



RANKRIDGE IIT JEE/NEET JUNIOR COLLEGE (LONGTERM)

TELANGANA

STREAM: JR MPC
Time: 3:00 Hours

MATHEMATICS
PHYSICS
CHEMISTRY

UNIT TEST-3

Date: 15-09-2025
Max Marks: 300

SYLLABUS

- : Functions , straight lines and pair of straight lines
- : Work Energy and Power complete chapter
- : Chemical bonding complete chapter

MATHEMATICS

(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) for its answer, out of which ONLY ONE option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and -1 in all other cases

1. If f and g are functions such that $f \circ g$ is onto then

- (A) f is onto (B) g is onto
(C) $g \circ f$ is into (D) Neither f nor g is onto

2. $f : A \rightarrow B$ is a bijection then $f \circ f^{-1} =$

- (A) I_A (B) I_B
(C) f (D) f^{-1}

3. The domain of the function

$$f(x) = \sqrt{3+x} + \sqrt{3-x}$$

- (A) $[-3, 3]$ (B) $(-3, 3)$
(C) $(-3, 3) - \{0\}$ (D) $[-3, 3] - \{0\}$

4. If $f(x) = ax + b$, where a and b are integers, $f(-1) = -5$ and $f(3) = 3$, then a and b are equal to

- (A) $a = -3, b = -1$ (B) $a = 2, b = -3$
(C) $a = 0, b = 2$ (D) $a = 2, b = 3$

5. If $f(x) = \begin{cases} x^2 + 1, & x \leq 0 \\ 2x - 1, & 0 < x < 5 \\ 4x + 3, & x \geq 5 \end{cases}$ then

$$\frac{f(-3) + f(2) + f(5)}{f(1)} =$$

- (A) 28 (B) 36
(C) 26 (D) 34

6. The function $y = f(x)$ such that

$$f\left(x + \frac{1}{x}\right) = x^2 + \frac{1}{x^2}$$

(A) $2 - x^2$ (B) $x^2 - 2$
(C) $x^2 + 4$ (D) $4x^2 - 2$

7. Let $f(x) = \frac{x}{e^x - 1} + \frac{x}{2}$, then f is

- (A) an odd function (B) an even function
(C) both odd and even (D) neither odd nor even

8. If $f(x) = 2x + 1$ and $g(x) = x^2 + 1$ then

$$(g \circ f)(2) =$$

(A) 112 (B) 122
(C) 12 (D) 124

9. $f : [0, \infty) \rightarrow [4, \infty)$ is defined by

$$f(x) = x^2 + 4 \text{ then } f^{-1}(13) =$$

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

10. If $f : R \rightarrow R$ and $g : R \rightarrow R$ are defined by

$f(x) = 2x + 3$ and $g(x) = x^2 + 7$, then the values of x such that $g(f(x)) = 8$ are.

- (A) 1, 2 (B) -1, 2
(C) -1, -2 (D) 1, -2

11. If f satisfies the relation

$$f(x+y) + f(x-y) = 2$$

$f(x) \cdot f(y) \forall x, y \in R$ and $f(0) \neq 0$; then

$$f(10) - f(-10) =$$

(A) 0 (B) 1
(C) 2 (D) 3

12. Centroid of the triangle formed by the

lines $12x^2 - 20xy + 7y^2 = 0$ and
 $2x - 3y + 4 = 0$ is

(A) $\left(\frac{2}{3}, \frac{2}{3}\right)$

(B) $\left(\frac{8}{3}, \frac{8}{3}\right)$

(C) $\left(\frac{3}{8}, \frac{3}{8}\right)$

(D) $\left(\frac{4}{3}, \frac{4}{3}\right)$

13. If $x^2 - 3xy + 2y^2 = 0$ represents two sides of triangle and orthocenter is $(2, 1)$ then equation of third side is

- (A) $x + 2y = 5$ (B) $2x + y = 5$
(C) $2x + y + 5 = 0$ (D) $2x + y = 6$

14. The triangle formed by $2x + 3y + 7 = 0$ the pair $(2x + 3y)^2 - 7(3x - 2y)^2 = 0$ is

(A) Isosceles (B) equilateral
(C) right angled (D) right angled isosceles

15. If $3x^2 - 11xy + 10y^2 - 7x + 13y + k = 0$ denotes a pair of straight lines, then the point of intersection of the lines is

(A) $(1, 3)$ (B) $(3, 1)$
(C) $(-3, -1)$ (D) $(1, -3)$

16. Combined equation of pair of lines passing through origin and inclined at 30° and 60° respectively with x-axis is

(A) $\sqrt{3}y^2 - x^2 = 0$ (B) $y^2 - \sqrt{3}x^2 = 0$
(C) $\sqrt{3}y^2 + 4xy - \sqrt{3}x^2 = 0$
(D) $\sqrt{3}y^2 - 4xy + \sqrt{3}x^2 = 0$

17. Assertion (A): $3x^2 + 4xy + y^2 = 0$ and $7x^2 + 12xy + y^2 = 0$ are equally inclined to each other.

Reason (R): The pair of lines

$ax^2 + 2hxy + by^2 = 0$ and $px^2 + 2qxy + ry^2 = 0$ are equally inclined to each other.

- (A) A is true, R is true and $R \Rightarrow A$
(B) A is true, R is true and $R \not\Rightarrow A$
(C) A is true, R is false
(D) A is false, R is true

18. If $x^2 + \alpha y^2 + 2\beta y = a^2$ represents a pair of perpendicular lines then $\beta =$

- (A) $2a$ (B) $3a$
(C) $4a$ (D) a

19. The lines $3x + 4y - 5 = 0$ cuts the curve $2x^2 + 3y^2 = 5$ at A and B. If 'O' is the origin, then $\angle AOB =$

(A) $\frac{\pi}{6}$

(B) $\frac{\pi}{3}$

(C) $\frac{\pi}{2}$

(D) $\frac{\pi}{8}$

20. $2x^2 - 5xy + 2y^2 = 0$ represents two sides of a triangle whose centroid is $(2, 3)$ then area of triangle is

(A) 2 (B) 4
(C) 6 (D) 12

(NUMERICAL VALUE TYPE)

Section-II contains 5 Numerical Value Type questions.

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21. Suppose that $f(x)$ is a function of the form

$$f(x) = \frac{ax^8 + bx^6 + cx^4 + dx^2 + 15x + 1}{x},$$

($x \neq 0$). If $f(5) = 2$, then the value of $|f(-5)|/4$ is 10.

22. If $f(x) = \frac{\cos^2 x + \sin^4 x}{\sin^2 x + \cos^4 x}$ for $x \in \mathbb{R}$ then $f(2002) =$ 1.

23. If $f(x) = \cos^2 x + \cos^2(60^\circ + x) + \cos^2(60^\circ - x)$ and $g(3/2) = 5$ then $(gof)(x) =$ 5.

24. If the distance between the pair of parallel lines $x^2 + 2xy + y^2 - 8ax - 8ay - 9a^2 = 0$ is $25\sqrt{2}$, then $|a| =$ 5

25. A pair of perpendicular lines passes through the origin and also through the points of intersection of the curve $x^2 + y^2 = 4$ with $x + y = a$, where $a > 0$. Then $a =$ 2

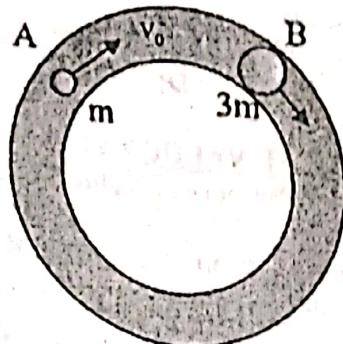
PHYSICS

(SINGLE CORRECT ANSWER TYPE)

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26. In a smooth circular tube of radius R , a particle of mass m moving with speed v_0 hits another particle of mass $3m$ at rest as shown. The time after which the next collision takes place (assume elastic collision):



- (A) $\frac{\pi R}{v_0}$
 (B) $\frac{2\pi R}{v_0}$
 (C) $\frac{\pi R}{2v_0}$
 (D) $\frac{\pi R}{4v_0}$

27. Two steel balls A and B of mass 10 kg and 10 g rolls towards each other with 5 m/s and 1 m/s respectively on a smooth floor. After collision, with what speed B moves (perfectly elastic collision)?

- (A) 8 m/s
 (B) 10 m/s
 (C) 11 m/s
 (D) zero

28. An object has a displacement from position -vector $\vec{r}_1 = (2\hat{i} + 3\hat{j})m$ to

$$\vec{r}_2 = (4\hat{i} + 6\hat{j})m \text{ under a force}$$

$\vec{F} = (3x^2\hat{i} + 2y\hat{j})N$, then work done by the force is

- (A) 24J
 (B) 33J
 (C) 83J
 (D) 45J

29. A force $\vec{F} = (6\hat{i} - 8\hat{j})N$, acts on a particle and displaces it over 4 m along the X-axis and 6m along the Y-axis. The work done during the total displacement is

- (A) 72 J
 (B) 24 J
 (C) -24 J
 (D) zero

30. A force overline $\vec{F} = (2\hat{i} + 3\hat{j} - 4\hat{k})N$ acts on a particle which is constrained to move in the XOY plane along the line $x = y$. If the particle moves $5\sqrt{2}m$, the work done by force in joule is

- (A) $25\sqrt{2}$
 (B) $5\sqrt{58}$

31. 25 A woman weighing 63 kg eats plum cake whose energy content is 9800 calories. If all this energy could be utilized by her, she can ascend a height of

- (A) 1m
 (B) 67m
 (C) 100m
 (D) 42m

32. A meter scale of mass 400 gm is lying horizontally on the floor. If it is to be held vertically with one end touching the floor, the work to be done is

- (A) 6J
 (B) 4J
 (C) 40J
 (D) 2J

33. If a body of mass 3 kg is dropped from the top of a tower of height 25 metre, then its kinetic energy after 1 second will be ($g = 10 \text{ m/s}^2$)

- (A) 1126 J
 (B) 1048 J
 (C) 735 J
 (D) 150 J

34. If the mass of a moving body decreased by one third of its initial mass and velocity is tripled, then the percentage change in its kinetic energy is

- (A) 500%
 (B) 600%
 (C) 300%
 (D) 200%

35. Two spheres of same material are moving with kinetic energies in the ratio 108:576. If the ratio of their velocities is 2:3, then the ratio of their radii is

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

36. A uniform chain of length 2 m is kept on a table such that a length of 60 cm hangs freely from the edge of the table. The total mass of the chain is 4 kg. What is the work done in pulling the entire chain on the table

- (A) 7.2 J
 (B) 3.6 J
 (C) 120 J
 (D) 1200 J

37. A block of mass m moving with speed v compresses a spring through distance x before its speed is halved. What is the value of spring constant?

- (A) $\frac{mv^2}{4x^2}$
 (B) $\frac{mv^2}{2x^2}$
 (C) $\frac{2mv^2}{x^2}$

38. A vehicle of mass 1000 kg is moving with a velocity of 15 ms^{-1} . It is brought to rest by applying brakes and locking the wheels. If the sliding friction between the tyres and the road is 6000N, then the distance moved by the vehicle before coming to rest is

- (A) 37.5 m (B) 18.75 m
 (C) 75 m (D) 15 m
- 39.** The mass of a simple pendulum bob is 100 gm. The length of the pendulum is 1 m. The bob is drawn aside from the equilibrium position so that the string makes an angle of 60° with the vertical and let go. The kinetic energy of the bob while crossing its equilibrium position will be
 (A) 0.49 J (B) 0.94 J
 (C) 1 J (D) 1.2 J
- 40.** A machine gun fires 420 bullets per minute. The velocity of each bullet is 300ms^{-1} and the mass of each bullet is 1gm. The power of the machine gun is
 (A) ~~315W~~ (B) 315000W
 (C) 630W (D) 3150W
- 41.** A body of mass m is rotated in a vertical circle with help of light string such that velocity of body at a point is equal to critical velocity at that point. If T_1, T_2 be the tensions in the string when the body is crossing the highest and the lowest positions then the following relation is correct
 (A) $T_2 - T_1 = 6mg$ (B) $T_2 - T_1 = 4mg$
 (C) $T_2 - T_1 = 3mg$ (D) $T_2 - T_1 = 2mg$
- 42.** A vehicle is travelling with uniform speed along a concave road of radius of curvature 19.6m. At lowest point of concave road if the normal reaction on the vehicle is three times its weight, the speed of vehicle is
 (A) 4.9m/s (B) 9.8m/s
 (C) 14.7m/s (D) 19.6m/s
- 43.** A point size mass 100 gm is rotated in a vertical circle using a cord of length 20cm. When the string makes an angle 60° with the vertical, the speed of the mass is 1.5m/s. The tangential acceleration of the mass in that position is (in ms^{-2})
 (A) 4.9 (B) $4.9\sqrt{2}$
 (C) $4.9\sqrt{3}$ (D) 9.8
- 44.** Two identical balls collide head on. The initial velocity of one is 0.75ms^{-1} while that of the other is -0.43ms^{-1} . If the collision is perfectly elastic, then their respective final velocities are
 (A) $0.75\text{ms}^{-1}, -0.43\text{ms}^{-1}$
 (B) $-0.43\text{ms}^{-1}, 0.75\text{ms}^{-1}$
- (C) $-0.75\text{ms}^{-1}; 0.43\text{ms}^{-1}$
 (D) $0.43\text{ms}^{-1}; 0.75\text{ms}^{-1}$
- 45.** Two identical balls moving in opposite direction with speeds 20 m/s and 25 m/s undergo head on perfectly inelastic collision. The speed of combined mass after collision is
 (A) 20 m/s (B) 22.5 m/s
 (C) 25 m/s (D) 2.5 m/s

NUMERICAL VALUE TYPE

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- 46.** A billiard ball moving with a speed of 5 m/s collides with an identical ball, originally at rest. If the first ball stops dead after collision, then the second ball will move forward with a speed of 5 in ms^{-1} .
- 47.** A force $(\vec{F}) = 3\hat{i} + 6\hat{j} + 2\hat{k}$ acting on a particle causes a displacement :
 $(\vec{S}) = -4\hat{i} + 2\hat{j} + 3\hat{k}$ in its own direction. If the work done is 6J, then the value of 'C' is C.
- 48.** A small bob tied at one end of a thin string of length 1m is describing a vertical circle so that the maximum and minimum tension in the string are in the ratio 5: 1. The velocity of the bob at the height position is _____ m/s. (Take $g = 10\text{m/s}^2$).
- 49.** A bomb of mass 9 kg explodes into 2 pieces of mass 3kg and 6kg. The velocity of mass 3kg is 1.6 m/s. The K.E. of mass 6kg is 108×10^{-2} in Joule
- 50.** A body of mass 6kg is under a force which causes displacement in it gives by $S = \frac{t^2}{4}$ meters where / is time. The work done by the force in 2 second is 8 in Joule.

CHEMISTRY (SINGLE CORRECT ANSWER TYPE)

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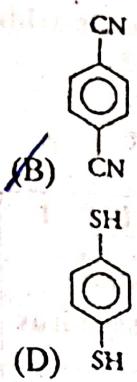
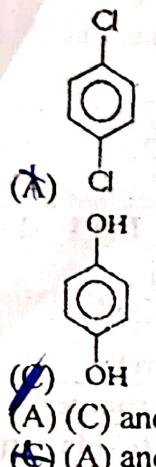
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51. Oxidation state of S in SO_4^{2-}
 (A) +6 (B) +3
 (C) +2 (D) -2
52. Which of the following has least oxidation state of Fe?
 (A) $K_3[Fe(OH)_6]$ (B) $K_2[FeO_4]$
 (C) $FeSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$
 (D) $[Fe(CN)_6]^{3-}$
53. Percentage of copper and oxygen in samples of CuO obtained by different methods were found to be the same. This proves the law of
 (A) Constant proportions
 (B) Reciprocal proportions
 (C) Multiple proportions
 (D) Conservation of mass
54. In the reaction Hydrogen_(g)+Oxygen_(g) gives water vapour, the ratio of volumes is 2:1:2. This illustrates the law of
 (A) conservation of mass
 (B) combining weights
 (C) combining volumes
 (D) all the above
55. LIST-1
 A) Law of conservation of Mass
 B) Avogadro's Law
 C) Gay-Lussac's Law of combining volumes
 D) Law of conservation of energy
- LIST-2
 (A) $\frac{V_1}{V_2} = \frac{n_1}{n_2}$
 (B) $2H_{2(s)} + O_{2(g)} \rightarrow 2H_{2(l)}$
 (C) 12g of C + 32g of O₂ = 44g CO₂
 (D) $H_{2(g)} + Cl_{2(g)} \rightarrow 2HCl_{(g)}$
 (E) $H_{2(g)} + Cl_{2(g)} \rightarrow 2HCl_{(g)}$, $\Delta H = -184.6\text{ kJ}$
- The correct match is
 A B C D A B C D
 (A) 3 1 4 5 (B) 3 1 5 4
 (C) 3 1 2 5 (D) 1 2 4 5
56. Oxidation state of N in N₃H is
 (A) +1/3 (B) +3
 (C) -1/3 (D) -1
57. The element that always exhibits a negative oxidation state in its compounds is
 (A) Nitrogen (B) Oxygen
 (C) Fluorine (D) Chlorine
58. The oxidation number of sulphur in S₈, S₂F₂ and H₂S are
 (A) 0, +1 and -2 (B) +2, +1 and -2
 (C) 0, +1 and +2 (D) 2, +1 and 2
59. In bleaching powder oxidation states of Cl are
 (A) -1, +2 (B) -2, +1
 (C) -1, +1 (D) -2, +1
60. What are the oxidation numbers of 'N' in NH₄NO₃?
 (A) +3, -5 (B) -3, +5
 (C) +3, +6 (D) -2, +2
- 61.
- | | LIST - 1 | | LIST - 2 |
|----|------------------|----|----------------------------------|
| A. | White phosphorus | I. | $-\frac{1}{2}$ (oxidation state) |
| B. | Benzene | 2. | 20 g/mole |
| C. | Super oxide | 3. | +3 (oxidation state) |
| D. | Neon | 4. | 4 (atomicity) |
| | | 5. | CH (empirical formula) |
- The correct match is
 A B C D A B C D
 (A) 3 5 2 1 (B) 4 3 1 2
 (C) 4 1 2 5 (D) 4 5 1 2
62. The number of molecules in one litre of air at STP is
 (A) 6×10^{23} (B) $6 \times 10^{23} / 22400$
 (C) $6 \times 10^{23} / 22.4$ (D) data insufficient
63. A compound on analysis was found to contain 53.33% C, 15.5% H, and the rest nitrogen. The formula of the compound is
 (A) C₆H₇N (B) C₂H₇N
 (C) C₄H₁₀N (D) C₂H₈N
64. Among the following molecules/ions, C²⁻, N²⁻, O₂⁻, O₂⁺
 Which one is diamagnetic and has the shortest bond length?
 (A) C²⁻ (B) O₂
 (C) O₂⁻ (D) N²⁻
65. Which of the following molecule(s) show/s paramagnetic behaviour?
 A. O₂ B. N₂
 C. F₂ D. S₂
 E. Cl₂
- Choose the correct answer from the options given below:
 (A) A and E only (B) B only
 (C) A and D only (D) A and C only

66. What is the number of unpaired electrons in the highest occupied molecular orbital of the following species N_2 ; N_2^+ ; O_2 ; O_2^+ ?

- (A) 2, 1, 2, 1 (B) 0, 1, 0, 1 (C) 2, 1, 0, 1 (D) 0, 1, 2, 1

67. For which of the following molecules significant $\mu \neq 0$?



- (C)

- (D)

68. 8g H_2 , and 32g O_2 is allowed to react to form water then which of the following statement is correct?

- (A) O_2 is limiting agent
 (B) O_2 is reagent in excess
 (C) H_2 is limiting reagent
 (D) 40g of water is formed

69. How many litres of oxygen at STP, are required for complete combustion of 39 gms of liquid Benzene? (Atomic weights C = 12, H = 1, O = 16)

- (A) 84 (B) 22.4
 (C) 42 (D) 11.2

70. The volume in lit of CO_2 liberated at S.T.P when 10g of 90% pure lime is heated completely is

- (A) 2.016

- (C) 2.24

- (B) 20.16
 (D) 22.4

(NUMERICAL VALUE TYPE)

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71. 16 g of SO_2 gas occupies 5.6L at 1 atm and 273K. What will be the value of x? 9

72. The difference between bond orders of CO and NO^+ is $\frac{x}{2}$ where x = 0.

(Round off to the Nearest Integer)

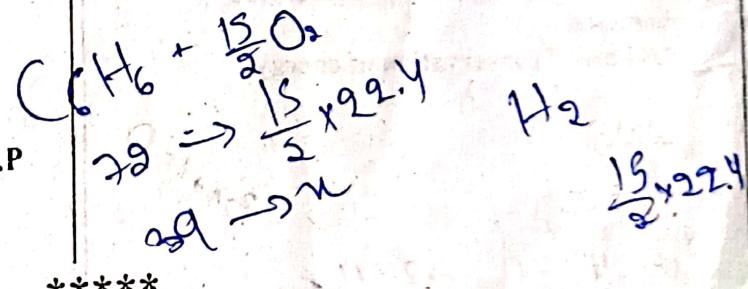
The maximum possible number of hydrogen bonds a water molecule can form is 4.

74. On complete combustion 0.30 g of an organic compound gave 0.20 g of carbon dioxide and 0.10 g of water. The percentage of carbon in the given organic compound is _____. (Nearest Integer)

75. The number of atoms in 8 g of sodium is $x \times 10^{23}$. The value of x is _____. (Nearest integer).

[Given : $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$

Atomic mass of Na = 23.0u]



BEST OF LUCK

23 \rightarrow 6.0224 $\times 10^{23}$

8 \rightarrow 0.20

0.20 \rightarrow 0.30

0.30 \rightarrow 0.0224

0.0224 \rightarrow 20.25

20.25 \rightarrow 11.2

11.2 \rightarrow 2.24

2.24 \rightarrow 0.207

23 \rightarrow 6.0224 $\times 10^{23}$

8 \rightarrow 0.20

0.20 \rightarrow 0.30

0.30 \rightarrow 0.0224

0.0224 \rightarrow 20.25

20.25 \rightarrow 11.2

11.2 \rightarrow 2.24

2.24 \rightarrow 0.207