ADMISSION CUM SCHOLARSHIP TEST

SAMPLE TEST PAPER

(For Students Going to Class 12TH IN 2024)

STREAM : ENGINEERING | COURSE OFFERED : COUNTDOWN

Time : 2 hours **Maximum Marks: 240**

DO NOT BREAK THE SEALS ON THIS BOOKLET, AWAIT INSTRUCTIONS FROM THE INVIGILATOR.

INSTRUCTIONS

(A) General :

1. This Question paper contains **THREE** parts (Physics, Chemistry and Mathematics).
2. This Question Paper contains 12 pages, other than the OMR.
3. This Question Paper contains total **60 questions, 20 questions each** in **Physics, Chemistry and Mathematics**.
4. The Question Paper has blank spaces at the bottom of each page for rough work.No additional sheets will be provided for rough work.
5. Blank papers, clip boards, log tables, slide rule, calculators, cellular phones, pagers and electronic gadgets, in any form, are **NOT** allowed.
6. This booklet also contains the **OMR** answer sheet (i.e., A machine gradable Response Sheet).

(B) Answering on the OMR:

7. Each question will have **4 choices** in both the Sections, out of which **only one choice is correct**.
8. Fill the bubble with **Ball Pen (Blue or Black) ONLY.**

(C) Filling – Name and Registration No.

9. On the **OMR sheet**, write your Name and Registration No. using ball pen. Also, put your signature in the appropriate box using ball pen.

(D) Marking Scheme:

9. (a) For each question, you will be awarded **4 marks** if you have darkened only one bubble corresponding to the right answer.
   (b) In case you have not darkened any bubble, you will be awarded 0 mark for that question.
   (c) In all other cases, you will be awarded **–1 mark**.

SEAL

Name :.....

Registration No.: | | | | | | | | | | | | | | | |

PART-A : PHYSICS

1. There are two force vectors, one of 5N and other of 12N, at what angle the two vectors be added to get resultant vector of 17N, 7N and 13N respectively –

(A) 0º, 180º and 90º (B) 0º, 90º and 180º (C) 0º, 90º and 90º (D) 180º, 0º and 90º

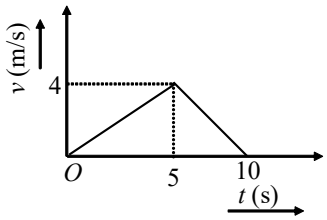
2. The force *F* is given in terms of time *t* and displacement *x* by the equation $F = A\cos Bx + C\sin Dt$. The dimensions of $\frac{D}{B}$ are

(A) $M^0L^0T^0$ (B) $M^0L^0T^{-1}$ (C) $M^0L^{-1}T^0$ (D) $M^0L^1T^{-1}$

3. At what angle to the horizontal should an object be projected so that the maximum height reached is equal to the horizontal range?

(A) tan θ = 2 (B) tan θ = 4 (C) tan θ = 2/3 (D) tan θ = 3

4. The velocity-time graph of a particle moving along a straight line is as shown in figure. Calculate the distance covered between *t* = 0 to *t* = 10 seconds.



(A) 10 m (B) 20 m (C) 60 m (D) 50 m

5. A river is flowing from west to east with a speed of 5 m/min. A man can swim in still water with a velocity 10 m/min. In which direction should the man swim, so as to take the shortest possible path to go to the south?

(A) 30° with downstream (B) 60° with downstream

(C) 120° with downstream (D) towards south

Space for rough work

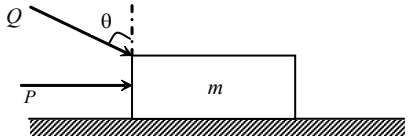
6. At a curved path of the road, the roadbed is raised a little on the side away from the center of the curved path. The slope of the roadbed is given by

(A) $\tan^{-1}\frac{v^2 g}{r}$ (B) $\tan^{-1}\frac{rg}{v^2}$ (C) $\tan^{-1}\frac{r}{gv^2}$ (D) $\tan^{-1}\frac{v^2}{rg}$

7. A block of metal weighing 2 kg is resting on a frictionless plane. It is struck by a jet of water at a rate of 1 kgs^{-1} at a speed of 5 ms^{-1}. The initial acceleration of the block is

(A) $\frac{2}{5}$ ms^{-2} (B) $\frac{5}{2}$ ms^{-2} (C) 5 ms^{-2} (D) $\frac{1}{5}$ ms^{-2}

8. A block of mass *m*, lying on a rough horizontal plane, is acted upon by a horizontal force *P* and another force *Q* inclined at an angle θ to the vertical as shown. The block will remain in equilibrium, if the coefficient of friction between it and the surface is



(A) $(P + Q \sin\theta) / (mg + Q \cos\theta)$ (B) $(P \cos\theta + Q) / (mg - Q \sin\theta)$

(C) $(P + Q \cos\theta) / (mg + Q \sin\theta)$ (D) $(P \sin\theta - Q) / (mg - Q \cos\theta)$

9. A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle. The motion of the particle takes place in a plane. It follows that

(A) its velocity is constant (B) its acceleration is constant

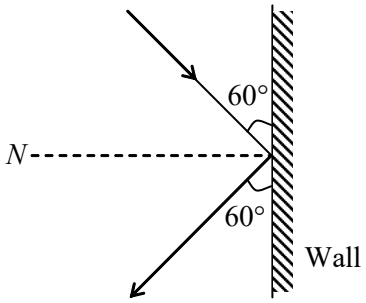
(C) its kinetic energy is constant (D) it moves in a straight line

10. A block of mass $m = 0.1$ kg is released from a height of 4 m on a curved smooth surface. On the horizontal smooth surface it collides with a spring of force constant 800 N/m. The maximum compression in spring will be ($g = 10$ m/s^2)

(A) 1 cm (B) 5 cm (C) 10 cm (D) 20 cm

Space for rough work

11. A 3 kg ball strikes a heavy rigid wall with a speed of 10 m/s at an angle of 60° with the wall. It gets reflected with the same speed at 60° with the wall. If the ball is in contact with the wall for 0.2 s, the average force exerted on the ball by the wall is



(A) 300 N (B) zero (C) $150\sqrt{3}$ N (D) 150 N

12. An inelastic ball is dropped from a height of 100 m. If 20% of its energy is lost, to what height will the ball rise?

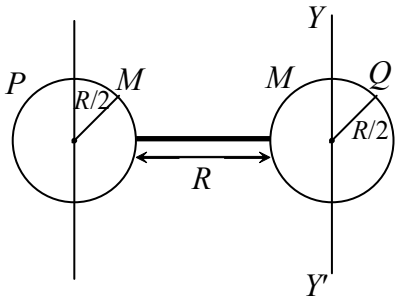
(A) 80 m (B) 40m (C) 60m (D) 20m

13. A thin circular ring of mass m and radius *R* is rotating about its axis with a constant angular velocity ω. Two objects each of mass *M* are attached gently to the opposite ends of a diameter of the ring. The ring now rotates with an angular velocity ω' =

(A) $\frac{\omega m}{(m+2M)}$ (B) $\frac{\omega(m+2M)}{m}$ (C) $\frac{\omega(m-2M)}{(m+2M)}$ (D) $\frac{\omega m}{(m+M)}$

Space for rough work

14. Two spheres each of mass *M* and radius *R*/2 are connected with a massless rod of length *R* as shown in the figure. The moment of inertia of the system about an axis passing through the centre of one of the spheres and perpendicular to the rod is



(A) $\frac{21}{5}MR^2$ (B) $\frac{2}{5}MR^2$ (C) $\frac{5}{2}MR^2$ (D) $\frac{5}{21}MR^2$

15. Two water pipes of diameters 2 cm and 4 cm are connected with the main supply line in sereis.The velocity of flow of water in the pipe of 2 cm diameter is

(A) 4 times that in the other pipe (B) $\frac{1}{4}$ times that in the other pipe

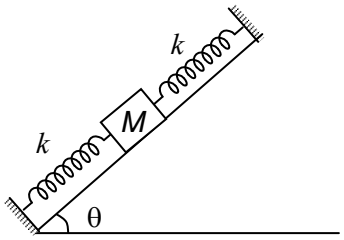
(C) 2 times that in the other pipe (D) $\frac{1}{2}$ times that in the other pipe

16. Work done in splitting a drop of water of 1 mm radius into 64 droplets is (Surface tension of water is 72×10^{-3} J/m^2)

(A) 2.0×10^{-6} J (B) 2.7×10^{-6} J (C) 4×10^{-6} J (D) 5.4×10^{-6} J

Space for rough work

17. On a smooth inclined plane a body of mass M is attached between two springs. The other ends of the springs are fixed to firm supports. If each spring has a force constant k, the period of oscillation of the body is (assuming the spring as massless)



(A) $2\pi\sqrt{\frac{M}{2k}}$ (B) $2\pi\sqrt{\frac{2M}{k}}$ (C) $2\pi\sqrt{\frac{M\sin\theta}{2k}}$ (D) $2\pi\sqrt{\frac{2M\sin\theta}{k}}$

18. A whistle giving out 450 Hz, approaches a stationary observer at a speed of 33 m/s. The frequency heard by the observer in Hz is (speed of sound = 330 m/s)

(A) 409 (B) 429 (C) 517 (D) 500

19. If the temperature of the sun is increased from T to $2T$ and its radius from R to $2R$, then the ratio of the radiant energy received on earth to what it was previously will be

(A) 4 (B) 16 (C) 32 (D) 64

20. The root mean square velocity of the gas molecules is 300 m/s. What will be the root mean square speed of the molecules if the atomic weight is double and absolute temperature is halved?

(A) 300 m/s (B) 150 m/s (C) 600 m/s (D) 75 m/s

Space for rough work

PART-B : CHEMISTRY

21. XeF_6 fluorinates I_2 to IF_7 and liberates Xenon(g). 210 mmol of XeF_6 can yield a maximum of_____ mmol of IF_7 ; $[7XeF_6 + 3I_2 \rightarrow 7Xe + 6IF_7]$

(A) 420 (B) 180 (C) 210 (D) 245

22. How many moles of potassium chlorate need to be heated to produce 11.2 litre oxygen at N.T.P.

(A) $\frac{1}{2}$ mol (B) $\frac{1}{3}$ mol (C) $\frac{1}{4}$ mol (D) $\frac{2}{3}$ mol

23. The correct set of quantum numbers for unpaired electrons of chlorine atom is

	n	ℓ	m
(A)	2	1	0
(B)	2	1	1
(C)	3	1	1
(D)	3	0	0

24. Which of the following does not characterise X - rays ?

(A) The radiation can ionise gases

(B) It causes ZnS to flurescence

(C) Deflected by electric and magnetic field

(D) have wavelengths shorter than ultraviolet rays

25. The root mean square speed of 8 g of He is 300 ms^{-1} . Total kinetic energy of He gas is :

(A) 120 J (B) 240 J (C) 360 J (D) None of these

26. Two glass bulbs A and B at same temperature are connected by a very small tube having a stopcock. Bulb A has a volume of 100 cm^3 and contained the gas while bulb B was empty. On opening the stopcock, the pressure fell down to 20%. The volume of the bulb B is .

(A) 100 cm^3 (B) 200 cm^3 (C) 250 cm^3 (D) 400 cm^3

Space for rough work

27. The magnitude of work done in ergs for the reversible expansion of one mole of an ideal gas from a volume of 10 L to 20 L at 25° C is

(A) $2.303 \times 298 \times 0.082 \log 2$ (B) $298 \times 10^7 \times 8.31 \times 2.303 \log 2$

(C) $2.303 \times 298 \times 0.082 \log 0.5$ (D) $2.303 \times 298 \times 2 \log 2$

28. One mole of an ideal gas expands isothermaly against a constant external pressure of 1 atm from a volume of 10 dm^3 to a volume of 30 dm^3. Calculate the work by the gas in joules

(A) – 3039 J (B) –4052 J (C) –1013 J (D) –2026 J

29. consider a gas phase reaction $2SO_2 + O_2 \rightleftharpoons 2SO_3$. If P_{SO_2} ; P_{O_2} and P_{SO_3} represent Equilibrium partial pressue of respective substance. What will be expression of K_p for above reaction?

(A) $\frac{P^2_{SO_3}}{P^2_{SO_2}.P_{O_2}}$ (B) $\frac{P^2_{SO_2}.P_{O_2}}{P^2_{SO_3}}$ (C) $\frac{P_{SO_2}.P^2_{o_2}}{P_{SO_3}}$ (D) $\frac{P^2_{SO_2}.P^2_{SO_3}}{P_{O_2}}$

30. The equilibrium constant (K_C) for the reaction $2HCl(g) \rightleftharpoons H_2(g) + Cl_2(g)$ is 4×10^{-34} at 25ºC. What is the equilibrium constant for the reaction ?

$$\frac{1}{2}H_2(g) + \frac{1}{2}Cl_2(g) \rightleftharpoons HCl(g)$$

(A) 2×10^{-17} (B) 2.5×10^{33} (C) 5×10^6 (D) None of these

31. When 0.4 g of NaOH is dissolved in one litre of solution, the pH of the solution is –

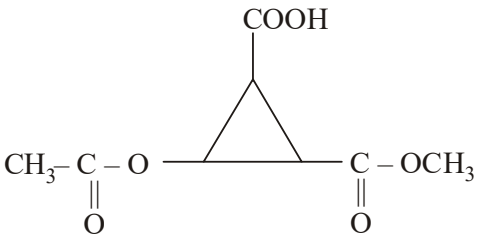
(A) 12 (B) 2 (C) 6 (D) 10

32. The hydrogen ion concentration and pH of the solution made by mixing 100 mL of 1.0 M HNO_3 with 100 mL of 0.8 M KOH, are –

(A) $[H^+] = 0.1$ M, pH = 1 (B) $[H^+] = 0.01$ M, pH = 2

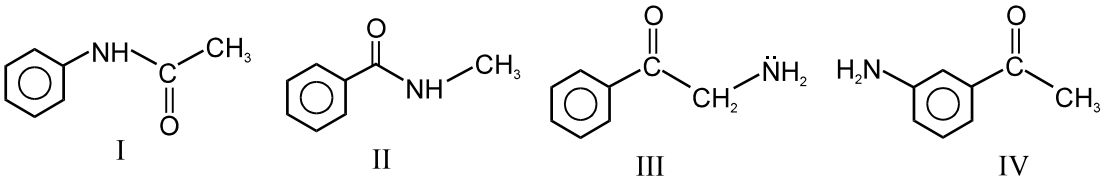
(C) $[H^+] = 1 \times 10^{-12}$ M, pH = 12 (D) $[H^+] = 1 \times 10^{-7}$ M, pH = 7

Space for rough work

33.  IUPAC name of the compound is

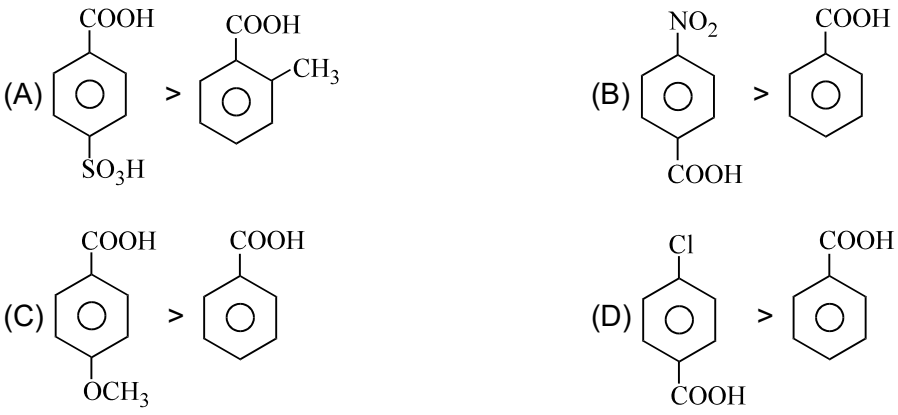
(A) 2-ethanoyl oxy-3-methoxycarbonyl cyclopropane carboxylic acid
(B) 2-methoxycarbonyl-3-ethanoyloxy cyclopropane carboxylic acid
(C) methyl-2-carboxy-3-ethanoyloxy cyclopropane carboxylate
(D) 2-methoxycarbonyl-3-carboxy cyclopropyl ethanoate

34. The correct basic strength order is :



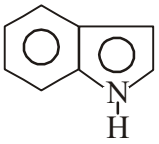
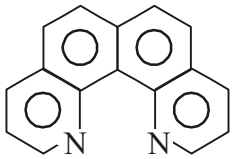
(A) I > II > IV > III
(B) IV > III > II > I
(C) III > II > IV > I
(D) III > IV > II > I

35. Which order of acid strength is wrong:



Space for rough work

36. Which of the following is the correct order of basic nature.

(P)  (Q)  (R) 

(A) Q > R > P (B) R > Q > P (C) R > P > Q (D) Q > P > R

37. Which of the following gaseous atoms has highest value of ionisation energy?

(A) P (B) Si (C) Mg (D) Al

38. Polarisability of halide ions increases in the order :

(A) F^-, I^-, Br^-, Cl^- (B) Cl^-, Br^-, I^-, F^- (C) I^-, Br^-, Cl^-, F^- (D) F^-, Cl^-, Br^-, I^-

39. The correct order of bond length :

(A) $F_2 < F_2^+ < F_2^-$ (B) $F_2^+ < F_2 < F_2^-$ (C) $F_2^+ < F_2^- < F_2$ (D) $F_2^- < F_2^+ < F_2$

40. Which of the following order is correct?

(A) AgCl > AgF : (Covalent character) (B) BaO < BaF_2 : (Melting point)

(C) BeF_2 < BaF_2 : (Solubility) (D) $LiNO_3$ > $RbNO_3$: (Thermal stability)

PART-C : MATHEMATICS

41. The value of 'p' for which the polynomials $2x^3 - 5x + p$ and $px^3 + 3x^2 - 13$ leaves same remainder when divided by (x + 2)

(A) $\frac{5}{9}$ (B) $\frac{4}{3}$ (C) $\frac{-13}{4}$ (D) $\frac{-2}{9}$

42. Number of real solutions of $|x-3|^{3x^2-10x+3} = 1$ will be

(A) 4 (B) 3 (C) 2 (D) 1

43. If $a + b\tan\theta - \sec\theta = 0$ and $b - a\tan\theta - 3\sec\theta = 0$, then value of $(a^2 + b^2)$ is

(A) 4 (B) 6 (C) 8 (D) 10

Space for rough work

44. The maximum value of $\log_{20}(3\sin x - 4\cos x + 15)$ is equal to :

(A) 1 (B) 2 (C) 3 (D) 4

45. If $0 < x, y < 2\pi$, the number of solutions of the system of equations sin x sin y = 3/4 and cos x cos y = 1/4 is

(A) 0 (B) 1 (C) 2 (D) infinite

46. If $0 \le x \le \frac{\pi}{2}$, then the solution of the equation $16^{\sin^2 x} + 16^{\cos^2 x} = 10$ is given by x equal to

(A) $\frac{\pi}{6}, \frac{\pi}{3}$ (B) $\frac{\pi}{3}, \frac{\pi}{2}$ (C) $\frac{\pi}{6}, \frac{\pi}{2}$ (D) none of these

47. If the points (2a, a), (a, 2a) and (a, a) enclose a triangle of area 72 units, then co-ordinates of the centroid of the triangle may be :

(A) (4, 4) (B) (–4, 4) (C) (12, 12) (D) (16, 16)

48. A point 'R' lies on the line segment joining the points P(4, –3) and Q(–1, 7) internally such that 5PR = 3PQ. Then the co-ordinates of point 'R' is :

(A) (1, 3) (B) (3, – 2) (C) (1, – 4) (D) (–2, 1)

49. The radius of the circle $x^2 + y^2 - 4x + 2y - 45 = 0$ is

(A) $5\sqrt{2}$ units (B) $4\sqrt{2}$ units (C) $3\sqrt{5}$ units (D) $4\sqrt{5}$ units

50. Let a and b represent the length of a right triangle's legs. If d is the diameter of a circle inscribed into the triangle and D is the diameter of a circle circumscribed on the triangle, then d + D equals

(A) a + b (B) 2(a+b) (C) $\frac{1}{2}(a+b)$ (D) $\sqrt{a^2+b^2}$

51. If the segment intercepted by the parabola $y^2 = 4ax$ with the line $\ell x + my + n = 0$ subtends a right angle at the vertex, then

(A) $4a\ell + n = 0$ (B) $4a\ell + 4am + n = 0$ (C) $4am + n = 0$ (D) $a\ell + n = 0$

52. The latus rectum of the ellipse $9x^2 + 5y^2 = 45$ is

(A) $\frac{18}{\sqrt{5}}$ (B) $\frac{\sqrt{5}}{18}$ (C) $\frac{\sqrt{5}}{3}$ (D) none of these

Space for rough work

53. Equation of the hyperbola passing through the point (1, –1) and having asymptotes x-axis and y-axis

(A) $xy = -1$ (B) $xy = 1$ (C) $x + y = 0$ (D) none of these

54. If $a_1, a_2, a_3, \ldots\ldots, a_n, a_{n+1}$ are in A.P., then evaluate :

$$\left(\frac{1}{a_1 \cdot a_2}+\frac{1}{a_2 \cdot a_3}+\frac{1}{a_3 \cdot a_4}+\ldots\ldots\ldots\ldots+\frac{1}{a_{n-1} \cdot a_n}+\frac{1}{a_n \cdot a_{n+1}}\right)$$

(A) $\frac{n-1}{a_1 \cdot a_{n+1}}$ (B) $\frac{n+1}{a_1 \cdot a_{n+1}}$ (C) $\frac{1}{a_1 \cdot a_{n+1}}$ (D) $\frac{n}{a_1 \cdot a_{n+1}}$

55. There are n A.M's between 3 and 54, such that the 8th mean : $(n-2)^{th}$ mean : : 3 : 5. The value of n is.

(A) 12 (B) 16 (C) 18 (D) 20

56. If α, β are the roots of $x^2 - 2x + 4 = 0$ then $\alpha^5 + \beta^5 =$

(A) 8 (B) 32 (C) 24 (D) 16

57. If each of the roots of $x^2 + x + a = 0$ exceeds a then

(A) $a = 1/2$ (B) $a < -1/2$ (C) $a > -1/2$ (D) $a = 2$

58. The conjugate of a complex number is $\frac{1}{i-1}$. Then that complex number is

(A) $\frac{1}{i-1}$ (B) $-\frac{1}{i-1}$ (C) $\frac{1}{i+1}$ (D) $-\frac{1}{i+1}$

59. In how many ways can 10 books be arranged in a shelf so that a particular pair of books shall be always together ?

(A) 8 ! (B) 9 ! (C) 2 × 8 ! (D) 2 × 9 !

60. The ratio of the coefficient of x^n in the expansion of $(1 + x)^{2n}$ and $(1 + x)^{2n-1}$ will be

(A) 1 : 2 (B) 2 : 1 (C) 3 : 1 (D) 1 : 3

Space for rough work

ANSWER KEYS

SAMPLE TEST PAPER

(For Students Going to Class 12TH IN 2024)

STREAM : ENGINEERING | COURSE OFFERED : COUNTDOWN

PHYSICS

1. (A)	2. (D)	3. (B)	4. (B)
5. (C)	6. (D)	7. (B)	8. (A)
9. (C)	10. (C)	11. (C)	12. (A)
13. (A)	14. (A)	15. (A)	16. (B)
17. (A)	18. (D)	19. (D)	20. (B)

CHEMISTRY

21. (B)	22. (B)	23. (C)	24. (C)
25. (C)	26. (D)	27. (B)	28. (D)
29. (A)	30. (D)	31. (A)	32. (A)
33. (A)	34. (D)	35. (C)	36. (B)
37. (A)	38. (D)	39. (B)	40. (A)

MATHEMATICS

41. (A)	42. (B)	43. (D)	44. (A)
45. (C)	46. (A)	47. (D)	48. (A)
49. (A)	50. (A)	51. (A)	52. (D)
53. (A)	54. (D)	55. (B)	56. (B)
57. (B)	58. (D)	59. (D)	60. (B)