MELUHA INTERNATIONAL SCHOOL

HYDERABAD

SR MPC | **JEE MAINS (REVISION TEST-1)** | **Date: 24-03-2020**

Time: 3 Hours

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which **ONLY ONE** option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and -1 if not correct.

MATHS

SYLLABUS: Sets & Relations, Functions & Straight lines

1. **If** $A=\left\{8^n-7n-1:n\in N\right\}$ and $B=\left\{49(n-1):n\in N\right\}$ then

1) $A\subset B$ 2) $B\subseteq A$ 3) $A=B$ 4) $A\subseteq B$

2. **Suppose** $A_1,A_2.....,A_{30}$ are thirty sets each with five elements and $B_1,B_2,.....B_n$ are n sets each with three elements such that $\bigcup_{i=1}^{30}A_i=\bigcup_{j=1}^{n}B_j=S$. If each elements of S belongs to exactly ten of the $A_i's$ and exactly 9 of the $B_j's$, then the value of n is

1) 15 2) 135 3) 45 4) 90

3. **Let A be a set of first ten natural numbers and R be a relation on A, defined by (x,y) $\in$ R $\Leftrightarrow$ x + 2y = 10,then domain of R is**

1) {1,2,3,....., 10} 2) {2,4,6,8} 3) {1,2,3,4} 4) {2,4,6,8,10}

4. **In the set** $A=\{1,2,3,4,5\}$, **a relation R is defined by** $R=\left\{(x,y):x,y\in A,x<y\right\}$. **Then R is**

1) reflexive 2) symmetric 3) transitive 4) equivalence

5. **Let R be the real line. consider the following subsets of the plane** $R\times R$**.**

$S=\left\{(x,y):y=x+1 \text{ and } 0<x<2\right\}$, **T = {(x,y) : x-y is an integer}.Which one of the following is true ?**

1) S is an equivalence relation on R but T is not
2) T is an equivalence relation on R but S is not
3) Neither S nor T is an equivalence relation on R
4) Both S and T are equivalence relations on R

6. **A function whose graph is symmetrical about the y axis is given by**

1) $f(x)=\sin\left[\log\left(x+\sqrt{x^2+1}\right)\right]$ 2) $f(x)=\dfrac{\sec^4 x+\cos ec^4 x}{x^3+x^4\cot x}$

3) $f(x+y)=f(x)+f(y)\forall x,y\in R$ 4) $f(x)=x^2$

7. **The maximum possible domain and the corresponding range of** $f(x)=(-1)^x$ **are**

1) $D_f=R,R_f=[-1,1]$ 2) $D_f=Z,R_f=\{1,-1\}$ 3) $D_f=Z,R_f=[-1,1]$ 4) $D_f=R,R_f=\{-1,1\}$

8. **A function** $f:R\to R$ **satisfy the equation** $f(x)f(y)-f(xy)=x+y$ **for all** $x,y\in R$ **and f(y)>0, then**

1) $f(x)=x+\dfrac{1}{2}$ 2) $f(x)=\dfrac{x}{2}+1$ 3) $f(x)=\dfrac{x}{2}-1$ 4) $f(x)=x+1$

9. **If the period of the function** $f(x)=\sin\left(\sqrt{[n]}x\right)$ **where [n] denotes the greatest integer less than or equal to n is** 2π **, then**

1) $1\le n<2$ 2) $1<n<2$ 3) $1\le n\le 2$ 4) $0\le n\le 1$

10. The domain of $f(x)=\sqrt{e^{\sin^{-1}\left(\log_{16}x^2\right)}}$ is

1) $\left[\frac{1}{4},4\right]$ 2) $\left[-4,\frac{-1}{4}\right]\cup\left[\frac{1}{4},4\right]$ 3) $\left[-4,\frac{-1}{4}\right]$ 4) $\left[4,\frac{1}{4}\right]$

11. Locus of the image of the point (2,3) in the lines $(x-2y+3)+\lambda(2x-3y+4)=0$ is(where $\lambda\in R$)

1) $x^2+y^2-3x-4y-7=0$ 2) $2x^2+3y^2+2x+4y-7=0$

3) $x^2+y^2-2x-4y+4=0$ 4) $x^2+y^2-2x-4y+3=0$

12. The orthocentre of the triangle ABC is 'B' and the circumcentre is 'S' (a,b) .If A is origin then the coordinate of C are :

1) (2a,2b) 2) $\left(\frac{a}{2},\frac{b}{2}\right)$ 3) $(\sqrt{a^2+b^2},0)$ 4) none of these

13. Let Δ_1 denotes the area of the triangle formed by the vertices $(am_1^2,2am_1),(am_2^2,2am_2),(am_3^2,2am_3)$ and Δ_2 denotes the area of the triangle formed by the vertices $[am_1m_2.a(m_1+m_2)]$, $[am_2m_3,a(m_2+m_3)]$ and $[am_3m_1,a(m_3+m_1)]$. Find $\frac{\Delta_1}{\Delta_2}$.

1) 1 2) 2 3) 3 4) 4

14. A point P(x,y) moves so that the sum of the distance from P to the coordinates axes is equal to the distance from P to the point A(1,1) .The equation of the locus of P in the first quadrant is:

1) $(x+1)(y+1)=1$ 2) $(x+1)(y+1)=2$ 3 $(x-1)(y-1)=1$ 4) $(x-1)(y-1)=2$

15. A and B are any two points on the positive X and Y axes respectively satisfying 2(OA)+3(OB) =10.If P is the middle point of AB then the locus of P is:

1) $2x+3y=5$ 2) $2x+3y=10$ 3) $3x+2y=5$ 4) $3x+2y=10$

16. The straight lines $x+2y-9=0,3x+5y-5=0$ and $ax+by-1=0$ are concurrent , if the straight line 35x-22y+1=0 passes through the point :

1) (a,b) 2) (b,a) 3) (-a,-b) 4) none of these

17. The line $\frac{x}{a}+\frac{y}{b}=1$ meets the x-axis at A, the y axis at B , and the line y=x at C such that the area of ΔAOC is twice the area of ΔBOC .Then the co ordinates of C are

1) $\left(\frac{b}{3},\frac{b}{3}\right)$ 2) $\left(\frac{2a}{3},\frac{2a}{3}\right)$ 3) $\left(\frac{2b}{3},\frac{2b}{3}\right)$ 4)none of these

18. If $\frac{a}{bc}-2=\sqrt{\frac{b}{c}}+\sqrt{\frac{c}{b}}$ where a,b,c>0, then the family of lines $\sqrt{a}x+\sqrt{b}y+c=0$ passes through the fixed point given by

1) (1,1) 2) (1-,2) 3) (-1,2) 4) (-1,1)

19. If the intercept made on the line y=mx by lines y=2 and y=6 is less than 5, then the range of values of m is

1) $(-\infty,-4/3)\cup(4/3,+\infty)$ 2) $(-4/3,4/3)$ 3) $(-3/4,4/3)$ 4) none of these

20. A line is drawn perpendicular to line y=5x, meeting the coordinate axes at A and B . If the area of triangle OAB is 10sq.units, Where O is the origin, then the equation of drawn line is

1) x+5y = 10 2) x-5y=10 3) x+4y=10 4) x-4y=10

SECTION-II
(Numerical Value Answer Type)

21. **Let $f(x,y)$ be a periodic function satisfying the condition**

$f(x,y)=f(2x+2y,2y-2x)\forall x,y\in R$ **and let $g(x)$ be a function defined as $g(x)=f(2^x,0)$.**

If T is period of $g(x)$ then find the value of T/4.

22. **Let $f(x)$ be a function such that $f(x-1)+f(x+1)=\sqrt{3}.f(x)\forall x\in R$. If $f(5)=10$. Then the value of $g'(x)$ where $g(x)=\sum_{r=0}^{99} f(5+12r)$ is.**

23. **If 'f' is a polynomial function satisfying the condition**
$f(\tan x)+f(\cot x)=f(\tan x).f(\cot x)$
$\forall x\in\left(\frac{-\pi}{2},\frac{\pi}{2}\right)-\{0\}$ **and $f(2)=9$ then the value of $\frac{f'(2)}{6}$ is.**

24. **If A and B are two points on the line $3x+4y+15=0$ such that OA=OB=9 units , then the area of the triangle OAB is _____ sq. units**

25. **The number of integral values of m, for which the X-coordinate of the point of intersection of the lines $3x+4y=9$ and $y=mx+1$ is also integer is_____**

PHYSICS

SYLLABUS: Kinematics, Newton's Laws of motion

26. **When a ball is thrown up vertically with velocity v_0, it reaches a maximum height of h. If one wishes to triple the maximum height then the ball should be thrown with velocity**

1) $\sqrt{3}\,v_0$ 2) $3\,v_0$ 3) $9\,v_0$ 4) $\frac{3}{2}v_0$

27. **Identify the correct statement related to the projectile motion.**

1) It is uniformly accelerated everywhere
2) It is uniformly accelerated everywhere except at the highest position where it is moving with constant velocity
3) Acceleration is never perpendicular to velocity
4) None of the above

28. **A particle has initial velocity, $v=3\hat{i}+4\hat{j}$ and a constant force $F=4\hat{i}-3\hat{j}$ acts on it. The path of the particle is**

1) straight line 2) parabolic 3) circular 4) elliptical

29. **A body is projected at an angle 60^0 with the horizontal with kinetic energy K. When the velocity makes an angle 30^0 with the horizontal, the kinetic energy of the body will be**

1) K/2 2) K/3 3) 2K/3 4) 3K/4

30. **A train is moving on a track at 30 ms^{-1}. A ball is thrown from it perpendicular to the direction of motion with 30 ms^{-1} at 45^0 from horizontal. Find the distance of ball from the point of projection on train to the point where it strikes the ground.**

1) 90 m 2) $90\sqrt{3}$ m 3) 60m 4) $60\sqrt{3}$ m

31. **A particle is fired horizontally from an inclined plane of inclination 30^0 with horizontal with speed 50 ms^{-1}. If $g=10\ ms^{-2}$, the range measured along the incline is**

1) 500 m 2) $\frac{1000}{3}$ m 3) $200\sqrt{2}$ m 4) $100\sqrt{3}$ m

32. A fixed mortar fires a bomb at an angle of 53^0 above the horizontal with a muzzle velocity of 80 ms^{-1}. A tank is advancing directly towards the mortar on level ground at a constant speed of 5 m/s. The initial separation (at the instant mortar is fired) between the mortar and tank, so that the tank would be hit is [Take g = 10 ms^{-2}]

1) 662.4 m 2) 526.3 m 3) 486.6 m 4) None of these

33. A particle is dropped from a height h. Another particle which is initially at a horizontal distance d from the first is simultaneously projected with a horizontal velocity u and the two particles just collide on the ground. Then

1) $d^2 = \frac{u^2 h}{2h}$ 2) $d^2 = \frac{2u^2 h}{g}$ 3) $d = h$ 4) $gh^2 = u^2 h$

34. If T_1 and T_2 are the times of flight for two complementary angles, then the range of projectile R is given by

1) $R = 4gT_1T_2$ 2) $R = 2gT_1T_2$ 3) $R = \frac{1}{4}gT_1T_2$ 4) $R = \frac{1}{2}gT_1T_2$

35. A gun is firing bullets with velocity v_0 by rotating it through 360^0 in the horizontal plane. The maximum area covered by the bullets is

1) $\frac{\pi v_0^2}{g}$ 2) $\frac{\pi^2 v_0^2}{g}$ 3) $\frac{\pi v_0^4}{g^2}$ 4) $\frac{\pi^2 v_0^4}{g}$

36. A grass hopper can jump maximum distance 1.6m. It spends negligible time on ground. How far can it go in $10\sqrt{2}$ s?

1) 45m 2) 30 m 3) 20 m 4) 40 m

37. Two stones are projected with the same speed but making different angles with the horizontal. Their horizontal ranges are equal. The angle of projection of one is $\frac{\pi}{3}$ and the maximum height reached by it is 102m. Then the maximum height reached by the other in metres is

1) 76 2) 84 3) 56 4) 34

38. A ball is projected upward from the top of a tower with a velocity 50 ms^{-1} making an angle 30^0 with the horizontal. The height of tower is 70m. After how many seconds from the instant of throwing, will the ball reach the ground. (g = 10 ms^{-2})

1) 2s 2) 5s 3) 7s 4) 9s

39. Two balls A and B of same size are dropped from the same point under gravity. The mass of A is greater than that of B. If the air resistance acting on each ball is same, then

1) both the balls reach the ground simultaneously
2) the ball A reaches earlier
3) the ball B reaches earlier 4) nothing can be said

40. A block of mass m is placed at rest on an inclined plane of inclination θ to the horizontal. If the coefficient of friction between the block and the plane is μ, then the total force the inclined plane exerts on the block is

1) mg 2) $\mu mg\cos\theta$ 3) $mg\sin\theta$ 4) $\mu mg\tan\theta$

41. At what minimum acceleration should a monkey slide a rope whose breaking strength is $\frac{2}{3}$ rd at weight?

1) $\frac{2g}{3}$ 2) g 3) $\frac{g}{3}$ 4) zero

42. The time taken by a body to slide down a rough 45^0 inclined plane is twice that required to slick down a smooth 45^0 inclined plane. The coefficient of kinetic friction between the object and rough plane is given by

1) $\frac{1}{3}$ 2) $\frac{3}{4}$ 3) $\sqrt{\frac{3}{4}}$ 4) $\sqrt{\frac{2}{3}}$

43. The force required to just move a body up the inclined plane is double the force required to just prevent the body from sliding down the plane. The coefficient of friction is μ. If θ is the angle of inclination of the plane than tang is equal to

1) μ 2) 3μ 3) 2μ 4) 0.5μ

44. A force F1 accelerates a particle from rest to a velocity v. Another force F_2 decelerates the same particle from v to rest, then

1) F_1 is always equal to F_2 2) F_2 is greater than F_1
3) F_2 may be smaller than, greater than or equal to F_1
4) F_2 cannot be equal to F_1

45. A particle is placed at rest inside a hollow hemisphere of radius R. The coefficient of friction between the particle and the hemisphere is $\mu = \frac{1}{\sqrt{3}}$. The maximum height up to which the particle can remain stationary is

1) $\frac{R}{2}$ 2) $\left(1-\frac{\sqrt{3}}{2}\right)R$ 3) $\frac{\sqrt{3}}{2}R$ 4) $\frac{3R}{8}$

SECTION- II
(Numerical Value Answer Type)

46. During the first 18 min of a 60 min trip, a car has an average speed of 11 ms^{-1}. What should be the average speed for remaining 42 min so that car is having an average speed of 21 ms^{-1} for the entire trip_____ ms^{-1}

47. Water drops fall at regular intervals from a tap 5 m above the ground. The third drop is leaving the tap, the instant the first drop touches the ground. How far above the ground is the second drop at that instant. (g=10 ms^{-2})_____ m.

48. A stone is dropped from the top of a tower and one second later, a second stone is thrown vertically downward with a velocity 20 ms^{-1}. The second stone will overtake the first after travelling a distance of (g=10 ms^{-2})_____ m.

49. A rope is stretched between two boats at rest. A sailor in the first boat pulls the rope with a constant force of 100N. First boat with the sailor has a mass of 250 kg where as the mass of second boat is double of this mass. If the initial distance between the boats was 100m, the time taken for two boats to meet each other in seconds (neglect water resistance between boats and water)

50. In order to raise a block of mass 100 kg a man of mass 60 kg fastens a rope to it and passes the rope over a smooth pulley. He climbs the rope with an acceleration $\frac{5g}{4}$ relative to rope. The tension in the rope is $\left(g = 10ms^{-2}\right)$.

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

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CHEMISTRY

SYLLABUS : Atomic structure and Periodic table.

51. $n = 3, l = 2, m = -2, s = -\frac{1}{2}$. The element could be in its +2 oxidation state.

1) Zn 2) Cu 3) Cr 4) Ni

52. The quantum number that reflects Cr^{+3} ion among these:

1) $n = 3, l = 2, m = 0, s = +\frac{1}{2}$ 2) $n = 3, l = 2, m = 0, s = -\frac{1}{2}$
3) $n = 4, l = 0, m = 0, s = -\frac{1}{2}$ 4) $n = 3, l = 2, m = -2, s = +\frac{1}{2}$

53. The number of electrons present in $C(CN)_4$ is____

1) 20 2) 30 3) 48 4) 58

54. Which of the following requires more energetic radiation to cause photo electric effect?
1) Cs 2) K 3) Pt 4) Cu

55. The best reducing agent among these:
1) Be 2) Al 3) B 4) Cl

56. Which of the following effect photographic filon to great extent?
1) α - rays 2) β - rays 3) γ -rays 4) neutrons.

57. Smallest size species among these:
1) Fe^{+2} 2) Fe^{+3} 3) Co^{+3} 4) Sc^{+3}

58. A metal absorb which of the following frequencies?
1) 1/2hv 2) ¾ hv 3) 1/8hv 4) 1hv

59. The name of 111th element is
1) Rontgenium 2) Copernecium 3) Hassium 4) Dubinium

60. Quick silver among these:
1) z= 80 2) z= 47 3) z =82 4) z= 41

61. B.P of Kr and Rn are -152^0C and -62^0C respectively. The approximate boiling point of Xe is____
1) $+107^0C$ 2) -107^0C 3) -120^0C 4) -40^0C

62. Which of the following is a bridge element?
1) Li 2) Al 3) Mg 4) Hg

63. The elements with stable + 8 oxidation states in their compounds among these:
1) Hg,Zn,Cd 2) Os, Ir, Pt 3) Ru, Os, Xe 4) Cr, Mo, W

64. To accommodate elements $z = 1-112$, how many periods will be needed suppose lanthanides and actinoids need no separate position?
1) 7 2) 8 3) 9 4) 6

65. Which pair of elements behave as metalloid?
1) Ge, As 2) Pt, I 3) Rb, Cs 4) Al, Zn

66. Number of electrons with $-\frac{1}{2}$ **spin in n= 4 is**
1) 32 2) 16 3) 8 4) 9

67. Bond dissociation energy of AB molecules in 300 KJ/mole. The number of moles of Photons of wavelength 6625 A^0 requires to dissociate 3 moles of AB molecule is
1) 1 2) 2 3) 4 4) 5

68. Photo electric emission is observed from surface for frequencies V_1 and V_2 the K.E in the two cases are in the ratio 1:K , then the threshold frequency V_0 is given by
1) $\frac{V_2 - V_1}{K-1}$ 2) $\frac{KV_1 - V_2}{K-1}$ 3) $\frac{KV_2 - V_1}{K-1}$ 4) $\frac{V_2 - V_1}{K}$

69. The ejection of the photo electron from the silver metal in the photo electric effect experiment can be stopped by applying 0.35 V. When the radiation of 256.7 nm is used, W of the silver metal is _____
1) 4.48 eV 2) 3.35 eV 3) 44.8 eV 4) 22.4 eV

70. Which of the following condition is incorrect for a well behaved wave function (Ψ)?
1) Ψ must be finite 2) Ψ must be single valued
3) Ψ must be infinite 4) Ψ must be continuous

SECTION- II
(Numerical Value Answer Type)

71. How many of the following require more energy to remove an electron than in He.
(1) H (2) Li (3) Li^+ (4) Be^{+2} (5) Al (6) Ne (7) Na^+ (8) Mg (9) C (10) F (11) O

72. Calculate the amount of energy required to convert 7.974 g of caesium atom in the gaseous state to form caesium ion. IE, of Cs= 374 kJ /mole and atomic mass of Cs is 132.9 a.m.u.

73. Calculate the electro negativity of silicon using Allred –Rochow method, covalent radius of silicon is 1.175 A^0. $\left(X = 0.359 \frac{Z_{eff.}}{r^2} + 0.744 \right)$.

74. The energy of an electron in an orbit of Hydrogen is 0.85 eV. Find the orbit value.

75. If the uncertainty in position of electron is $5 \times 10^{-10} M$ **. Then the uncertainity in momentum is** $A \times 10^{-25} Kg$ **m/sec. What is the value of A?**

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SR MPC
Time: 3 Hours

JEE MAINS (REVISION TEST-1)

Date: 24-03-2020

KEY SHEET

MATHS

1) **1**	2) **3**	3) **2**	4) **3**	5) **2**	6) **4**	7) **2**	8) **4**	9) **1**	10) **2**
11) **4**	12) **1**	13) **2**	14) **2**	15) **1**	16) **1**	17) **3**	18) **4**	19) **1**	20) **1**
21) **3**	22) **0**	23) **2**	24) **25.45**	25) **2**					

PHYSICS

26) **1**	27) **1**	28) **2**	29) **2**	30) **1**	31) **2**	32) **4**	33) **2**	34) **4**	35) **3**
36) **4**	37) **4**	38) **3**	39) **2**	40) **1**	41) **3**	42) **2**	43) **2**	44) **3**	45) **2**
46) **25.3**	47) **3.75**	48) **11.25**	49) **18.3**	50) **1218**					

CHEMISTRY

51) **1**	52) **1**	53) **4**	54) **3**	55) **1**	56) **2**	57) **3**	58) **4**	59) **1**	60) **1**
61) **2**	62) **3**	63) **3**	64) **4**	65) **1**	66) **2**	67) **4**	68) **2**	69) **1**	70) **3**
71) **2**	72) **22.44**	73) **1.82**	74) **4**	75) **1.05**					

HINTS & SOLUTIONS

MATHS-A

1. $8^n = (7+1)^n$

$= {}^n c_0 7^n + {}^n c_1 7^{n-1} + \ldots\ldots + {}^n c_{n-2} 7^2 + {}^n c_{n-1} 7 + {}^n c_n$

$= {}^n c_0 7^n + {}^n c_1 7^{n-1} + \ldots\ldots + {}^n c_{n-2} 49 + 7n + 1$

$8^n - 7n - 1 = 49\left[{}^n c_0 7^{n-2} + {}^n c_1 7^{n-3} + \ldots + {}^n c_{n-2} \right]$

$8^n - 7n - 1$ is a multiple of 49 for all $n \in N$

$\therefore$ A contains elements which are multiple of 49 and clearly B contains all multiples of 49.

$\therefore A \subset B$

2. $S = \underset{i=1}{\overset{30}{\cup}} A_i \Rightarrow n(S) = \frac{1}{10}(5 \times 30) = 15$

Again, $S = \underset{j=1}{\overset{n}{\cup}} B_j \Rightarrow n(S) = \frac{1}{9}(3 \times n) = \frac{n}{3}.$

Thus $\frac{n}{3} = 15 \Rightarrow n = 45$

3. $x + 2y = 10 \Rightarrow x = 10 - 2y$

$A = \{1, 2, 3, \ldots 10\}$

Domain of $R = \{2, 4, 6, 8\}$

$R = \{(2,4), (4,3), (6,2), (8,1)\}$

4. $xRy, yRz \Rightarrow xRz$

5. $S = \{(x, y); y = x + 1, 0 < x < 2\} \Rightarrow$

S is not symmetric

$T = \{(x, y) : x - y \ \ is\ an\ \text{int}eger\}$

$\Rightarrow$ clearly T is an equivalence

6. A funciton whose graph is symmbrical about the y-axis must be even since sinx and $\log\left(x + \sqrt{x^2 + 1}\right)$ are odd function.

Therefore $\sin\left(\log\left(x + \sqrt{x^2 + 1}\right)\right)$ must be odd

Also, $\frac{\sec^4 + \cos ec^4 x}{x^3 + x^4 \cot x}$ is an odd function

Now, let

$f(x) + y = f(x) + f(y) \forall x, y \in R$

$\therefore f(0+0) = f(0) + f(0). \therefore f(0) = 0$

$f(x - x) = f(x) + f(-x) \text{ or } 0 = f(x) + f(-1)$

i.e., $f(-x) = -f(x) \therefore f(x)$ is odd.

7. $f(x) = (-1)^x$ is defined when x is an integer

$\therefore$ Domain = Z, range = $\{-1, 1\}$

8. Take $f(x) = x + 1$ and verify

9. Sin x is a periodic function with period 2π, therefore $\sin\left(\sqrt{[n]}x\right)$ is a periodic function with period $\frac{2\pi}{\sqrt{[n]}}$

But the period of f(x) is 2π (given)

$\therefore \frac{2\pi}{\sqrt{[n]}} = 2\pi \Rightarrow \sqrt{[n]} = 1$

$\Rightarrow [n] = 1 \Rightarrow 1 \le n < 2$

10. $f(x)$ is defined if

$-1 \le \log_{16}{}^{x^2} \le 1 \Rightarrow 16^{-1} \le x^2 \le 16^1$

11. $x - 2y + 3 = 0$

$2x - 3t + 4 = 0$ they intersect at $(1, 2)$.

Eq. of line of slope m passing through (1, 2).

$y - 2 = m(x - 1)$ let the image of (2, 3) be (h, k) so, $\frac{3-k}{2-h} = -\frac{1}{m}$ and $\frac{h+2}{2}, \frac{k+3}{2}$ lies on the line.

$\frac{k-1}{2} = -\frac{(2-h)}{(3-k)} \cdot \frac{h}{2}$

$h(2-h) + (k-1)(3-k) = 0$

$2h - h^2 - (k^2 - 4k + 3) = 0$

$2h + 4k - 3 - h^2 - k^2 = 0$

$h^2 + k^2 - 2h - 4k + 3 = 0$

12. ΔABC is right angled at B. Midpoint of AC is S(a, b).

As A is origin (0, 0) so, C will be (2a, 2b).

13.

$$\Delta_1 = \frac{1}{2}\begin{vmatrix} am_1^2 & 2am_1 & 1 \\ am_2^2 & 2am_2 & 1 \\ am_3^2 & 2am_3 & 1 \end{vmatrix} = \frac{1}{2}\left(2a^2\right)\begin{vmatrix} m_1^2 & m_1 & 1 \\ m_2^2 & m_2 & 1 \\ m_3^2 & m_3 & 1 \end{vmatrix}$$

$$= \frac{1}{2}\left(2a^2\right)\left(m_1 - m_2\right)\left(m_2 - m_3\right)\left(m_3 - m_1\right)$$

$$\Delta_2 = \frac{1}{2}\begin{vmatrix} am_1m_2 & a\left(m_1 + m_2\right) & 1 \\ am_2m_3 & a\left(m_2 + m_3\right) & 1 \\ am_3m_1 & a\left(m_3 + m_1\right) & 1 \end{vmatrix}$$

$$\Delta_2 = \frac{1}{2}\left(a^2\right)\begin{vmatrix} m_1m_2 & \left(m_1 + m_2\right) & 1 \\ m_2m_3 & \left(m_2 + m_3\right) & 1 \\ m_3m_1 & \left(m_3 + m_1\right) & 1 \end{vmatrix}$$

$$= \frac{1}{2}\left(a^2\right)\left(m_1 - m_2\right)\left(m_2 - m_3\right)\left(m_3 - m_1\right)$$

Thus, $\frac{\Delta_1}{\Delta_2} = 2$.

14. $|x| + |y| = \sqrt{(x-1)^2 + (y-1)^2}$

Square both sides and in first quadrant,

$|x| = x, |y| = y$

$x^2 + y^2 + 2xy = x^2 + 1 - 2x + y^2 - 2y + 1$

$2x + 2y + 2xy - 2 = 0$

$x + y + xy - 1 = 0$

$(x+1)(y+1) = 2$

15. $OA = 2h$

$OB = 2k$

$2(2h) + 3(2k) = 10$

$2h + 3k = 5$

$2x + 3y = 5$

16. $\begin{vmatrix} 1 & 2 & -9 \\ 3 & 5 & -5 \\ a & b & -1 \end{vmatrix} = 0$

$1(-5 + 5b) - 2(-3 + 5a) - 9(3b - 5a) = 0$

$-5 + 5b + 6 - 10a - 27b + 45a = 0$

$35a - 22b + 1 = 0$

17. Given ar $\Delta AOC = 2(\text{ar } \Delta BOC)$

Or $\frac{1}{2}(OA)(x_1) = \frac{2 \times 1}{2}(OB)(x_1)$

Or $2 = 2b$

The equation of AB is

$\frac{x}{a} + \frac{y}{b} = 1$ .....(i)

Or $\frac{x}{2b} + \frac{y}{b} = 1$ .....(ii)

Since point C lies on line (ii), we have

$\frac{x_1}{2b} + \frac{x_1}{b} = 1$ or $x_1 = \frac{2b}{3} = \frac{a}{3}$

Or $C \equiv \left(\frac{2b}{3}, \frac{2b}{3}\right)$.

18. $\frac{a}{\sqrt{bc}} - 2 = \sqrt{\frac{b}{c}} + \sqrt{\frac{c}{b}}$

Or $a = b + c + 2\sqrt{bc}$

Or $a = \left(\sqrt{b} + \sqrt{c}\right)^2$

Or $\left(\sqrt{a} - \sqrt{b} - \sqrt{c}\right)\left(\sqrt{a} + \sqrt{b} + \sqrt{c}\right) = 0$

Or $\sqrt{a} - \sqrt{b} - \sqrt{c} = 0$

Since $\sqrt{a} + \sqrt{b} + \sqrt{c} \neq 0$ (as a, b, c > 0).

Comparing with $\sqrt{a}x + \sqrt{b}y - \sqrt{c} = 0$, we have $x = -1, y = 1$.

19. The distance between (2/m, 2) and (6/2,6) is less than 5.

Hence, $\left(\frac{2}{m} - \frac{6}{m}\right)^2 + (2-6)^2 < 25$

Or $\frac{16}{m^2} < 9$

Or $m^2 > \frac{16}{9}$

i.e., $m > \frac{4}{3}$ *or* $m < \frac{-4}{3}$.

20. Let the equation of line be $\frac{x}{a} + \frac{y}{b} = 1$

AB is perpendicular to y=5x. Hence,

$-\frac{b}{a} \times 5 = -1$ *or* $5b = a$

Area of $\Delta OAB = \frac{1}{2}|ab|$

Or $10 = \frac{1}{2}|5b^2|$

Or $b^2 = 4$ *or* $b = \pm 2, a = \pm 10$

The line can be

$\frac{x}{10} + \frac{y}{2} = 1$ *or* $\frac{x}{10} + \frac{y}{2} = -1$.

21.

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

$= f(8y,-8x)$

$=$

$f(8(-8x),-8(8y))=f(-64x,-64y)$

$=f(-64(-64x),-64(-64y))$

$=f(2^{12}x,2^{12}y)$

$f(x,y)=f(2^{12}x,2^{12}y)$

$f(x,0)>f(2^{12}x,0)$

$g(x)=f(2^x,0)=f(2^{12}2^x,0)$

$= f(2^{x+12},0) \quad = g(x+12)$

$\Rightarrow g(x)=g(x+12)$

$\Rightarrow$ period of g(x) *is* $12=T \Rightarrow \frac{T}{4}=3$

22. Sol. $f(x-1)+f(x+1)=\sqrt{3}.f(x)$ - (1)

Putting $x=x+1$

$f(x)+f(x+2)=\sqrt{3}.f(x+1)$ - (2)

Again putting $x=x+1$

$f(x+1)+f(x+3)=\sqrt{3}.f(x+2)$ - (3)

+ (3) $\Rightarrow f(x-1)+f(x+3)=f(x+1)$ - (4)

Continning like this we get

$f(x)$ is a periodic function with period '12'

Then

$g(x)=\sum_{r=0}^{99} f(5+12r)=100\times f(5)$

$= 1000$

$\Rightarrow g(x) =$ a constant function . Hence

$g'(x)=0$

23. Putting $\tan x=t$, we get $f(t)$ is a polynomial function of the form,

$f(t)=\pm t^n+1$

When t =2, $f(2)=9 \Rightarrow n=3$

$\therefore f(t)=t^3+1$

$f'(2)=12 \qquad \therefore \frac{f'(2)}{6}=2$

24. $OA=OB=9, OD=\frac{15}{\sqrt{25}}=3$

$\therefore AB=2AD=2\sqrt{81-9}=2\sqrt{72}=12\sqrt{2}$

Hence $\Delta=\frac{1}{2}(3\times 12\sqrt{2})=18\sqrt{2}$ sq. units.

25. $3x+4y=9$ and $y=mx+1$

$3x+4(mx+1)=9$

$(3+4m)x=5$

$x=\frac{5}{(3+4m)}$

For $m=-1; x=-5$

$m=-2; x=-1$

Two values.

PHYSICS

26. $h=\frac{u^2}{2g}$ *or* $u\propto\sqrt{h}$

27. a =g = constant for small heights.

28. $F.v=0 \Rightarrow F\perp v$

Hence path is parabola.

29. $v_x=u_x$

$\therefore v\cos 30^0=u\cos 60^0$

Or $v=\frac{u}{\sqrt{3}}$

Velocity has become $\frac{1}{\sqrt{3}}$ times. Therefore, kinetic energy will become 1/3 times.

30. Velocity of train in the direction of train is also 30 m/s. So there is no relative motion in this direction. In perpendicular direction,

$d=R=\frac{u^2\sin 2\theta}{g}$

$=\frac{(30)^2\sin 90^0}{10}=90m$

31. $R=\dfrac{u^2}{g\cos^2\beta}\left[\sin(2\alpha+\beta)+\sin\beta\right]$

$u=50m/s, g=10m/s^2, \alpha=0^0$

$R=\dfrac{(50)^2}{10\cos^2 30^0}\left[\sin(2\times 0+30^0)+\sin 30\right]$

$=\dfrac{(2500)}{10\times(3/4)}\left(\dfrac{1}{2}+\dfrac{1}{2}\right)$

$=\dfrac{1000}{3}m$

32. $T=\dfrac{2u\sin\theta}{g}=\dfrac{(2)(8)\sin 53^0}{10}=1.28s$

$R=\dfrac{u^2\sin 2\theta}{g}=\dfrac{(80)^2\sin(106^0)}{10}=615.2m$

Distance travelled by tank,

$d=(5)T=(5)(1.25)=6.4m$

$\therefore$ Total distance $=(615.2+6.4)m$

$=621.6m$

33. $T=\sqrt{\dfrac{2h}{g}}$

$g=(u)T=u\sqrt{\dfrac{2h}{g}}$

$\therefore d^2=\dfrac{2hu^2}{g}$

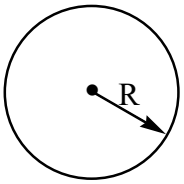
34. $T_1=\dfrac{2u\sin\theta}{g}, T_2=\dfrac{2u\cos\theta}{g}$

$R=\dfrac{2(u\sin\theta)(u\cos\theta)}{g}$

$=\dfrac{2\left(\dfrac{gT_1}{2}\right)\left(\dfrac{gT_2}{2}\right)}{g}$

$=\dfrac{1}{2}gT_1T_2.$

35. $R_{\max}=\dfrac{v_0^2}{g}\ at\ \ \theta=45^0$



$\therefore A_{\max}=\pi R_{\max}^2$

36. Maximum range is obtained at 45^0

$\dfrac{u^2}{g}=1.6\ \ or\ \ u=4\,m/s$

$T=\dfrac{2u\sin 45^0}{g}=\dfrac{2\times 4\times(1/\sqrt{2})}{10}$

$=0.4\sqrt{2}s$

Number of jumps in given time,

$n=\dfrac{t}{T}=\dfrac{10\sqrt{2}}{0.4\sqrt{2}}=25$

$\therefore$ Total distance travelled

$=1.6\times 25=10m$

37. $H_1=\dfrac{u^2\sin^2\theta}{2g}$

$\therefore 102=\dfrac{(u^2)\sin^2 60^0}{20}$

$\therefore u=52.2m/s$

Other stone should be projected at $90^0-\theta$ or 30^0 from horizontal.

$\therefore H_2=\dfrac{u^2\sin^2 30^0}{2g}$

$=\dfrac{(52.2)^2(1/4)}{20}$

$=34m$

38. Using $s=ut+\dfrac{1}{2}at^2$ in vertical direction

$\therefore -70=(50\sin 30^0)t+\dfrac{1}{2}(-10)t^2$

On solving this equation, we get t =7s.

39. $a=\dfrac{dv}{dt}=(8\hat{i}-4t\hat{j})$

At 1s $F_{net}=ma=(1)(8\hat{i}-4\hat{j})=(8\hat{i}-4\hat{j})$

$=W+F$

Where F= force on cube

$\therefore F=(8i-4\hat{j})-w$

$=(8\hat{i}-4\hat{j})-(-10\hat{j})$

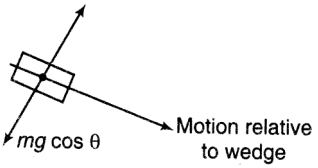
$=(8\hat{i}+6\hat{j})$

Or $|F|=\sqrt{(8)^2+(6)^2}$

=10 N

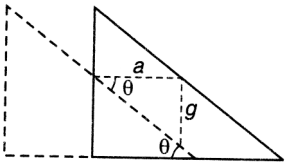
40. During motion of block, a component of its acceleration comes in the direction of $mg=\cos\theta$.

Therefore,



$mg\cos\theta > N$

41. $\frac{a}{g}=\cot\theta$



$\therefore \quad a=g\cot\theta$

42. $a_1=\frac{m_2g}{m_1+m_2}=\frac{30}{7}m/s^2$

$a_2=\frac{(m_1-m_2)g}{m_1+m_2}$

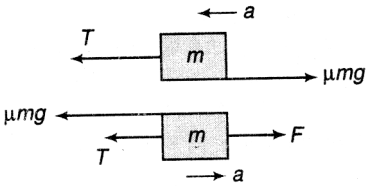
$=\frac{10}{7}m/s^2$

$a_3=\frac{m_2g-m_1g\sin 30^0}{m_1+m_2}$

$=\frac{10}{7}m/s^2$

$\therefore a_1>a_2=a_3$

43. $T-\mu mg=ma$



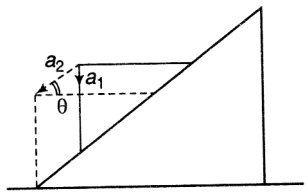
$\therefore T=\mu mg+ma$

$F-T-\mu mg=ma$

$\therefore F-\mu mg-ma-\mu mg=ma$

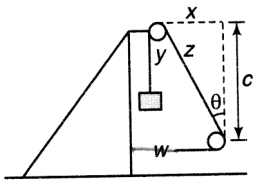
Or $a=\frac{F}{2m}-\mu g$

44. $\frac{a_1}{a_2}=\sin\theta$



$\therefore \quad a_1=a_2\sin\theta$

45. $z=\sqrt{x^2+c^2}$



Now, $w+y+z=l$

Or $w+y+\sqrt{x^2+c^2}=l$

$\therefore \frac{dw}{dt}+\frac{dy}{dt}+\frac{x}{\sqrt{x^2+c^2}}.\frac{dx}{dt}=0$

Or $\left(-\frac{dw}{dt}\right)+\frac{x}{z}\left(-\frac{dx}{dt}\right)=\frac{dy}{dt}$ .....(i)

$-\frac{dw}{dt}=-\frac{dx}{dt}=v_2$

$\frac{dy}{dt}=v_1$

And $\frac{x}{z}=\sin\theta$

Substituting these values in Eq.(i) we have $v_2(1+\sin\theta)=v_1$.

46. $v_{av}=\frac{d}{t}=\frac{d_1+d_2}{t_1+t_2}$

$21=\frac{(18)(11)+(42)(v)}{60}$

$\Rightarrow v=25.3m/s$

47. $t=\sqrt{\frac{2h}{g}}=\sqrt{\frac{2\times5}{10}}=1s$

Let t_0 is the interval between two drops. Then $2t_0=t$

$\therefore \quad t_0=0.5s$

2nd drop has taken t_0 time to fall. Therefore distance fallen,

$d=\frac{1}{2}gt_0^2=\left(\frac{1}{2}\right)(10)(0.5)^2$

=1.25 m

$\therefore$ Height from ground $\therefore=h-d$

$=5-1.25$

$=3.75m$

48. $\frac{1}{2}gt^2=20(t-1)+\frac{1}{2}g(t-1)^2$

Solving this equation we get,

$\therefore \quad t=1.5s$

Now, $d=20(t-1)+\frac{1}{2}g(t-1)^2$

$=11.25cm$.

49. F= 100 N,

$m_1=250kg, m_2=500kg, S=100m$

Force acts on both the boats is same.

Using F=ma; $F=m_1a_1; F=m_2a_2$

$a_1=\frac{F}{m_1}=\frac{100}{250} \qquad a_2=\frac{F}{m_2}=\frac{100}{500}$

$a_1=0.4\,ms^{-2} \qquad a_2=0.2ms^{-2}$

Relative acceleration $a_{rel}=a_1+a_2$

$a_{rel}=0.4+0.2=0.6\,ms^{-2}$

Using $s=ut+\frac{1}{2}a_{rel}t^2, u=0$

$$t=\sqrt{\frac{2s}{a_{rel}}}=\sqrt{\frac{2\times100}{0.6}}=18.3s$$

50. $m_m=60kg, m_B=100kg$

'a' be acceleration of rope.

$$a_{rel}=\frac{5g}{4}, a_{rel}=a_m+a;\ a_m=a_{rel}-a$$

$$a_m=\frac{5g}{4}-a$$

$T-m_Bg=m_Ba$ ……(i)

$T-m_mg=m_ma_m$ ……...(ii)

Solving (i) & (ii), we get

$T-100g=100a$ ……(iii)

$$T-60g=60\left(\frac{5g}{4}-a\right)\text{……(iv)}$$

(iii) – (iv), $-40g=100a-75g+60a$

$$160a=350\Rightarrow a=\frac{35}{16}ms^{-2}$$

$$T=100g+100a=1000+100\times\frac{35}{16}=1218N$$

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CHEMISTRY

51. Zn z= 30 has $4s^23d^{10}+2$ oxidation state indicates $3d^{10}$.

$$\therefore n=3, l=2\quad m=-2,\ s=-\frac{1}{2}.$$

52. $Cr^{+3}\ 3d^3\ n=3\ l=2\ m=0\ s=+\frac{1}{2}$

53. $C(CN)_4$ Tetra cyano methane

$5C+4N=5\times6+4\times7=30+28=58$

54. Energy order $Cs<K<Cu<Pt$.

55. It can be decided on the basic of S.R.P

$Be^{+2}+2e^-\rightarrow Be\ E^0=-1.99V\quad Al^{+3}+3e^-+Al\ E^0=-1.66V$

$2B+6H^++6e^-\rightarrow B_7H_6E^0=-1.56V$

$Cl_{2(g)}+2e^-\rightarrow2Cl^-_{(g)}\ E^0=-1.360V$

56. Highest e/m ratio for beta rays.

57. Along a period size decreases.

58. It absorbs in whole number quanta i.e $hv, 2hv, 3hv, 4hv$ etc.

59. 111 is Rontgenium

60. quick silver is mercury $z=80$.

61. B.P of

$$Xe=\frac{B.P\ of\ Kf+B.P\ of\ Rh}{2}=\frac{-152+(-62)}{2}=-107^0C$$

62. Mg as it resembles IIA and IIB group elements i.e, Ca, Sr, Ba, Ra, and Zn, Cd, Hg

63. $RuO_4, OsO_4\ and\ XeO_4$ in them Ru, Os, and Xe have + 8 oxidation state.

64. 6 periods will be enough only thing periodic table gets elongated.

65. Ge, As, Ga, act as metalloids.

66. Total number of electron in

$n=u=2n^2=2\times4^2=32$

Half of them will have -1/2 as they will be Paired $\therefore=\frac{32}{2}=16$.

67. $$E=\frac{Nhc}{\lambda}=N=\frac{E\lambda}{hc}$$

$$\mu=\frac{300\times10^3\times6.625\times10^{-10}}{6.625\times10^{-34}\times3\times10^8\times6.023\times10^{23}}\times3$$

$=5.01=5.0$ moles of photons

68. $hv_1=hv_0+1\quad 1=hv_1-hv_0=h(v_1-v_0)$

$hv_2=hv_0+k\quad k=hv_2-hv_0=h(v_2-v_0)$

$$\frac{1}{k}=\frac{h(v_1-v_0)}{h(v_2-v_0)}=\frac{v_1-v_0}{v_2-v_0}$$

$k(v_1-v_0)=v_2-v_0$

$kv_1-kv_0=v_2-v_0$

$kv_1-v_2=-v_2+kv_0=v_0(k-1)$

$$v_0=\frac{kv_1-v_2}{k-1}.$$

69. $$KE=\frac{1240}{\lambda}=\frac{1240}{256.7}=4.83eV$$

$TE=4.83eV\qquad TE=W+KE$

$KE=0.35eV$

$W=TE-KE=4.83-0.35=4.48eV$

70. Ψ cannot be infinite it should be finite to measure amplitude of wave function.

71. $Li^{+2}=1s^2\quad Be^{+2}=1s^2\quad Na^+=1s^22s^22p^6$.

$He=1s^2$ I.P of $He=24.6\ eV$

IP_2 of He = 54.4 eV

$Li^+\ IP_2=75.63eV$

$Be^{+2}IP_3=153.9eV$

$Na^+\ IP_2=47.27eV$

$\therefore\ Li^+$ and Be^{+2} require more energy than in He based on electronic configuration and effective nuclear change.

72. Moles of $Cs=\frac{W}{At.wr}=\frac{7.974}{132.9}=0.06$

Energy required

$=n\times E=0.06\times374=22.44KJ$.

73. $Si \quad Z=14 \quad E.C \ 1s^2 2s^2 2p^6 3s^2 3p^2$

$Z_{eff} = Z - \sigma$ (shielding constant)

$Z_{eff} = 1.4 - \left[0.35\times 3 + 8\times 0.85 + 2\times 1.00\right]$

$= 14 - 9.85 = 4.15$

$$\alpha = 0.359 \times \frac{4.15}{(1.175)^2} + 0.744 = 1.82$$

74. $$En = \frac{-13+6}{n^2} \qquad n^2 = \frac{-13.6}{0.85} = 16$$

$n = \sqrt{16} = 4$

75. $$\Delta x.\Delta p = \frac{h}{4\pi}$$

$$\Delta p = \frac{h}{4\pi\Delta x}$$

$$= \frac{6.625\times 10^{-34}}{4\times 3.14\times 5\times 10^{-10}}$$

$$= 0.10549\times 10^{-24}$$

$$= 1.0549\times 10^{-25}$$

$$= 1.05\times 10^{-25}$$