

Diagnostic cum Scholarship Tests

SAMPLE PAPER

For Students of Class XII

Paper 2

Other Engineering Entrance Exam & JEE Main

Duration : 90 minutes

Paper Code: 1112-2

Maximum Marks : 192

Please read the instructions and guidelines carefully :

Important Note : Please ensure to accurately input the details for the Question Paper Code as indicated at the top of this sheet (Side 2) into the corresponding columns / fields on the OMR sheet before proceeding with the paper. Incorrectly filled information regarding the class or paper may result in inaccurate outcomes or results.

"This paper has been scientifically designed to evaluate your potential – manifested and hidden for the target examinations mentioned in various sections of the paper. Thus, your adherence to the instructions is critical in the evaluation of the same"

1. This Question paper consists of 2 sections.
2. Student should devote allotted time for each section. If a section is easy, then it is easy for everyone & was meant to be like that with a goal in mind. Do not switch over to another section if you find the section to be easy. If a section is tough, then it is tough for everyone. You are advised to spend 45 Minutes on Section-I & 45 Minutes on Section-II. Dedicating the required time to finish each section successfully is essential. Opening the next section before completing the allotted time for the preceding section is not permitted. This adherence is crucial for assessing your true potential, as each section is meticulously crafted to evaluate your potential for the corresponding competitive examinations.
3. Candidate should open the seal of Section-II only after devoting 45 minutes on Section-I.
4. Sheets will be given to each candidate for rough work. Candidate must fill all details on the rough sheet and submit the same to invigilator along with OMR sheet. Candidate must mention the Question No. while doing the rough work in the sheet.
5. Please note candidates are not allowed to bring any prohibited items into the exam hall such as electronic devices, mobile phones, smart watch, earphones, calculators, books, notes, formula sheets, and bags.
6. Marking scheme is given in table below:

Section	Subject	Question no.	Marking Scheme for each question	
			Correct answer	Wrong answer
SECTION – I (Other Engineering Entrance Exam) Time Allotted: 45 Minutes	PHYSICS (PART-A)	1 to 4	+4	-1
	CHEMISTRY (PART-B)	5 to 8	+4	-1
	MATHEMATICS (PART-C)	9 to 12	+4	-1
	PHYSICS (PART-D)	13 to 16	+4	-1
	CHEMISTRY (PART-E)	17 to 20	+4	-1
	MATHEMATICS (PART-F)	21 to 24	+4	-1
SECTION – II (JEE Main) Time Allotted: 45 Minutes	PHYSICS (PART-A)	25 to 28	+4	-1
	CHEMISTRY (PART-B)	29 to 32	+4	-1
	MATHEMATICS (PART-C)	33 to 36	+4	-1
	PHYSICS (PART-D)	37 to 40	+4	-1
	CHEMISTRY (PART-E)	41 to 44	+4	-1
	MATHEMATICS (PART-F)	45 to 48	+4	-1

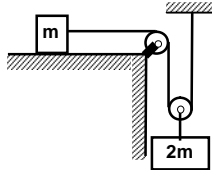
Section - I

Time: 45 Minutes

PHYSICS - (PART - A)

This part contains 4 Multiple Choice Questions number 1 to 4. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

1. Find the acceleration of blocks of mass m . Assume pulleys are massless and frictionless.

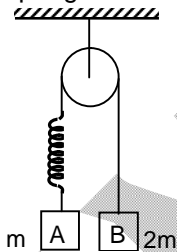


- (A) $g/3$ (B) $2g/3$
(C) $g/2$ (D) $g/6$

2. What is the value of linear velocity, if $\vec{\omega} = 3\hat{i} - 4\hat{j} + \hat{k}$ and $\vec{r} = 5\hat{i} - 6\hat{j} + 6\hat{k}$?

- (A) $6\hat{i} + 2\hat{j} - 3\hat{k}$ (B) $-18\hat{i} - 13\hat{j} + 2\hat{k}$
(C) $4\hat{i} - 13\hat{j} + 6\hat{k}$ (D) $6\hat{i} - 2\hat{j} + 8\hat{k}$

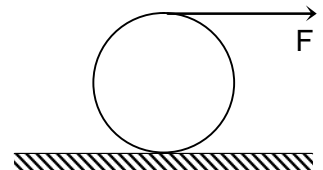
3. There are blocks A and B of masses m and $2m$ respectively. These are held at rest such that the spring is in natural length. Find out the accelerations of both the blocks just after release.



- (A) $g \downarrow, g \downarrow$ (B) $\frac{g}{3} \downarrow, \frac{g}{3} \downarrow$
(C) $0, 0$ (D) $g \downarrow, g \uparrow$

4. A force 'F' is applied at the top of a ring of mass 'M' and radius 'R' placed on a rough horizontal surface as shown in the figure. Friction is sufficient to prevent slipping. The friction force acting on the ring is

- (A) $\frac{F}{2}$ towards right (B) $\frac{F}{3}$ towards right
(C) $\frac{2F}{3}$ towards right (D) Zero

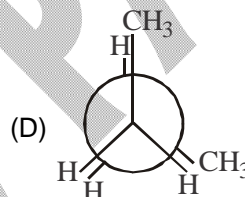
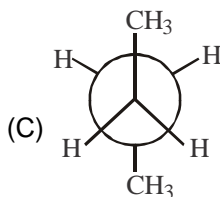
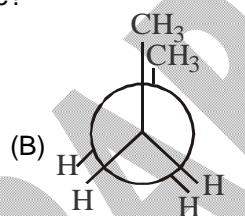
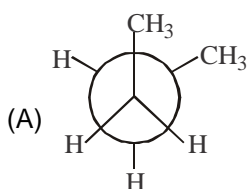


CHEMISTRY – (PART – B)

This part contains 4 Multiple Choice Questions number 5 to 8. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

5. For which of the following species, Bohr's theory is not applicable
 (A) Be^{+3} (B) Li^{+2}
 (C) He^{+2} (D) H
6. 6.02×10^{20} molecules of urea are present in 200 mL of its solution. The concentration of urea solution is
 (A) 0.001 M (B) 0.01 M
 (C) 0.005 M (D) 0.10 M

7. Which one is most stable conformers of n-butane?



8. The correct order in which the C–O bond length in CO , CO_3^{-2} and CO_2 is :
 (A) $\text{CO}_3^{-2} < \text{CO}_2 < \text{CO}$ (B) $\text{CO}_2 < \text{CO}_3^{-2} < \text{CO}$
 (C) $\text{CO} < \text{CO}_3^{-2} < \text{CO}_2$ (D) $\text{CO} < \text{CO}_2 < \text{CO}_3^{-2}$

MATHEMATICS – (PART – C)

This part contains 4 Multiple Choice Questions number 9 to 12. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

9. If $a - b$, $b - c$, $c - a$ are in A.P., then the straight line $(a - b)x + (b - c)y + (c - a) = 0$ will pass through
 (A) (1, -2) (B) (2, 1)
 (C) (2, 3) (D) (3, 1)
10. The equations of the lines representing the sides of a triangle are $3x - 4y = 0$, $x + y = 0$ and $2x - 3y = 7$. The line $3x + 2y = 0$ always passes through the
 (A) incentre (B) centroid
 (C) circumcentre (D) orthocentre
11. The range of values of α for which the line $2y = gx + \alpha$ is a normal to the circle $x^2 + y^2 + 2gx + 2gy - 2 = 0$ for all values of g is
 (A) $[1, \infty)$ (B) $[-1, \infty)$
 (C) $(0, 1)$ (D) $(-\infty, 1)$

12. The circle drawn with variable chord $x + ay - 5 = 0$ (a being a parameter) of the parabola $y^2 = 20x$ as diameter will always touch the line
- (A) $x + 5 = 0$ (B) $y + 5 = 0$
 (C) $x + y + 5 = 0$ (D) $x - y + 5 = 0$

PHYSICS - (PART - D)

This part contains **TWO (02)** comprehensions. Based on each comprehension, there are **TWO (02)** questions of **Multiple Choice Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

Comprehension-1 for Q. No. 13 to 14

We generally ignore the kinetic energy of the moving coil of a spring but consider a spring of mass M , equilibrium length L and spring constant k . Consider a spring, as described above, that has one end fixed and the other end moving with speed v . Assume that the speed of points along the length of the spring varies linearly with distance L from the fixed end. Assume also that the mass M of the spring is distributed uniformly along the length of the spring. Assume further that the force applied by the spring is spring constant times its deformation. In a spring gun, such a spring of mass 0.243 kg and force constant 3200 N/m is compressed 2.50 cm from its unstretched length. When the trigger is pulled, the spring pushes horizontally the ball of mass of 0.053 kg.

13. Kinetic energy of the spring
- (A) $\frac{1}{2} Mv^2$ (B) $\frac{1}{6} Mv^2$
 (C) Mv^2 (D) $\frac{1}{4} Mv^2$
14. Ball's speed when the spring reaches its uncompressed length is
- (A) 3.9 m/s (B) 6.1 m/s
 (C) 14 m/s (D) 1.62 m/s

Comprehension-2 for Q. No. 15 to 16

The minimum and maximum distances of a satellite from the centre of earth are $2R$ and $4R$, where R is radius of earth. If mass of earth be M :

15. Minimum and maximum speeds of the satellite are:
- (A) $\sqrt{\frac{GM}{5R}}$, $\sqrt{\frac{3GM}{2R}}$ (B) $\sqrt{\frac{GM}{6R}}$, $\sqrt{\frac{2}{3} \frac{GM}{R}}$
 (C) $\sqrt{\frac{GM}{6R}}$, $\sqrt{\frac{2GM}{R}}$ (D) $\sqrt{\frac{GM}{3R}}$, $\sqrt{\frac{5GM}{2R}}$
16. Angular momentum of the satellite about centre of earth:
- (A) $(2GMm^2R)^{1/2}$ (B) $(4GMm^2R)^{1/2}$
 (C) $(3GMm^2R)^{1/2}$ (D) $\left(\frac{8}{3}GMm^2R\right)^{1/2}$

CHEMISTRY – (PART – E)

This part contains **TWO (02)** comprehensions. Based on each comprehension, there are **TWO (02)** questions of **Multiple Choice Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

Comprehension-1 for Q. No. 17 to 18

Vitamin C (M = 176) is a compound of C, H and O found in many natural source, especially citrus fruits. When a 1.0 g sample of vitamin C is placed in a combustion chamber and burned, the following data are obtained

Mass of CO₂ absorber after combustion = 85.35 g
 Mass of CO₂ absorber before combustion = 83.85 g
 Mass of H₂O absorber after combustion = 37.96 g
 Mass of H₂O absorber before combustion = 37.55 g

17. What is the percentage of carbon, by wt. in vitamin C?
 (A) 66.67% (B) 40.8%
 (C) 20% (D) 60%
18. What is the empirical formula of vitamin C?
 (A) CH₂O (B) C₃H₄O₃
 (C) C₆H₄O₆ (D) CHO

Comprehension-2 for Q. No. 19 to 20

In a vessel, the equilibria: $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ and $N_2(g) + 2H_2(g) \rightleftharpoons N_2H_4(g)$ are achieved simultaneously. Initially the vessel contains N₂ and H₂ in molar ratio of 9: 13. The equilibrium pressure is 7P₀ in which due to ammonia, the pressure is P₀ and due to hydrogen, pressure is 2P₀.

19. The value of K_p for the reaction: $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ is
 (A) $20 P_0^2$ (B) $\frac{20P_0^2}{3}$
 (C) $\frac{1}{20P_0^2}$ (D) $\frac{3}{20P_0^2}$
20. The value of K_p for the reaction: $N_2(g) + 2H_2(g) \rightleftharpoons N_2H_4(g)$ is
 (A) $20 P_0^2$ (B) $\frac{20P_0^2}{3}$
 (C) $\frac{1}{20P_0^2}$ (D) $\frac{3}{20P_0^2}$

MATHEMATICS – (PART – F)

This part contains **TWO (02)** comprehensions. Based on each comprehension, there are **TWO (02)** questions of **Multiple Choice Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

Comprehension-1 for Q. No. 21 to 22

For the equation $(2x^2 - 1)^2 + 2ax(2x^2 - 1) + x^2(4a^2 - 1) = 0$

21. The values of a for which above equation has all roots positive
 (A) $(-\infty, -1)$ (B) $(-1, 2)$
 (C) $(2, \infty)$ (D) None of these
22. The values of a for which above equation has two positive and two negative roots
 (A) $(-\infty, -4)$ (B) $(5, \infty)$
 (C) $\left[-\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}\right]$ (D) None of these

Comprehension-2 for Q. No. 23 to 24

Consider a pair of perpendicular straight lines $ax^2 + 3xy - 2y^2 - 5x + 5y + c = 0$.

23. The value of a is
 (A) 1 (B) 3
 (C) 2 (D) -2
24. The value of c is
 (A) -3 (B) 3
 (C) -1 (D) 1

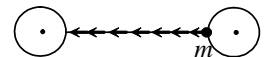
Section – II

Time: 45 Minutes

PHYSICS – (PART – A)

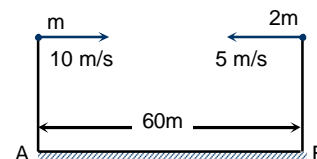
This part contains **4 Multiple Choice Questions** number **25 to 28**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

25. Two identical spherical masses are kept at some distance as shown. Potential energy when a mass m is taken from surface of one sphere to the other

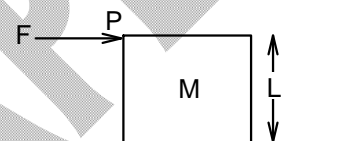


- (A) increases continuously (B) decreases continuously
 (C) first increases then decreases (D) first decreases then increases

26. Two particles, one of mass m and the other of mass $2m$, are projected horizontally towards each other from the same level above the ground with velocities 10 m/s and 5 m/s , respectively. They collide in air and stick to each other. The distance of the combined mass where they fall from point A is



- (A) 40 m (B) 20 m
 (C) 30 m (D) zero
27. A wheel of radius R rolls on the ground with a uniform velocity v . The relative acceleration of topmost point of the wheel with respect to the bottom most point is
- (A) $\frac{v^2}{R}$ (B) $\frac{2v^2}{R}$
 (C) $\frac{v^2}{2R}$ (D) $\frac{4v^2}{R}$
28. A cubical block of side L rests on a rough horizontal surface with coefficient of friction μ . A horizontal force F is applied on the block as shown. If the coefficient of friction is sufficiently high so that the block does not slide before toppling, the minimum force F required to topple the block is
- (A) Infinitesimal (B) $Mg/4$
 (C) $Mg/2$ (D) $Mg(1-\mu)$



CHEMISTRY – (PART – B)

This part contains 4 Multiple Choice Questions number 29 to 32. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

29. For the configuration $\uparrow\downarrow \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow$ which rule is violated ?
 (A) Aufbau principle (B) $(n + \ell)$ Rule
 (C) Pauli's Rule (D) Hund's Rule
30. The oxidation state of iodine in H_2IO_6^- is :
 (A) +7 (B) -1
 (C) +5 (D) +1
31. The mass of Mg_3N_2 produced if 48 g of Mg metal is reacted with 34 g NH_3 gas is
 $\text{Mg} + \text{NH}_3 \rightarrow \text{Mg}_3\text{N}_2 + \text{H}_2$
 (A) $(200/3) \text{ g}$ (B) $(100/3) \text{ g}$
 (C) $(400/3) \text{ g}$ (D) $(150/3) \text{ g}$
32. $\text{P}_4 + 3\text{NaOH} + 3\text{H}_2\text{O} \rightarrow 3\text{NaH}_2\text{PO}_2 + \text{PH}_3$ is an example of :-
 (A) Inter molecular Redox reaction (B) Intra molecular Redox reaction
 (C) Disproportionation Redox reaction (D) None of these

MATHEMATICS – (PART – C)

This part contains 4 Multiple Choice Questions number 33 to 36. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE is correct.

33. If $A = \{x \mid x^2 = 4\}$ and $B = \{x \mid x^2 - 5x + 6 = 0\}$, then $A \cup B$
 (A) $\{2, 3\}$ (B) $\{-2, 3\}$
 (C) $\{2\}$ (D) $\{-2, 2, 3\}$
34. A and B are two sets having 3 and 4 elements respectively and having 2 elements in common. The number of relations which can be defined from A to B is
 (A) 2^5 (B) $2^{10} - 1$
 (C) $2^{12} - 1$ (D) none of these
35. For any real θ , the maximum value of $\cos^2(\cos\theta) + \sin^2(\sin\theta)$
 (A) is 1 (B) is $1 + \sin^2 1$
 (C) is $1 + \cos^2 1$ (D) does not exist
36. If α and β are the roots of the equation $x^2 - x + 11 = 0$, then the value of $3\alpha^3 - 3\alpha^2 + 2\beta^3 - 2\beta^2 + 11\alpha$ is equal to
 (A) 33 (B) -33
 (C) 22 (D) -22

PHYSICS – (PART – D)

This part contains TWO (02) comprehensions. Based on each comprehension, there are TWO (02) questions of Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE is correct.

Comprehension-1 for Q. No. 37 to 38

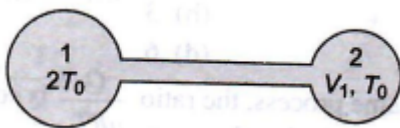
In a container of negligible heat capacity, 200 gm ice at 0°C and 100 gm steam at 100°C are added to 200 gm of water that has temperature 55°C . Assume no heat is lost to the surroundings and the pressure in the container is constant 1.0 atm.

37. What is the final temperature of the system?
 (A) 48°C (B) 72°C
 (C) 94°C (D) 100°C
38. At the final temperature, mass of the total water present in the system, is
 (A) 472.6 gm (B) 483.3 gm
 (C) 493.6 gm (D) 500 gm

Comprehension-2 for Q. No. 39 to 40

As shown, the same gas is filled at the temperature T_0 in two containers (1 and 2) both at pressure P_0 occupying a total volume V_0 . The smaller container of volume V_1 is maintained at the same temperature but the gas in bigger containers is heated at temperature $2T_0$.

39. Find the pressure of the gas:



- (A) $\frac{P_0 V_0}{V_1 + V_0}$ (B) $\frac{4 P_0 V_0}{3 (V_1 + V_0)}$
 (C) $\frac{2 P_0 V_0}{(V_1 + V_0)}$ (D) $\frac{P_0 V_0}{2 (V_1 + V_0)}$
40. Find the ratio of number of moles in the two containers, when smaller container is maintained at temperature T_0 and other is heated at $2T_0$:
- (A) $\frac{2 V_0}{(V_0 - V_1)}$ (B) $\frac{V_0}{(V_0 - V_1)}$
 (C) $\frac{V_1}{(V_0 - V_1)}$ (D) $\frac{2V_1}{(V_0 - V_1)}$

CHEMISTRY – (PART – E)

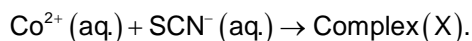
This part contains **TWO (02)** comprehensions. Based on each comprehension, there are **TWO (02)** questions of **Multiple Choice Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

Comprehension-1 for Q. No. 41 to 42

Double salts are addition compounds which lose their identity in aqueous solution whereas complexes which are also addition compounds do not lose their identity in aqueous solution. The coordination compounds show isomerism and find applications in photography, qualitative analysis, metallurgy, water purification and in the treatment of various diseases.

41. Which of the following statements is incorrect ?
 (A) Alum is a double salt.
 (B) EDTA salt of calcium is used in the treatment of lead poisoning.
 (C) Effective atomic number of the metals in complexes $[\text{Ni}(\text{CO})_4]$ and $[\text{Fe}(\text{CN})_6]^{4-}$ is same.
 (D) Chloridotris (triphenylphosphine) rhodium(I) is effective heterogeneous catalyst for hydrogenation of alkenes.
42. Which of the following statements is true for the complex, $[\text{Co}(\text{NH}_3)_4 \text{Br}_2] \text{NO}_2$?
 (A) It shows ionisation, linkage and geometrical isomerism.
 (B) It does not show optical isomerism because its cis and trans forms each have at least one plane of symmetry.
 (C) Its ionisation isomers cannot be differentiated by silver nitrate solution.
 (D) both (A) and (B)

Comprehension-2 for Q. No. 43 to 44



The coordination number of cobalt and nickel in complexes X and Y are four.

43. The IUPAC names of the complexes (X) and (Y) are respectively :
- (A) tetrathiocyanato-S-cobalt(II) and bis(dimethylglyoximate) nickel (II).
 (B) tetrathiocyanato-S-cobaltate (II) and bis (dimethylglyoximato) nickel (II).
 (C) tetrathiocyanato-S-cobaltate (II) and bis (dimethylglyoximato) nickelate (II).
 (D) tetrathiocyanato-S-cobaltate(III) and bis (dimethylglyoximato) nickel (II).
44. The geometry of complexes (X) and (Y) are respectively :
- (A) tetrahedral and square planar (B) both tetrahedral
 (C) square planar and tetrahedral (D) both square planar

MATHEMATICS – (PART – F)

This part contains **TWO (02)** comprehensions. Based on each comprehension, there are **TWO (02)** questions of **Multiple Choice Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

Comprehension-1 for Q. No. 45 to 46

To the circle $x^2 + y^2 = 4$, two tangents are drawn from $P(-4,0)$, which touch the circle at T_1 and T_2 . A rhombus $PT_1P'T_2$ is completed.

45. The circumcenter of triangle PT_1T_2 is at
- (A) $(-2,0)$ (B) $(2, 0)$
 (C) $(\sqrt{3}/2,0)$ (D) None of these
46. The ratio of the area of triangle PT_1P' to that of triangle $P'T_1T_2$ is
- (A) $2 : 1$ (B) $1 : 2$
 (C) $\sqrt{3} : 2$ (D) None of these

Comprehension-2 for Q. No. 47 to 48

$$\text{If } \sin\alpha + \sin\beta = \frac{1}{4} \text{ and } \cos\alpha + \cos\beta = \frac{1}{3}$$

47. The value of $\sin(\alpha + \beta)$ is
- (A) $\frac{24}{25}$ (B) $\frac{13}{25}$
 (C) $\frac{12}{13}$ (D) None of these

48. The value of $\cos(\alpha + \beta)$ is

(A) $\frac{12}{25}$

(B) $\frac{7}{25}$

(C) $\frac{12}{13}$

(D) None of these

SAMPLE PAPER

FIITJEE

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SAMPLE PAPER

For Students of Class XII

Paper 2

Other Engineering Entrance Exam & JEE Main

Paper Code: 1112-2

ANSWER KEY

1.	B	2.	B	3.	A	4.	D
5.	C	6.	C	7.	C	8.	D
9.	A	10.	D	11.	B	12.	A
13.	B	14.	B	15.	B	16.	D
17.	B	18.	B	19.	C	20.	D
21.	D	22.	C	23.	C	24.	A
25.	C	26.	A	27.	B	28.	C
29.	C	30.	A	31.	A	32.	C
33.	D	34.	D	35.	B	36.	D
37.	D	38.	B	39.	C	40.	D
41.	D	42.	C	43.	B	44.	A
45.	A	46.	D	47.	A	48.	B