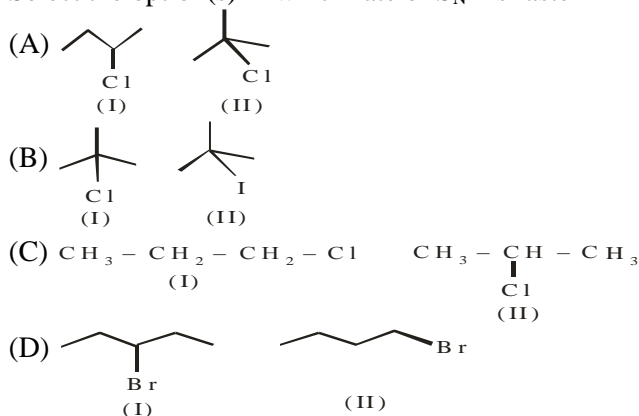
**Full Marks** : +4 If only the bubble(s) corresponding to all the correct option(s) is(are) darkened

**Partial Marks** : +1 For darkening a bubble corresponding to each correct option, provided NO incorrect option is darkened

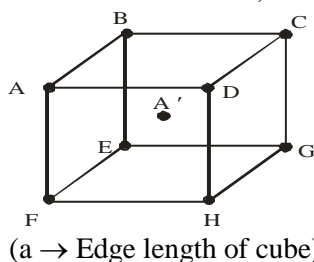
**Zero Marks** : 0 If none of the bubbles is darkened

**Negative Marks** : -2 In all other cases
- For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will results in +4 marks; darkening only (A) and (D) will result in +2 marks; and darkening (A) and (B) results in -2 marks, as a wrong option is also darkened

19. Select the option(s) in which rate of  $S_N1$  is faster in II than I?



20. In body centered cubic lattice given below, the three distance AB, AC and AA' are:



- (A)  $AB = a$       (B)  $AC = \sqrt{2}a$       (C)  $AA' = \frac{\sqrt{3}a}{2}$       (D)  $AA' = \sqrt{3}a$

21. Which of the following is/are hydrophobic sols?

- (A) Protein sol      (B) Gold sol      (C) Gum sol      (D)  $\text{Fe}(\text{OH})_3$  sol

22. Which of the following is/are endothermic reaction(s)?

- (A) Combustion of methane      (B) Decomposition of water  
(C) Dehydrogenation of ethane to ethylene      (D) Conversion of graphite to diamond.

**Space for Rough Work**



23. Complexes formed in the cyanide process are:  
 (A)  $[\text{Au}(\text{CN})_2]^-$  (B)  $[\text{Ag}(\text{CN})_2]^-$  (C)  $[\text{Cu}(\text{CN})_2]^{2-}$  (D)  $[\text{Zn}(\text{CN})_4]^{2-}$
24. Diborane undergoes unsymmetrical cleavage reactions with:  
 (A) Dimethylamine (B) Ammonia at low temperature  
 (C) Methylamine (D) Carbon dioxide
25. Which of the following statement(s) about DNA is/are correct?  
 (A) It has a double helix structure. (B) It undergoes replication.  
 (C) The two strands in DNA molecule are exactly similar. (D) It contains the 2-deoxyribose pentose sugar.

### SECTION-2 (MAXIMUM MARKS : 15)

- This section contains **FIVE** questions  
 ➤ The answer to each question is a **SINGLE DIGIT INTEGER** ranging 0 to 9, both inclusive  
 ➤ For each question, darken the bubble corresponding to the correct integer in the ORS  
 ➤ For each question, marks will be awarded in one of the following categories:  
**Full Marks : +3 If only the bubble corresponding to the correct answer is darkened**  
**Zero Marks : 0 If all other cases**

26. Consider a prototypical fullerene,  $\text{C}_{60}$ .  
 Let, a = number of 5-membered rings  
 b = number of 6-membered rings  
 c = number of  $\pi$  bonds in  $\text{C}_{60}$   
 Find the value of  $(3a - 2b + c)$ . Report your answer after dividing it by 13.
27. The number of oxygen atoms in borax which do not form  $p\pi-p\pi$  back bond is:
28. How many of the following process of refining is/are chemical methods.  
 (i) Liquation process. (ii) Fractional distillation process  
 (iii) Zone refining method (iv) Chromatographic method  
 (v) Cupellation (vi) Poling process  
 (vii) Hoop's process (viii) Kroll's process  
 (ix) Mond's process
29. Calculate the enthalpy change when infinitely diluted solution of  $\text{CaCl}_2$  and  $\text{Na}_2\text{CO}_3$  are mixed.  $\Delta H_f^0$  For  $\text{Ca}^{2+}(\text{aq.})$ ,  $\text{CO}_3^{2-}(\text{aq.})$  and  $\text{CaCO}_3(\text{s})$  are  $-129.80$ ,  $-161.7$ ,  $-288.5 \text{ Kcal mol}^{-1}$  respectively.
30. How many of these reactions are homogeneously catalyzed?  
 (i)  $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \xrightarrow{\text{NO}(\text{g})} 2\text{SO}_3(\text{g})$   
 (ii)  $\text{C}_{12}\text{H}_{22}\text{O}_{11}(\text{aq.}) + \text{H}_2\text{O}(\ell) \xrightarrow{\text{H}_2\text{SO}_4(\ell)} \underset{\text{Glucose}}{\text{C}_6\text{H}_{12}\text{O}_6(\text{aq.})} + \underset{\text{Fructose}}{\text{C}_6\text{H}_{12}\text{O}_6(\text{aq.})}$   
 (iii)  $2\text{SO}_3(\text{g}) + \text{O}_2(\text{g}) \xrightarrow{\text{Pt}(\text{s})} 2\text{SO}_3(\text{g})$  (iv)  $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \xrightarrow{\text{Fe}(\text{s})} 2\text{NH}_3(\text{g})$   
 (v)  $4\text{NH}_3(\text{g}) + 5\text{O}_2(\text{g}) \xrightarrow{\text{Pt}(\text{s})} 4\text{NO}(\text{g}) + 6\text{H}_2\text{O}(\text{g})$  (vi)  $\text{CH}_3\text{COOCH}_3(\ell) \xrightarrow{\text{HCl}(\ell)} \text{CH}_3\text{COOH}(\text{aq.})$   
 (vii) Vegetable oils  $(\ell) + \text{H}_2(\text{g}) \xrightarrow{\text{Ni}(\text{s})} \text{Vegetable ghee}$

**Space for Rough Work**

**SECTION-3 (MAXIMUM MARKS : 18)**

- This section contains **SIX** questions of matching type
- This section contains **TWO** tables (each having 3 columns and 4 rows)
- Based on each table, there are **THREE** questions
- Each question has **FOUR** options (A), (B), (C), and (D). **ONLY ONE** of these four options is correct
- For each question, darken the bubble corresponding to the correct option in the ORS
- For each question, marks will be awarded in one of the following categories:
 

**Full Marks** : +3 If only the bubble corresponding to the correct option is darkened

**Zero Marks** : 0 If none of the bubbles is darkened

**Negative Marks** : -1 In all other cases

**Answer Q.31, Q. 32 and Q.33 by appropriately matching the information given in the three columns of the following table.**

Column 1: Type of structure, Column 2: Co-ordination number of cation, Column 3: Co-ordination number of anion.					
Column 1		Column 2		Column 3	
(I)	FCC	(i)	12	(P)	4
(II)	Anti-Flourite	(ii)	6	(Q)	12
(III)	BCC	(iii)	8	(R)	8
(IV)	Flourite	(iv)	4	(S)	6

31. The only correct combination for  $\text{Na}_2\text{O}$  is:  
 (A) (II) (iii) (S)                      (B) (II) (iv) (R)                      (C) (IV) (iv) (R)                      (D) (IV) (iii) (P)
32. The only correct combination for  $\text{CaF}_2$  is:  
 (A) (II) (iii) (P)                      (B) (II) (iv) (R)                      (C) (IV) (iv) (R)                      (D) (IV) (iii) (P)
33. The only correct combination for zinc blende is:  
 (A) (II) (iv) (S)                      (B) (I) (iii) (S)                      (C) (I) (iv) (P)                      (D) (III) (iv) (P)

**Answer Q.34, Q.35 and Q.36 by appropriately matching the information given in the three columns of the following table.**

Column 1: Metal, Column 2: Ores, Column 3: Composition					
Column 1		Column 2		Column 3	
(I)	Aluminium	(i)	Haematite	(P)	$\text{CuFeS}_2$
(II)	Iron	(ii)	Zinc blende	(Q)	$\text{AlO}_x(\text{OH})_{3-2x}$
(III)	Copper	(iii)	Bauxite	(R)	$\text{Fe}_2\text{O}_3$
(IV)	Zinc	(iv)	Copper pyrite	(S)	$\text{ZnS}$

34. The only combination for which froth floatation method is used:  
 (A) (II) (iv) (P)                      (B) (I) (iii) (S)                      (C) (IV) (ii) (S)                      (D) (III) (iv) (P)
35. The only combination in which  $\text{CO}_2$  is passed for neutralization is:  
 (A) (II) (iv) (S)                      (B) (I) (iii) (S)                      (C) (I) (iv) (P)                      (D) (I) (iii) (Q)
36. The only correct combination in which “Reduction” is used for the extraction of metal:  
 (A) (II) (i) (R)                      (B) (II) (i) (P)                      (C) (I) (iv) (P)                      (D) (III) (iv) (P)

**Space for Rough Work**

## PART-III : MATHEMATICS

### SECTION-1 (MAXIMUM MARKS : 28)

- This section contains **SEVEN** questions
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct
- For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS
- For each question, marks will be awarded in one of the following categories:
 

**Full Marks** : +4 If only the bubble(s) corresponding to all the correct option(s) is(are) darkened

**Partial Marks** : +1 For darkening a bubble corresponding to each correct option, provided NO incorrect option is darkened

**Zero Marks** : 0 If none of the bubbles is darkened

**Negative Marks** : -2 In all other cases
- For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will results in +4 marks; darkening only (A) and (D) will result in +2 marks; and darkening (A) and (B) results in -2 marks, as a wrong option is also darkened

37. Let  $I = \int_1^3 \sqrt{3+x^3} dx$ , then the value of I lies in the interval

- (A) [4, 6]                      (B) [1, 3]                      (C)  $[4, 2\sqrt{30}]$                       (D)  $[\sqrt{15}, \sqrt{30}]$

38. Let  $A = \int_{e^{-1}}^{\tan x} \frac{t dt}{t^2 + 1}$  and  $B = \int_{e^{-1}}^{\cot x} \frac{dt}{t(1+t^2)}$  then

- (A) At  $x = \frac{\pi}{4}$ ,  $A + B = 1$                       (B)  $A + B = 1$  for all  $x$  in  $\left(0, \frac{\pi}{2}\right)$
- (C)  $A + B = 1$  for all  $x$  in  $\left(0, \frac{\pi}{4}\right)$  and 2 for all  $x$  in  $\left(\frac{\pi}{4}, \pi\right)$                       (D)  $A = B$  for all  $x$

39. A line which makes an acute angle  $\theta$  with the positive direction of x-axis is drawn through the point P(3, 4) to meet the line  $x = 6$  at R and  $y = 8$  at S, then

- (A)  $PR = 3 \sec \theta$                       (B)  $PS = 4 \operatorname{cosec} \theta$
- (C)  $PR + PS = \frac{2(3 \sin \theta + 4 \cos \theta)}{\sin 2\theta}$                       (D)  $\frac{9}{(PR)^2} + \frac{16}{(PS)^2} = 1$

40. Line  $\frac{x}{a} + \frac{y}{b} = 1$  cuts the coordinate axes at A (a, 0) and B(0, b) and the line  $\frac{x}{a'} + \frac{y}{b'} = -1$  at A' (-a', 0) and B' (0, -b'). If the point A, B, A', B' are concyclic then the orthocenter of the triangle ABA' is

- (A) (0, 0)                      (B) (0, b')
- (C)  $\left(0, \frac{aa'}{b}\right)$                       (D)  $\left(0, \frac{bb'}{a}\right)$

**Space for Rough Work**

41. Let  $a_n = \underbrace{(111 \dots 1)}_{n \text{ times}}$ , then

- (A)  $a_{912}$  is not prime      (B)  $a_{951}$  is not prime      (C)  $a_{480}$  is not prime      (D)  $a_{91}$  is not prime

42. There are  $n$  lines in a plane, no two of which are parallel and no three of them are concurrent. Let plane be divided in  $U_n$  parts by these  $n$  lines. Then

- (A)  $U_4 = 11$       (B)  $U_3 = 7$       (C)  $U_2 = 3$       (D)  $U_n = U_{n-1} + 4$

43. Thirteen persons are sitting in a row. Number of ways in which four persons can be selected so that no two of them are consecutive is also equal to

- (A) Number of ways in which letters of word CINEMA can be arranged if all vowels are together  
 (B) Number of numbers lying between 100 and 1000 using only the digits 1, 2, 3, 4, 5, 6, 7 without repetition  
 (C) Number of ways in which 4 alike flowers can be distributed among 10 girls so that each girl gets atmost one  
 (D) Number of triangles which can be formed by joining 12 points in a plane of which 5 are collinear

## SECTION-2 (MAXIMUM MARKS : 15)

- This section contains **FIVE** questions
- The answer to each question is a **SINGLE DIGIT INTEGER** ranging 0 to 9, both inclusive
- For each question, darken the bubble corresponding to the correct integer in the ORS
- For each question, marks will be awarded in one of the following categories:

**Full Marks** : +3 If only the bubble corresponding to the correct answer is darkened

**Zero Marks** : 0 If all other cases

44. If  $f(x) = x + \int_0^1 (xy^2 + x^2y) f(y) dy$ , and  $f(x) = \frac{Ax^2 + Bx}{119}$  then  $\left[ \frac{A+B}{100} \right] =$  (where  $[.]$  is G.I.F)

45. If  $\int_0^{\pi/2} f(\sin 2x) \sin x dx = \frac{\lambda\sqrt{2}}{4} \int_0^{\pi/4} f(\cos 2x) \cos x dx$  then the value of  $\lambda$  must be.....

46. If  $\left( \frac{a^3}{a-1}, \frac{a^2-3}{a-1} \right), \left( \frac{b^3}{b-1}, \frac{b^2-3}{b-1} \right)$  and  $\left( \frac{c^3}{c-1}, \frac{c^2-3}{c-1} \right)$  are collinear and  $\alpha(abc) + \beta(a+b+c) = \gamma(ab+bc+ca)$ , where  $\alpha, \beta, \gamma \in \mathbb{N}$ , then find the least value of  $\alpha + \beta + \gamma$ .

47. The sum of the squares of three distinct real numbers, which are in G.P. is  $S^2$ . If their sum is  $\alpha S$  and if  $\alpha^2 \in (a, b) - \{c\}$ , then find the value of  $ab + c$ .

48. The last non-zero digit in  $20!$  is\_\_\_\_\_

**Space for Rough Work**

### SECTION-3 (MAXIMUM MARKS : 18)

- This section contains **SIX** questions of matching type
- This section contains **TWO** tables (each having 3 columns and 4 rows)
- Based on each table, there are **THREE** questions
- Each question has **FOUR** options (A), (B), (C), and (D). **ONLY ONE** of these four options is correct
- For each question, darken the bubble corresponding to the correct option in the ORS
- For each question, marks will be awarded in one of the following categories:
 

**Full Marks** : +3 If only the bubble corresponding to the correct option is darkened

**Zero Marks** : 0 If none of the bubbles is darkened

**Negative Marks** : -1 In all other cases

Answer Q.49, Q. 50 and Q.51 by appropriately matching the information given in the three columns of the following table.

A line meets x-axis and y-axis at A and B respectively and O is the origin.					
Column 1		Column 2 Equation of AB		Column 3 Area of $\Delta OAB$	
(I)	Centroid $\Delta OAB$ is (1, 2)	(i)	$2x + y = 2$	(P)	6 sq. units
(II)	Circumcenter of $\Delta OAB$ is (1, 2)	(ii)	$3x + 4y = 12$	(Q)	9 sq. units
(III)	Distance of the orthocentre of $\Delta OAB$ From A and B is 1 and 2 respectively	(iii)	$2x + y = 6$	(R)	1 sq. units
(IV)	Incenter of $\Delta OAB$ is (1, 1)	(iv)	$2x + y = 4$	(S)	4 sq. units

49. Which of the following is correct combination?  
 (A) (I), (i), (R)                      (B) (I), (ii), (P)                      (C) (I), (iii), (Q)                      (D) (I), (iv), (S)
50. Which of the following is correct combination?  
 (A) (II), (i), (R)                      (B) (II), (ii), (P)                      (C) (II), (iii), (Q)                      (D) (II), (iv), (S)
51. Which of the following is correct combination?  
 (A) (III), (i), (R)                      (B) (III), (ii), (P)                      (C) (IV), (iii), (Q)                      (D) (IV), (iv), (S)

**Space for Rough Work**

Answer Q.52, Q. 53 and Q.54 by appropriately matching the information given in the three columns of the following table.

Column 1		Column 2		Column 3	
(I)	If $I = \int_{-2}^2 (\alpha x^3 + \beta x + \gamma) dx$ then I is	(i)	Independent of $\alpha$	(P)	dependent on $\alpha$
(II)	Let $\alpha, \beta$ be distinct roots of the equation $\tan x = 2x$ , then $\gamma \int_0^1 (\sin \alpha x \cdot \sin \beta x) dx$ is ( $\gamma \neq 0$ )	(ii)	Independent of $\gamma$	(Q)	dependent on $\beta$
(III)	If $f(x + \alpha) + f(x) = 0$ where $\alpha > 0$ , then $\int_{\beta}^{\beta + 2\gamma\alpha} f(x) dx$ is, $\gamma \in \mathbb{N}$	(iii)	Independent of $\beta$	(R)	dependent on $\gamma$
(IV)	$\gamma \int_0^{\alpha} [\sin x] dx$ is ; $\gamma \neq 0, \alpha \in [(2\beta + 1)\pi, (2\beta + 2)\pi], \beta \in \mathbb{N}, [.]$ denotes G.I.F.	(iv)	dependent on $\alpha$	(S)	independent of $\beta$

52. Which of the following combination is correct?

- (A) (I) (iii) (R)                      (B) (I) (iii) (P)                      (C) (I) (i) (Q)                      (D) (I) (ii) (S)

53. Which of the following combination is correct?

- (A) (II) (i) (R)                      (B) (II) (I) (S)                      (C) (III) (iv) (Q)                      (D) (III) (ii) (P)

54. Which of the following combination is incorrect?

- (A) (IV) (iv) (Q)                      (B) (III) (iii) (P)                      (C) (II) (ii) (Q)                      (D) (III) (iv) (R)

**Space for Rough Work**