MELUHA INTERNATIONAL SCHOOL

HYDERABAD

SR MPC JEE MAINS	UNIT – II	Date: 23-04-2020
Time:	ASSIGNMENT – 3	Max. Marks:

MATHS

Syllabus: ***TRIGNOMETRY:– 1. TRIGNOMETRIC RATIOS, 2. COMPOUND ANGLES, 3.MUTIPLES AND SUBMULTIPLE, 4.TRANSFORMATIONS, 5.PERIODICITY AND EXTREME VALUES, 6. TRIGNOMETRIC EQUATIONS , 7.INVERSE TRIGNOMETRIC FUNCTIONS, 8.PROPERTIES OF TRIANGLES, 9.HEIGHTS AND DISTANCES, 10.COMPLEX NUMBERS , 11. DEMOIVERSES THEOREM***

1. If $\sqrt{1-\sin A} = \sin\frac{A}{2} - \cos\frac{A}{2}$, then $\frac{A}{2}-\frac{\pi}{4}$ could lie in quadrant

   (1) first (2) second (3) third (4) fourth

2. The values of x in $[0, 2\pi]$ which satisfy the equation $2^{1+|\sin x| + |\sin 2x| + |\sin 3x| + \ldots} = 2$ are

   (1) 0 (2) π (3) 2π (4) $3\pi/2$

3. The number of solutions of the equation $\cos^{-1}\left(\frac{1+x^2}{2x}\right) - \cos^{-1}x = \frac{\pi}{2} + \sin^{-1}x$ is given by

   (1) 0 (2) 1 (3) 2 (4) 3

4. If $-1 < x < 0$, then $\sin^{-1}x$ equals

   (1) $\pi - \cos^{-1}\left(\sqrt{1-x^2}\right)$ (2) $\tan^{-1}\frac{x}{\sqrt{1-x^2}}$ (3) $-\cot\left(\frac{\sqrt{1-x^2}}{x}\right)$ (4) $\operatorname{cosec}^{-1}x$

5. $\sin^{-1}x + \cot^{-1}\left(\frac{1}{2}\right) = \frac{\pi}{2}$, then x is

   (1) 0 (2) $\frac{\sqrt{3}}{2}$ (3) $\frac{2}{\sqrt{5}}$ (4) $\frac{1}{\sqrt{5}}$

6. The principal value of $\cos^{-1}\left(\cos\frac{2\pi}{3}\right) + \sin^{-1}\left(\sin\frac{2\pi}{3}\right)$ is

   (1) π (2) $\pi/2$ (3) $\pi/3$ (4) $4\pi/3$

7. The value of $\tan^{-1}\left(\frac{a_1x-y}{a_1y+x}\right) + \tan^{-1}\frac{a_2-a_1}{1+a_1a_2} + \tan^{-1}\frac{a_3-a_2}{1+a_2a_3} + \ldots + \tan^{-1}\frac{a_n-a_{n-1}}{1+a_na_{n-1}} + \tan^{-1}\frac{1}{a_n}$ is

   (1) 0 (2) 1 (3) $\tan^{-1}\frac{x}{y}$ (4) $\tan^{-1}\frac{y}{x}$

8. $\cos^{-1}[\cos(2\cot^{-1}(\sqrt{2}-1))]$ is equal to

   (1) $\sqrt{2}-1$ (2) $1-\sqrt{2}$ (3) $\pi/4$ (4) $3\pi/4$

9. The greatest of tan1, $\tan^{-1}1$, sin1, $\sin^{-1}1$ is

   (1) tan1 (2) $\tan^{-1}1$ (3) sin1 (4) $\sin^{-1}1$

10. If $\sin^{-1}x + \sin^{-1}y + \sin^{-1}z = \frac{3\pi}{2}$ then the value of $x^{100} + y^{100} + z^{100} - \frac{3}{x^{101}+y^{101}+z^{101}}$

    (1) 0 (2) 1 (3) 2 (4) 3

11. The equation $\sin^{-1}x - \cos^{-1}x = \cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$ has

    (1) no solution (2) unique solution (3) infinite number of solution (4) None of these

12. A solution of the equation $\tan^{-1}(1+x) + \tan^{-1}(1-x) = \pi/2$ is

(1) $x = 1$ (2) $x = -1$ (3) $x = 0$ (4) $x = \pi$

13. The value of x which satisfies equation $2\tan^{-1}2x = \sin^{-1}\frac{4x}{1+4x^2}$ is

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

14. The value of $\tan^{-1}1 + \tan^{-1}2 + \tan^{-1}3$ is

(1) 0 (2) 1 (3) π (4) $-\pi$

15. If x_1, x_2, x_3, x_4 are roots of the equation $x^4 - x^3\sin2\beta + x^2\cos2\beta - x\cos\beta - \sin\beta = 0$, then $\tan^{-1}x_1 + \tan^{-1}x_2 + \tan^{-1}x_3 + \tan^{-1}x_4 =$

(1) β (2) $\pi/2 - \beta$ (3) $\pi - \beta$ (4) $-\beta$

16. The value of $\sin^{-1}\left[\cot\left(\sin^{-1}\sqrt{\left(\frac{2-\sqrt{3}}{4}\right)} + \cos^{-1}\frac{\sqrt{12}}{4} + \sec^{-1}\sqrt{2}\right)\right]$ *is*

(1) 0 (2) $\pi/4$ (3) $\pi/6$ (4) $\pi/2$

17. If $A = 2\tan^{-1}(2\sqrt{2} - 1)$ and $B = 3\sin^{-1}(1/3) + \sin^{-1}(3/5)$, then

(1) A = B (2) A < B (3) A > B (4) none of these

18. If $x + \frac{1}{x} = 2$, then the principal value of $\sin^{-1}x$ is

(1) $\frac{\pi}{4}$ (2) $\frac{\pi}{2}$ (3) π (4) $\frac{3\pi}{2}$

19. If α satisfies the inequation $x^2 - x - 2 > 0$, then a value exist for

(1) $\sec^{-1}\alpha$ (2) $\sin^{-1}\alpha$ (3) $\cos^{-1}\alpha$ (4) none of these

20. Let $\theta = \tan^{-1}\left(\tan\frac{5\pi}{4}\right)$ and $\phi = \tan^{-1}\left(-\tan\frac{2\pi}{3}\right)$, then

(1) $\theta > \phi$ (2) $4\theta - 3\phi = 0$ (3) $\theta + \phi = \frac{7\pi}{12}$ (4) none of these

21. Let $f(x) = e^{\cos^{-1}\sin\left(x+\frac{\pi}{3}\right)}$, then

(1) $f\left(\frac{8\pi}{9}\right) = e^{\frac{5\pi}{18}}$ (2) $f\left(\frac{8\pi}{9}\right) = e^{\frac{13\pi}{18}}$ (3) $f\left(\frac{-7\pi}{4}\right) = e^{\frac{\pi}{12}}$ (4) $f\left(\frac{-7\pi}{4}\right) = e^{\frac{11\pi}{12}}$

22. If $\cos(2\sin^{-1}x) = \frac{1}{9}$, then value of x equals

(1) $\frac{2}{3}$ (2) $-\frac{2}{3}$ (3) $\frac{1}{3}$ (4) $-\frac{1}{3}$

23. If $\tan^{-1}\frac{x-1}{x+1} + \tan^{-1}\frac{2x-1}{2x+1} = \tan^{-1}\frac{23}{36}$, then x equals to

(1) $\frac{4}{3}$ (2) $-\frac{3}{8}$ (3) $\frac{2}{7}$ (4) $\frac{1}{6}$

24. If $\frac{1}{2} < |x| < 1$, then which of the following are real ?

(1) $\sin^{-1}x$ (2) $\tan^{-1}x$ (3) $\sec^{-1}x$ (4) $\cos^{-1}x$

25. If $6\sin^{-1}\left(x^2-6x+\frac{17}{2}\right)=\pi$; then

(1) x = 1 (2) x = 2 (3) x = 3 (4) x = 4

26. If a < 0, b > 0 then $\sqrt{a}\,.\sqrt{b}$ is equal to

(1) $-\sqrt{|a|.b}$ (2) $\sqrt{|a|.b}\,.i$ (3) $\sqrt{|a|.b}$ (4) None of these

27. The value of the sum $\sum_{n=1}^{13}\left(i^n+i^{n+1}\right)$, where $i=\sqrt{-1}$, is

(1) i (2) $i-1$ (3) $-i$ (4) 0

28. If $x+iy=\frac{a+ib}{a-ib}$ then $x^2+y^2=$

(1) 1 (2) 0 (3) $2i$ (4) $3i$

29. If $(a+ib)^5=\alpha+i\beta$ then $(b+ia)^5$ is equal to

(1) $\beta+i\alpha$ (2) $\alpha-i\beta$ (3) $\beta-i\alpha$ (4) $-\alpha-i\beta$

30. The value of $(1+i)^3+(1-i)^6$ is

(1) i (2) $2(-1+5i)$ (3) $1-5i$ (4) None of these

31. Im(z) is equal to

(1) $\frac{1}{2}(z+\bar{z})i$ (2) $\frac{1}{2}(z-\bar{z})$ (3) $\frac{1}{2}(\bar{z}-z)i$ (4) None of these

32. If $z_1=9y^2-4-10ix, z_2=8y^2-20i$, where $z_1=\bar{z}_2$, then z = x + iy is equal to

(1) $-2+2i$ (2) $-2\pm 2i$ (3) $-2\pm i$ (4) None of these

33. The complex numbers sin x – $i$cos 2x and cos x – $i$sin 2x are conjugate to each other for

(1) $x=n\pi$ (2) x = 0 (3) $x=(2n+1)\frac{\pi}{2}$ (4) No value of x

34. If z = $1+i\tan\alpha$, where $\pi<\alpha<\frac{3\pi}{2}$, then $|z|$ is equal to

(1) $\sec\alpha$ (2) $-\sec\alpha$ (3) $\operatorname{cosec}\alpha$ (4) None of these

35. If z is a complex number satisfying the relation $|z+1|=z+2(1+i)$ then z is

(1) $\frac{1}{2}(1+4i)$ (2) $\frac{1}{2}(3+4i)$ (3) $\frac{1}{2}(1-4i)$ (4) $\frac{1}{2}(3-4i)$

36. If z_1, z_2 are two nonzero complex numbers such that $|z_1+z_2|=|z_1|+|z_2|$ then amp $\frac{z_1}{z_2}$ is equal to

(1) π (2) $-\pi$ (3) 0 (4) $\pi/2$

37. If $z=\frac{\sqrt{3}+i}{\sqrt{3}-i}$ then the fundamental amplitude of z is

(1) $-\frac{\pi}{3}$ (2) $\frac{\pi}{3}$ (3) $\frac{\pi}{6}$ (4) $\frac{\pi}{4}$

38. A value of θ for which $\frac{2+3i\sin\theta}{1-2i\sin\theta}$ is purely imaginary, is:

(1) $\sin^{-1}\left(\frac{\sqrt{3}}{4}\right)$ (2) $\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$ (3) $\frac{\pi}{3}$ (4) $\frac{\pi}{6}$

39. For all complex numbers z of the form $1+i\alpha, \alpha \in$, if $z^2 = x+iy$, then

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

40. Let $z \neq -i$ be any complex number such that $\frac{z-i}{z+i}$ is a purely imaginary number.

Then $z+\frac{1}{z}$ is

(1) 0 (2) Any non-zero real number other than 1

(3) Any non-zero real number (4) A purely imaginary number

41. If z_1, z_2 and z_3, z_4 are 2 pairs of complex conjugate numbers, then $\arg\left(\frac{z_1}{z_4}\right)+\arg\left(\frac{z_2}{z_3}\right)$ equals

(1) 0 (2) $\frac{\pi}{2}$ (3) $\frac{3\pi}{2}$ (4) π

42. If z is a complex number of unit modulus and argument θ, then $\arg\left(\frac{1+z}{1+\bar{z}}\right)$ equals

(1) $-\theta$ (2) $\frac{\pi}{2}-\theta$ (3) θ (4) $\pi-\theta$

43. $|z_1+z_2|^2+|z_1-z_2|^2$ is equal to

(1) $2(|z_1|+|z_2|)$ (2) $2\left(|z_1|^2+|z_2|^2\right)$ (3) $|z_1||z_2|$ (4) $|z_1|^2+|z_2|^2$

44. The locus of a point $P(\alpha, \beta)$ moving under the condition that the line $y=\alpha x+\beta$ is a tangent to the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ is

(1) An ellipse (2) A circle (3) A parabola (4) A hyperbola

45. If the tangent and the normal to $x^2-y^2=4$ at a point cut off intercepts a_1, a_2 on the x-axis respectively and b_1, b_2 on the y-axis respectively then the value of $a_1a_2+b_1b_2$ is

(1) 1 (2) – 1 (3) 0 (4) 4

46. The smallest positive integral value of n for which $\left(\frac{1-i}{1+i}\right)^n$ is purely imaginary with positive imaginary part, is

(1) 1 (2) 3 (3) 5 (4) None of these

47. If z = x + *i*y satisfies amp (z – 1) = amp (z + 3*i*) then the value of (x – 1) : y is equal to $1:\lambda$, where λ is

(1) 4 (2) 3 (3) 1 (4) 6

48. Let z be a complex number of constant modulus such that z^2 is purely imaginary then the number of possible values of z is

(1) 2 (2) 1 (3) 4 (4) 6

49. $|z-4|<|z-2|$ represents the region given by

(1) Re(z) > 0 (2) Re(z) < 0 (3) Re(z) > 2 (4) None of these

50. If $\log_{1/2}\frac{|z|^2+2|z|+4}{2|z|^2+1}<0$ then the region traced by z is

(1) $|z|<3$ (2) $1<|z|<3$ (3) $|z|>1$ (4) $|z|<2$

51. $\left|\frac{z-1}{z+1}\right|=1$ represents

(1) A circle (2) An ellipse (3) A straight line (4) None of these

52. If $\text{Re}\left(\frac{z+4}{2z-i}\right)=\frac{1}{2}$ then z is represented by a point lying on

(1) A circle (2) An ellipse (3) A straight line (4) None of these

53. The angle that the vector representing the complex number $\frac{1}{\left(\sqrt{3}-i\right)^{25}}$ makes with positive direction of the real axis is

(1) $\frac{2\pi}{3}$ (2) $-\frac{\pi}{6}$ (3) $\frac{5\pi}{6}$ (4) $\frac{\pi}{6}$

54. If $|z_1|=|z_2|=|z_3|=|z_4|$ then the points representing z_1, z_2, z_3, z_4 are

(1) Concyclic (2) Vertices of a square
(3) Vertices of a rhombus (4) None of these

55. Suppose z_1, z_2, z_3 are the vertices of an equilateral triangle inscribed in the circle $|z|=2$. If $z_1=1+\sqrt{3}\,i$ and z_1, z_2, z_3 are in the anticlockwise sense then z_2 is

(1) $1-\sqrt{3}\,i$ (2) 2 (3) $\frac{1}{2}\left(1-\sqrt{3}\,i\right)$ (4) None of these

56. If $amp\,\frac{z-1}{z+1}=\frac{\pi}{3}$ then z represnts a point on

(1) A straight line (2) A circle (3) A pair of lines (4) None of these

57. The equation $z\bar{z}+(4-3i)z+(4+3i)\bar{z}+5=0$ represents a circle whose radius is

(1) 5 (2) $2\sqrt{5}$ (3) 5/2 (4) None of these

58. Let z_1 and z_2 be two nonreal complex cube roots of unity and $|z-z_1|^2+|z-z_2|^2=\lambda$ be the equation of a circle with z_1, z_2 as ends of a diameter then the value of λ is

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

59. The equation $|z-i|+|z+i|=k$, k > 0, can represents an ellipse if k is

(1) 1 (2) 2 (3) 4 (4) 1/2

60. The equation $|z-i|+|z+i|=k$ represents a hyperbola is

(1) – 2 < k < 2 (2) k > 2 (3) 0 < k < – 2 (4) k < 0

61. Let $z=1-t+i\sqrt{t^2+t+2}$, where t is real parameter. The locus of z in the Argand plane is

(1) A hyperbola (2) An ellipse (3) A straight line (4) None of these

62. If ω is an imaginary cube root of unity then $\left(1+\omega-\omega^2\right)^7$ equals

(1) $128\,\omega$ (2) $-128\,\omega$ (3) $128\omega^2$ (4) $-128\omega^2$

63. The smallest positive integral value of n for which $\left(1+\sqrt{3}\,i\right)^{n/2}$ is real is

(1) 3 (2) 6 (3) 12 (4) 0

64. If $z^2-z+1=0$ then z^n-z^{-n}, where n is a multiple of 3, is

(1) $2(-1)^n$ (2) 0 (3) $(-1)^{n+1}$ (4) None of these

65. If $\left(\sqrt{3}+i\right)^n=\left(\sqrt{3}-i\right)^n, n\in$□ then the least value of n is

(1) 3 (2) 4 (3) 6 (4) None of these

66. If $z_r=\cos\frac{2r\pi}{5}+i\sin\frac{2r\pi}{5}, r=0,1,2,3,4,...$ then $z_1z_2z_3z_4z_5$ is equal to

(1) – 1 (2) 0 (3) 1 (4) None of these

67. If ω is a nonreal cube root of unity then the expression $(1-\omega)(1-\omega^2)(1+\omega^4)(1+\omega^8)$ is equal to

(1) 0 (2) 3 (3) 1 (4) 2

68. If $3^{49}(x+iy)=\left(\frac{3}{2}+\frac{\sqrt{3}}{2}i\right)^{100}$ and x = ky then k is

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

69. If $\left(\sqrt{3}-i\right)^n=2^n, n\in$□ , the set of integers, then n is a multiple of

(1) 6.000 (2) 10.000 (3) 9.000 (4) 12.000

70. If z is a non real root of $\sqrt[7]{-1}$ then $z^{86}+z^{175}+z^{289}$ is equal to

(1) 0.000 (2) – 1.000 (3) 3.000 (4) 1.000

71. If α is a non real and $\alpha=\sqrt[5]{1}$ then the value of $2^{\left|1+\alpha+\alpha^2+\alpha^{-2}-\alpha^{-1}\right|}$ is equal to

(1) 4.000 (2) 2.000 (3) 1.000 (4) 8.000

72. For a complex number z, the minimum value of $|z|+|z-2|$ is

(1) 1.000 (2) 2.000 (3) 3.000 (4) 4.000

73. If□ ∈□ such that $|z|\geq 5$, then least value of $\left|z+\frac{2}{z}\right|$ is

(1) 4.600 (2) 4.800 (3) 5.400 (4) 5.600

74. The area of the triangle whose vertices are i,α,β , where $i=\sqrt{-1}$ and α,β are the normal cube roots of unity, is

(1) $\frac{3\sqrt{3}}{2}$ (2) $\frac{3\sqrt{3}}{4}$ (3) 0 (4) $\frac{\sqrt{3}}{4}$

75. The angle that the vector representing the complex number $\frac{1}{\left(\sqrt{3}-i\right)^{25}}$ makes with the positive direction of the real axis is

(1) $\frac{2\pi}{3}$ (2) $-\frac{\pi}{6}$ (3) $\frac{5\pi}{6}$ (4) $\frac{\pi}{6}$

76. The value of amp$(i\omega)+amp(i\omega^2)$, where $i=\sqrt{-1}$ and $\omega=\sqrt[3]{1}$ = non real, is

(1) 0 (2) $\frac{\pi}{2}$ (3) π (4) None of these

77. If $z\left(2-i2\sqrt{3}\right)^2=i\left(\sqrt{3}+i\right)^4$ then amplitude of z is

(1) $\frac{5\pi}{6}$ (2) $-\frac{\pi}{6}$ (3) $\frac{\pi}{6}$ (4) $\frac{7\pi}{6}$

78. If z is a non real root of $\sqrt[7]{-1}$ then $z^{86}+z^{175}+z^{289}$ is equal to

(1) 0 (2) – 1 (3) 3 (4) 1

79. If $\left(\sqrt{3}-i\right)^{n}=2^{n}, n\in \square$, the set of integers, then n is a multiple of

(1) 6 (2) 10 (3) 9 (4) 12

80. Let $z_1 = a+ib, z_2 = p+iq$ be two unimodular complex numbers such that $\operatorname{Im}\left(z_1\overline{z_2}\right)=1$. If $\omega_1 = a+ip, \omega_2 = b+iq$ then

(1) $\operatorname{Re}\left(\omega_1\omega_2\right)=1$ (2) $\operatorname{Im}\left(\omega_1\omega_2\right)=1$ (3) $\operatorname{Re}\left(\omega_1\omega_2\right)=0$ (4) $\operatorname{Im}\left(\omega_1\overline{\omega_2}\right)=1$

81. If $z_r = \cos\frac{2r\pi}{5}+i\sin\frac{2r\pi}{5}, r=0,1,2,3,4,\ldots$ then $z_1.z_2.z_3.z_4.z_5$ is equal to

(1) – 1 (2) 0 (3) 1 (4) None of these

82. If $\left(\sqrt{3}+i\right)^{n}=\left(\sqrt{3}-i\right)^{n}, n\in \square$ then the least value of n is

(1) 3 (2) 4 (3) 6 (4) None of these

83. If the fourth roots of unity are z_1, z_2, z_3, z_4 then $z_1^2+z_2^2+z_3^2+z_4^2$ is equal to

(1) 1 (2) 0 (3) i (4) None of these

84. If $x^3-1=0$ has the non real complex roots α, β then the value of $\left(1+2\alpha+\beta\right)^3-\left(3+3\alpha+5\beta\right)^3$ is

(1) – 7 (2) 6 (3) – 5 (4) 0

85. If $i=\sqrt{-1}$ then $4+5\left(\frac{-1}{2}+i\frac{\sqrt{3}}{2}\right)^{334}-3\left(\frac{1}{2}+i\frac{\sqrt{3}}{2}\right)^{365}$ is equal to

(1) $1-i\sqrt{3}$ (2) $-1+i\sqrt{3}$ (3) $4\sqrt{3}\,i$ (4) $-i\sqrt{3}$

PHYSICS

Syllabus: ***1. GRAVITATION, 2. OSCILLATIONS AND WAVES***

1. Two mechanical (transverse) waves move in two identical strings having tensions T_1 and T_2. The waves are given as $y=2\sin(100t-2x)$ and $y_2=4\cos(200t-8x)$. The value of $\frac{T_1}{T_2}=$

   (1) 2 (2) 4 (3) 1 (4) 8

2. Two corks are 10 m apart in a lake. Each goes up and down with period 5 s. It is observed that when one is at its highest point, other one is at lowest point. The possible speed of wave is (in m/s)

   (1) 2.5 (2) 5.0 (3) 40.0 (4) 4.0

3. A point source emits sound of power 200π watts. The loudness of sound at a distance 10 m from the source is (in dB) (reference intensity = 2×10^{-9} W/m^2)

   (1) 70 (2) 84 (3) 74 (4) 100

4. Increase in sound level by 3 dB is equal to an increase in intensity by n times where 'n' is

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

5. A point source produces a sound of loudness L = 40 dB at a distance of r_1. The loudness decreases to 20 dB at a distance r_2. Then r_1/r_2 =

   (1) 0.5 (2) 0.1 (3) 0.05 (4) 0.2

6. Imagine a light planet revolving around a very massive star in a circular orbit of radius R with a period of revolution T. if the gravitational force of attraction between the planet and the star is proportional to $R^{-5/2}$, then

   (1) T^2 is proportional to R^2 (2) T^2 is proportional to $R^{7/2}$
   (3) T^2 is proportional to $R^{3/2}$ (4) T^2 is proportional to $R^{3.75}$

7. A geostationary satellite orbits around the earth in a circular orbit of radius 36,000 km. Then, the time period of a spy satellite orbiting a few hundred km above the earth's surface (R_e = 6400km) will approximately be

(1) 1/2 h (2) 1 h (3) 2 h (4) 4 h

8. If the period of revolution of an artificial satellite just above the earth's surface is T and the density of earth is ρ, then ρT^2

(1) is a universal constant whose value is $\frac{3\pi}{G}$

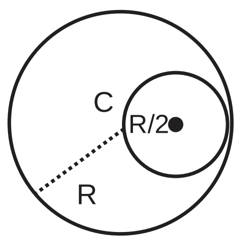
(2) is a universal constant whose value is $\frac{3\pi}{2G}$

(3) is proportional to radius of earth R

(4) is proportional to square of the radius of earth R

Here G = universal gravitational constant

9. A spherical cavity is made in a solid sphere of radius R. The mass of the sphere before hollowing was M. The gravitational field at the centre of the hole due to the remaining mass is (Distance between centres of solid sphere and cavity is $\frac{R}{2}$)

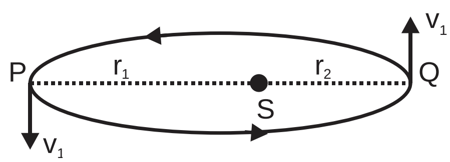


(1) zero (2) $\frac{GM}{8R^2}$ (3) $\frac{GM}{2R^2}$ (4) $\frac{GM}{R^2}$

10. The minimum energy required to launch a satellite of mass m from the surface of earth of radius R in a circular orbit at an altitude 2R is (mass of earth is M)

(1) $\frac{5GmM}{6R}$ (2) $\frac{2GmM}{3R}$ (3) $\frac{GmM}{2R}$ (4) $\frac{GmM}{3R}$

11. A planet is moving in elliptical path around the sun as shown in figure. Speed of planet in figure. Speed of planet in positions P and Q are v_1 and v_2 respectively with SP = r_1 and SQ = r_2, then v_1/v_2 is equal to



(1) $\frac{r_1}{r_2}$ (2) $\frac{r_2}{r_1}$ (3) constant (4) $\left(\frac{r_1}{r_2}\right)^2$

12. If the earth were to suddenly contract to $1/n^{th}$ of its present radius without any change in its mass, the duration of the new day will be nearly

(1) 24/n hours (2) 24n hours (3) $24/n^2$ hours (4) $24n^2$ hours

13. If g is the acceleration due to gravity on the earth's surface, the gain in the potential energy of an object of mass m raised from the surface of the earth to a height equal to the radius R of the earth, is

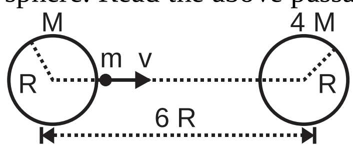
(1) $\frac{1}{2}mgR$ (2) 2mgR (3) mgR (4) $\frac{1}{4}mgR$

14. A double star system consists of two stars A and B which have time periods T_A and T_B. Radius R_A and R_B and mass M_A and M_B. Choose the correct option.
(1) If $T_A > T_B$ then $R_A > R_B$ (2) If $T_A > T_B$ then $M_A > M_B$
(3) $\left(\frac{T_A}{T_B}\right)=\left(\frac{R_A}{R_B}\right)$ (4) $T_A = T_B$

15. A uniform ring of mass M and radius R is placed directly above a uniform sphere of mass 8M and of same radius R. the centre of the ring is at a distance of d = $\sqrt{3}$ R from the centre of the sphere. The gravitational attraction between the sphere and the ring is
(1) $\frac{8GM^2}{R^2}$ (2) $\frac{2GM^2}{\sqrt{3}R^2}$ (3) $\frac{3GM^2}{2R^2}$ (4) $\frac{\sqrt{3}GM^2}{R^2}$

Passage:–

Two uniform solid spheres of equal radii R, but mass M and 4M have a centre to centre separation 6R, as shown in the figure. The two spheres are held fixed. A projectile of mass m is projected from the surface of the sphere of mass M directly towards the centre of the second sphere. Read the above passage and answer the following questions.



16. When the projectile is launched with the minimum speed v_m such that it reaches the surface of the second sphere.
(1) its speed on the surface of the second sphere is zero
(2) its speed on the surface of the second sphere is less than v_m.
(3) its speed on the surface of the other projectile is equal to v_m
(4) its speed on the surface of the other projectile is more than v_m

17. The distance from the centre of the sphere of mass M of the point between the two sphere where the net gravitational force on the projectile is zero is
(1) 4R (2) 3R (3) 2 R (4) $\sqrt{5}$R

18. The value of v_m is (V_m = minimum speed such that is reaches the surface of other sphere)
(1) $\left(\frac{3GM}{5R}\right)^{1/2}$ (2) $\left(\frac{3GM}{4R}\right)^{1/2}$ (3) $\left(\frac{2GM}{5R}\right)^{1/2}$ (4) $\left(\frac{2GM}{3R}\right)^{1/2}$

19. In a satellite moving around any planet, an ice cube exists. As it melts with passage of time, its shape will
(1) Remain unchanged (2) Change to spherical
(3) Become oval-shaped with long axis along the orbit plane
(4) Become oval-shaped with long axis perpendicular to orbit plane

20. A string of mass per unit length μ is clamped at both ends such that one end of the string is at x=0 and the other is at x=*l*. When string vibrates in fundamental mode amplitude of the mid-point O of the string is a, and tension in the string is T. Find the total oscillation energy stored in the string.
(1) $\frac{\pi^2 a^2 T}{2\ell}$ (2) $\frac{\pi^2 a^2 T}{4l}$ (3) $\frac{\pi^2 a^2 T}{\ell}$ (4) $\frac{2\pi^2 a^2 T}{\ell}$

21. A metallic rod of length 1 m is rigidly clamped at its mid-point. Longitudinal stationary waves are set-up in the rod in such a way that there are two nodes on either side of the mid-point. The amplitude of an antinode is 2×10^{-6}m. Write the equation of motion at a point 2cm from the mid-point. (Young's modulus of the material of the rod $= 2\times10^{11}\,Nm^{-2}$; density = 8000 kg m^{-3}).
(1) $y = 2\times10^{-6}\sin(0.1\pi)\sin(25000\pi t)$ (2) $y = 2\times10^{-6}\sin(0.2\pi)\sin(25000\pi t)$
(3) $y = 2\times10^{-6}\sin(0.1\pi)\sin(30000\pi t)$ (4) $y = 2\times10^{-6}\sin(0.2\pi)\sin(30000\pi t)$

22. A steel wire of length 1 m, mass 0.1 kg and uniform cross-sectional area $10^{-6}\,m^2$ is rigidly fixed at both ends. The temperature of the wire is lowered by 20°C. If transverse waves are set-up by plucking the string in the middle, calculate the frequency of the fundamental mode of vibration.
Given : $Y_{steel} = 2\times10^{11}\,N/m^2,\ \alpha_{steel} = 1.21\times10^{-5}/^{o}C$

(1) 11 Hz (B) 12 Hz (3) 13 Hz (4) 14 Hz

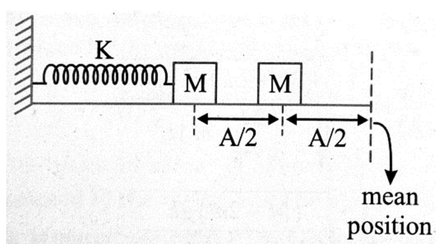
23. A copper wire is held at the two ends by rigid supports. At 30°C, the wire is just taut, with negligible tension. Find speed of transverse waves in this wire at 10°C.
Given, Young modulus of copper $== 1.3\times10^{11}\,N/m^2$,
Coefficient of linear expansion of copper $= 1.7\times10^{-5}\,{}^{o}C^{-1}$.
Density of copper $= 9\times10^3\,kg/m^3$

(1) 71.3 m/s (2) 72.4 m/s (3) 73.3 m/s (4) 70.1 m/s

24. The displacement of particles in a string stretched in the x-direction is represented by y. Among the following expressions for y, those describing wave motion is (are)

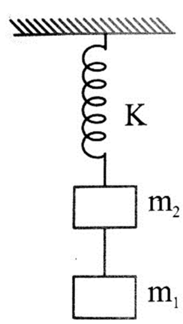
(1) $\cos kx \sin \omega t$ (2) $k^2x^2 - \omega^2t^2$
(3) $\cos^2(kx + \omega t)$ (4) Both (A) and (C)

25. A block of mass M is connected to a spring of force constant K and is placed on a smooth horizontal surface. The block is displaced and compressed the spring by "A". The block is left free to move from this position, when it is at a distance A/2 from mean position it collides elastically with another identical block. Total time taken by the block to move from extreme position to mean position is .



(A) $2\pi\sqrt{\frac{M}{K}}$ (B) $\frac{\pi}{2}\sqrt{\frac{M}{K}}$ (C) $\frac{\pi}{2}\sqrt{\frac{2M}{K}}$ (D) $\frac{5\pi}{6}\sqrt{\frac{M}{K}}$

26. Two masses m_1 and m_2 are suspended together by a massless spring of spring constant k (Fig). When the masses are in equilibrium, m_1 is removed. Frequency and amplitude of oscillation of m_2 are

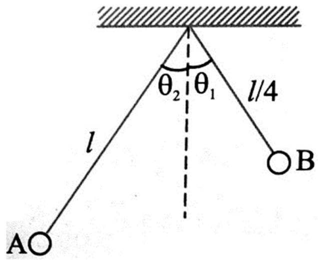


(A) $\omega = \sqrt{\frac{K}{m_1}}; A = \frac{m_2 g}{K}$ (B) $\omega = \sqrt{\frac{K}{m_2}}; A = \frac{m_1 g}{K}$

(C) $\omega = \sqrt{\frac{K}{m_1}}; A = \frac{m_1 g}{K}$ (D) $\omega = \sqrt{\frac{K}{m_2}}; A = \frac{m_2 g}{K}$

27. Two simple pendulums A and B having lengths l and $l/4$ respectively are released from the position as shown in fig. Calculate the time (in seconds) after which the two strings become parallel for the first time.

(Take $l=\frac{90}{\pi^2}$ m and $g=10\,m/s^2$) $\theta_1=\theta_2$



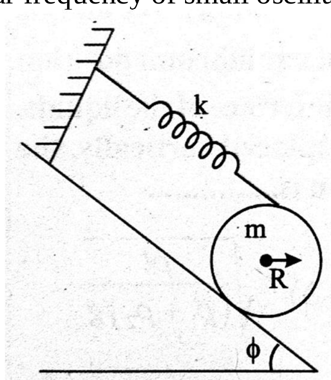
(1) 1 (2) 2 (3) 3 (4) 4

28. A torsional pendulum that consists of a uniform disc of mass m and R attached to a thin rod of torsional constant C. Initially, the disc is imparted an angular speed ω_0. The amplitude and energy of small torsional oscillations of the disc, respectively are

(1) $2\sqrt{\frac{mR^2}{2C}}\omega_0 . \frac{1}{2}mR^2\omega_0^2$ (2) $\sqrt{\frac{3mR^2}{2C}}\omega_0 . \frac{1}{4}mR^2\omega_0^2$

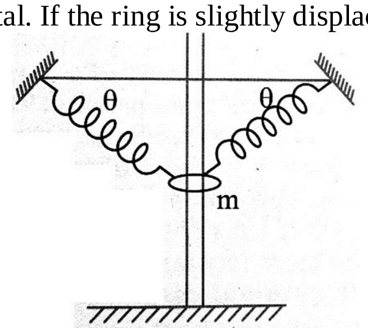
(3) $\frac{1}{2}\sqrt{\frac{mR^2}{2C}}\omega_0 . \frac{1}{2}mR^2\omega_0^2$ (4) $\sqrt{\frac{mR^2}{2C}}\omega_0 . \frac{1}{4}mR^2\omega_0^2$.

29. A uniform cylinder of mass m and radius R is in equilibrium on an inclined plane by the action of a light spring of stiffness k, gravity and reaction force acting on it. If the angle of inclination of the plane is ϕ, then angular frequency of small oscillations of the cylinder is .



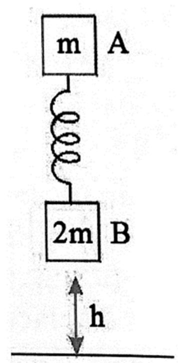
(1) $2\sqrt{\frac{k}{m}}$ (2) $2\pi\sqrt{\frac{ml}{F_0}}$ (3) $2\sqrt{\frac{2k}{3m}}$ (4) $\sqrt{\frac{2k}{m}}$

30. A ring of mass m can freely slide on a smooth vertical rod. The ring is symmetrically attached with two springs, as shown, each of stiffness k. Ring is displaced such that each spring makes an angle θ with the horizontal. If the ring is slightly displaced vertically, then time period is .



(1) $2\pi\sqrt{\frac{m}{k}}$ (2) $2\pi\sqrt{\frac{m\sin\theta}{2k}}$ (3) $\frac{2\pi}{\sin\theta}\sqrt{\frac{m}{2k}}$ (4) $\frac{\pi}{\sin\theta}\sqrt{\frac{m}{2k}}$.

31. From what minimum height h must the system be released when spring is unstretched so that after perfectly inelastic collision (e=0) with ground, B may be lifted off the ground : (Spring constant = k)



(1) mg/(4k) (2) 4mg/ k (3) mg / (2k) (4) 2 mg / k

32. A particle is subjected to two SHMs $x_1 = A_1 \sin\omega t$ and $x_2 = A_2 \sin\left(\omega t + \frac{\pi}{4}\right)$. The resultant SHM will have an amplitude of

(1) $\frac{A_1 + A_2}{2}$ (2) $\sqrt{A_1^2 + A_2^2}$ (3) $\sqrt{A_1^2 + A_2^2 + \sqrt{2}A_1A_2}$ (4) A_1A_2

33. The equation of motion of a particle in SHM is $a + 16\pi^2 x = 0$. Here 'a' is linear acceleration of the particle at displacement 'x' (a, x are in SI). Its time period is

(1) $\frac{1}{4}$s (2) $\frac{1}{2}$s (3) 1 s (4) 2s

34. The amplitude of a damped oscillator becomes $\frac{1}{27}$th of its initial value after 6 minutes. Its amplitude after 2 minutes is

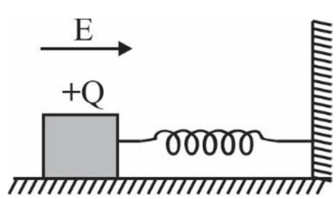
(1) $\frac{A_0}{3}$ (2) $\frac{A_0}{9}$ (3) $\frac{A_0}{54}$ (4) $\frac{A_0}{81}$

35. One end of a long metallic wire of length L is tied to the ceiling. The other end is tied to a massless spring of spring constant k. A mass m hangs freely from the free end of the spring. The area of cross-section and the Young's modulus of the wire are A and Y respectively. If the mass is slightly pulled down and released, it will oscillate with a time period T equal to

(1) $2\pi(m/k)^{1/2}$ (2) $2\pi\sqrt{\frac{m(YA + kL)}{YAk}}$

(3) $2\pi\left[(mYA/kL)^{1/2}\right]$ (4) $2\pi(mL/YA)^{1/2}$.

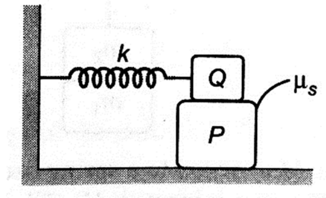
36. A wooden block performs SHM on a frictionless surface with frequency v_0. The block carries a charge +Q on its surface. If now a uniform electric field E is switched-on as shown, then the SHM of the block will be



(A) of the same frequency and with shifted mean position
(B) of the same frequency and with the same mean position
(C) of changed frequency and with shifted mean position
(D) of changed frequency and with the same mean position.

37. A block P of mass m is placed on a horizontal frictionless plane. A second block of same mass m is placed on it and is connected to a spring of spring constant k, the two blocks are pulled by

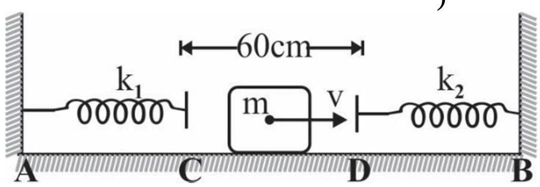
a distance A. Block Q oscillates without slipping. What is the maximum value of frictional force between the two blocks?



(1) kA/2 (2) kA (3) $\mu_s mg$ (4) Zero.

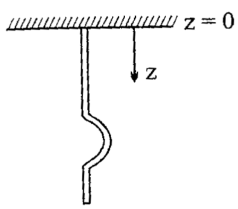
38. Two light springs of force constants k_1 and k_2 and a block of mass m are in one line AB on a smooth horizontal table such that one end of each spring is fixed on rigid supports and the other end is free as shown in the figure. The distance CD between the free ends of the spring is 60 cm. If the block moves along AB with a velocity 120 cm/s in between the springs, calculate the period o oscillation of the block.

(Take, $k_1 = 1.8 N/m,\ k_2 = 3.2 N/m,\ m = 200g$)



(1) 2.82 S (2) 1.82 S (3) 0.82 S (4) 3.82 S

39. A rope hangs from a rigid support. A pulse is set by jiggling the bottom end. We want to design a rope in which velocity v of pulse is independent of z, the distance of the pulse from fixed end of the rope. If the rope is very long the desired function for mass per unit length $\mu(z)$ in terms of μ_0 (mass per unit length of the rope at the top $(z=0)$, g, v and z is ('g' is acceleration due to gravity)



(1) $\mu(z) = \mu_0 e^{-[g/v^2]z}$

(2) $\mu(z) = \mu_0 e^{+[g/v^2]z}$

(3) $\mu(z) = \mu_0 \log_e\left(\frac{g}{v^2}\right)z$

(4) $\mu(z) = \mu_0 e + \left(\frac{v^2}{g}\right)z$

40. The pressure amplitude in a sound wave from a radio receiver is 2.0×10^{-2} N/m^2 and the intensity at a point is 5.0×10^{-7} W/m^2. If by turning the "volume" knob the pressure amplitude is increased to 2.5×10^{-2} N/m^2 evaluate the intensity.

(1) 8.8×10–7 W/m^2. (3) 7.8 ×10–7 W/m^2.

(3) 5.8×10^{7} W/m^2 (4) None

41. The wave disturbance propagating in the positive x-direction is given by y = $\frac{1}{1+x^2}$ at t = 0 and y = $\frac{1}{\left[1+(x-1)^2\right]}$ at t = 2 sec. Find the velocity of the wave. (x and y are in cm)

(1) 0.5 cm/sec (2) 1 cm/sec (3) 2 cm/sec (4) 4 cm/sec

42. If the Young's modulus of material of rod is 2×10^{11} N/m^2 and density is $8000 kg/m^3$, , what is the time taken by sound wave to travel 1m of the rod?

(1) 10^{-4} sec (2) 10^{-2} sec (3) 2×10^{-4} sec (4) 2×10^{-2} sec

43. A string of length 'L' is fixed at both ends. It is vibrating in its 3rd overtone with maximum amplitude 'a'. The amplitude at a distance L/3 from one end is

(1) a (2) 0 (3) $\frac{\sqrt{3}}{2}a$ (4) $\frac{a}{2}$

44. The time taken by a transverse pulse to travel full length of a uniform rope of mass 0.1 kg and length 2.45 m hanging from the ceiling, is

(1) 1 s (2) 0.5 s (3) 2 s (4) 1.5 s

45. The ends of a stretched wire of length L are fixed at x=0 and x=L. In one experiment, the displacement of particles of the wire is $Y_1 = A\sin\left(\frac{\pi x}{L}\right)\sin\omega t$ and energy is E_1 and in another experiment it is $Y_2 = A\sin\left(\frac{2\pi x}{L}\right)\sin 2\omega t$ and energy is E_2. Then

(1) $E_2=E_1$ (2) $E_2=2E_1$ (3) $E_2 = 4E_1$ (4) $E_2 = 16E_1$

46. The natural frequency of a tuning fork P is 432 Hz. 3 beats are produced when tuning fork P and another tuning fork Q are sounded together. If P is loaded with wax, the number of beats increases to 5 beats/s. The frequency of Q is

(1) 429 Hz (2) 435 Hz (3) 437 Hz (4) 427 Hz

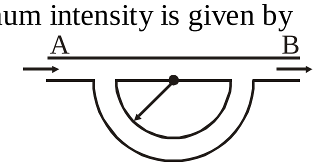
47. An organ pipe P_1 closed at one end vibrating in its first harmonic and another pipe P_2 open at ends vibrating in its third harmonic are in resonance with a given tuning fork. The ratio of the length of P_1 and $P_2$is :

(1) $\frac{8}{3}$ (2) $\frac{3}{8}$ (3) $\frac{1}{6}$ (4) $\frac{1}{3}$

48. A tuning fork vibrating with a sonometer wire of length 20 cm produces 5 beats per second. The beat frequency does not change if the length of the wire is changed to 21 cm. The frequency of the tuning fork must be

(1) 200 Hz (2) 210 Hz (3) 205 Hz (4) 215 Hz

49. Sound signal is sent through a composite tube as shown in the figure. The radius of the semicircular portion of the tube is r. Speed of sound in air is v. The source of sound is capable of giving varied frequencies in the range of ν_1 and ν_2 (where $\nu_2 > \nu_1$). If n is an integer then frequency for maximum intensity is given by



(1) $\frac{nv}{r}$ (2) $\frac{nv}{r(\pi-2)}$ (3) $\frac{nv}{\pi r}$ (4) $\frac{nv}{(r-2)\pi}$

50. Two pipes have each of length 2 m. One is closed at one end and the other is open at both ends. The speed of sound in air is 340 m/s. The frequency at which both can resonate is?

(1) 340 Hz (2) 510 Hz (3) 42.5 Hz (4) none of these.

51. Two persons A and B each carrying a source of sound of frequency 500 Hz are standing a few meter apart. A starts moving towards B with a velocity of 4.5 m/s. If the speed of sound is 300 m/s, which of the following statements are true?

(1) A hears a note of lower frequency
(2) Number of beats heard by A is higher than that heard by B
(3) The number of beats heard by B is 37 in 5 second
(4) Both A and B will hear the same number of beats every second

52. An engine moving towards a wall with a velocity 50 m/s emits a note1.2 kHz. Speed of sound in air is 350 m/s. The frequency of the note after reflection from the wall as heard by the driver of the engine is

(1) 2.4 kHz (2) 0.24 kHz (3) 1.6 kHz (4) 1.2 kHz

53. An engine is moving on a circular path of radius 100 m with a speed of 20 m/s. What will be the frequency observed by an observer standing stationary at the centre of circular path when the engine blows a whistle of frequency 500 Hz?
(1) more than 500 Hz (2) less than 500 Hz
(3) 500 Hz (4) no sound is heard

CHEMISTRY

Syllabus: ***SECOND YEAR IN ORGANIC CHEMISTRY:– 1.GENERAL PRINCIPAL OF METALLURGY, 2.GROUP -15 ELEMENTS, 3. GROUP -16 ELEMENTS, 4. GROUP -17 ELEMENTS , 5.GROUP -18 ELEMENTS, 6.D AND F -BLOCK ELEMENTS AND CO-ORDINATION COMPOUNDS***

1. Which is a double salt?
(1) Carnallite (2) Potassium Ferro cyanide
(3) Potassium ferricyanide (4) Nesslers reagent

2. What is the coordination number of metal in $[Co(en)_2Cl_2]^+$?
(1) 4 (2) 5 (3) 6 (4) 3

3. The fraction of chloride precipitated by 1 M $AgNO_3$ solution form $[Cu(NH_3)_5Cl]Cl_2$ is
(1) 1/2 (2) 2/3 (3) 1/3 (4) 1/4

4. The correct IUPAC name of $Mn_3(CO)_{12}$ is
(1) Dodecacarbonylmanganate (0) (2) Dodecacarbonylmanganic (II)
(3) Dodecacarbonyltrimanganese (0) (4) Manganicdodecacarbonyl (0)

5. The complex ions $[Co(NO_2)(NH_3)_5]^{2+}$ and $[Co(ONO)(NH_3)_5]^{2+}$ are called
(1) Ionization isomers (2) Linkage isomers
(3) Coordination isomers (4) Geometrical isomers

6. The coordination number and oxidation number of X in the compound $[X(SO_4)(NH_3)_5]$ will be
(1) 10 and 3 (2) 1 and 6 (3) 6 and 2 (4) 6 and 4

7. Which one of the following octahedral complexes does not show geometric isomerism? (A and B are monodentate ligands)
(1) $[MA_2B_4]$ (2) $[MA_3B_3]$ (3) $[MA_4B_2]$ (4) $[MA_5B]$

8. The diamagnetic complex among the following is
(1) $[Fe(CN)_6]^{4-}$ (2) $[Cu(NH_3)_4]^{2+}$ (3) $[Ni(H_2O)_4]^{2+}$ (4) $[Ti(H_2O)_6]^{3+}$

9. Assign the hybridization, shape and magnetic moment of $K_2[Cu(CN)_4]$
(1) sp^3, tetrahedral, 1.73 B.M. (2) dsp^2, square planar, 1.73 B.M.
(3) sp^3, tetrahedral, 2.44 B.M. (4) dsp^2, square planar, 2.44 B.M.

10. What will be the most probable coordination number of Nickel in a complex in which it has zero oxidation state.
(1) 4 (2) 5 (3) (4) Not predictable

11. Is of intense pink colour, though Mn is in (+7) oxidation state. It is due to
(1) Oxygen gives colour to it
(2) Charge transfer when Mn gives its electron to oxygen
(3) Charge transfer when oxygen gives its electrons to Mn making in Mn (+VI) hence coloured
(4) None is correct

12. The correct order of magnetic moments (spin only values in B.M.) among is

(1) $[Fe(CN)_6]^{4-} > [MnCl_4]^{2-} > [CoCl_4]^{2-}$ (2) $[MnCl_4]^{2-} > [Fe(CN)_6]^{4-} > [CoCl_4]^{2-}$

(3) $[MnCl_4]^{2-} > [CoCl_4]^{2-} > [Fe(CN)_6]^{2-}$ (4) $[Fe(CN)_6]^{4-} > [CoCl_4]^{2-} > [MnCl_4]^{2-}$

(Atomic nos. Mn = 25, Fe = 26, Co = 27)

13. Which of the following ligands forms a chelate

(1) Acetate (2) Oxalate (3) Cyanide (4) Ammonia

14. Among the following which are ambidentate ligands

(i) NO_2^- (ii) NO_3^- (iii) $EDTA^{4-}$ (iv) $C_2O_4^{2-}$

(v) SCN^- (vi) $H_2NCH_2CH_2NH_2$

(1) (i) and (ii) (2) (iii) and (iv) (3) (i) and (v) (4) (iii) and (iv)

15. In $[Ni(NH_3)_4]SO_4$, the E.A.N. of Ni is

(1) 34 (2) 35 (3) 36 (4) 37

16. $Ag_2S + NaCN \rightarrow Na\left[Ag(CN)_2\right] + Na_2S$ Equilibrium is shifted right hand side in presence of

(1) N_2 (2) H_2 (3) blast of air (4) Na_2S

17. $CuSO_4$ + KI $\longrightarrow$ ppt (A) + Salt (B): The white ppt (A) is(white)

(1) CuI_2 (2) Cu_2I_2 (3) $[CuI_4]^{-3}$ (4)

18. Consider the following isomerisms

1. Ionization 2. Hydrate 3. Co-ordination

4. Geometrical 5. Optical

Which of the above isomerisms are exhibited by $[Cr(NH_3)_2(OH)_2(cl_2]^{-1}$?

(1) 1 and 5 (2) 2 and 3 (3) 3 and 4 (4) 4 and 5

19. Crystal field splitting energy (Δ) for transition metals belonging to different transition series lies in the order:

(1) 3d > 4d > 5d (2) $3d \approx 4d \approx 5d$ (3) $3d < 4d < 5d$ (4) $3d > 4d > 5d$

20. Name the metal M which is extracted on the basis of following reactions:

$4M + 8CN^- + 2H_2O + O_2 \longrightarrow 4[M(CN)_2]^- + 4OH^-$

$2[M(CN)_2]^- + Zn \longrightarrow [Zn(CN)_4]^{2-} + 2M$

(1) Nickel (2) Silver (3) Copper (4) Mercury

SECTION-II
(Numerical Value Answer Type)

21. The total number of isomers possible for the complex $\left[Co(en)_2 Cl_2\right]^+$ is:

(1) 3 (2) 4 (3) 5 (4) 2

22. Identify the number of amphoteric species amongst the following:

$Mn_2O_7, CrO_3, V_2O_5, V_2O_4, V_2O_3, CrO, Fe_2O_3$

(1) 3 (2) 2 (3) 5 (4) 7

23. Define the oxidation states of Mn in product of the given reaction

$3K_2MnO_4 + 2H_2O + 4CO_2 \rightarrow 2X + Y + 4KHCO_3$ If the oxidation state of Mn in product X and Y are n_1 and n_2 respectively. Then find out the value of $(n_1 + n_2)$.

(1) 13 (2) 15 (3) 11 (4) 7

24. How many non-axial d-orbitals are involved in hybridization of CrO_2Cl_2?

(1) 7 (2) 5 (3) 4 (4) 3

25. Total number of moles of Mohr's salt required per mole of dichromate ions during volumetric analysis are…..

(1) 9 (2) 6 (3) 3 (4) 2

26. Ethylenediamine is an example of a …………………………….. legend.

(1) Mon dentate (2) Dentate
(3) Tridentate (4) Hex dentate

27. How many EDTA molecules are required to make an octahedral complex with Ca^{2+} ion?

(1) Six (2) Three (3) One (4) Two

28. A complex compound in which the oxidation number of metal is zero :

(1) $\left[Ni(CO)_4\right]$ (2) $\left[Pt(NH_3)_4\right]Cl_2$
(3) $K_4\left[Fe(CN)_6\right]$ (4) $K_3\left[Fe(CN)_6\right]$

29. The IUPAC name for the complex $\left[Co(NH_3)_5(NO_2)\right]Cl_2$ is

(1) nitrito-n-pentaamine cobalt (III) chloride
(2) nitrio-n-pentaamine cobalt (II) chloride
(3) pentaamine nitrio-n-cobalt (II) chloride
(4) penta amine nitrio-n-cobalt (III) Chloride

30. The IUPAC name of $Ni(CO)_4$ is

(1) Tetra carbonyl nickel ate (0) (2) Tetra carbonyl nickel ate (II)
(3) Tetra carbonyl nickel (0) (4) Tetra carbonyl nickel (II)

31. $\left[Co(NH_3)_5NO_2\right]Cl_2$ and $\left[Co(NH_3)_5ONO\right]Cl_2$ Br are related to each other as :

(1) Ionization isomers (2) linkage isomers
(3) Coordination isomers (4) geometrical isomers

32. Which of the following has the highest molar conductivity in solutio ?

(1) $\left[Pt(NH_3)_6\right]Cl_4$ (2) $\left[Pt(NH_3)_5Cl\right]Cl_3$
(3) $\left[Pt(NH_3)_4Cl_2\right]Cl_2$ (4) $\left[Pt(NH_3)_3Cl_2\right]Cl$

33. The hybridization in $Ni(CO)_4$ is :

(1) sp (2) sp^2 (3) sp^3 (4) dsp^2

34. The hybridization of Fe in $K_3\left[Fe(CN)_6\right]$ is

(1) sp^3 (2) dsp^3 (3) sp^3d^2 (4) d^2sp^3

35. Which one of the following is paramagnetic in nature?

(1) $Ni(CO)_4$ (2) $\left[Ni(CN)_4\right]^{2-}$ (3) $[NiCl_4]^{2-}$ (4) $\left[Co(NH_3)_6\right]^{3+}$

36. Which of the following systems has maximum number of unpaired electrons?

(1) d^4(octahedral, low spin) (2) d^6(tetrahedral)
(3) d^6(octahedral, low spin) (4) d^9(octahedral)

37. The following complex ions, which is diamagnetic in nature?

(1) $[NiCl_4]^{2-}$ (2) $\left[Ni(CN)_4\right]^{2-}$ (3) $[CuCl_4]^{2-}$ (4) $[CoF_6]^{3-}$

38. The complex ion which has the highest magnetic movement is :

(1) $[CoF_6]^{3-}$ (2) $\left[Co(NH_3)_6\right]^{3+}$ (3) $\left[Ni(NH_3)_4\right]^{2+}$ (4) $\left[Ni(CN)_4\right]^{2-}$

39. Which of the following is not ambidentate ligands?

(1) CN^- (2) SCN^- (3) NO_2^- (4) CH_3COO^-

40. Which of the following is inner orbital complex(es) ?

(1) $[CoF_6]^{3-}$ (2) $\left[Co(NH_3)_6\right]^{3+}$ (3) $\left[Fe(F)_6\right]^{4-}$ (4) $\left[Ni(NH_3)_6\right]^{2+}$

41. Which of the following is strongest field ligand in spectro chemical series ?
(1) CN^- (2) H_2O (3) F^- (4) Cl^-

42. π-bonded organometallic compound(s) is:
(1) Ferrocene (2) Bronze
(3) Trimethyl tin (4) Grignard reagent

43. The compounds that exhibit geometrical isomerism is
(1) $[Pt(en)Cl_2]$ (2) $[Pt(en)_2]Cl_2$
(3) $[Pt(en)_2Cl_2]Cl_2$ (4) $[FeF_6]^{3-}$

44. The complex possessing geometrical isomerisms
(1) $[Ni(gly)_3]^-$ (2) $[Nicl_2Br_2]^{-2}$ (3) $[ptcl_3Br]^{-2}$ (4) $[pt(en)_2]^{+2}$

45. Which of the following complex compounds exhibits cis-trans isomerism?
(1) $[Co(NH_3)_4(H_2O)Cl]$ (2) $[Co(NH_3)_3Cl_2]$
(3) $[Co(NH_3)_4Cl_2]$ (4) All of these

SECTION-II
(Numerical Value Answer Type)

46. The number of chloride ions which would be precipitated, when $CrCl_3.4NH_3$ is treated with silver nitrate solution :
(1) 3 (2) 2 (3) 1 (4) 0

47. The number of unpaired electrons in the complex ion $[CoF_6]^{3-}$ is :
(1) 3 (2) 4 (3) 0 (4) 2

48. The magnetic moment (spin only) of $[NiCl_4]^{2-}$ is
(1) 1.82 B.M (2) 5.46 B.M (3) 2.82 B.M (4) 1.41 B.M

49. The effective atomic number of Cr (Z = 24) in $[Cr(NH_3)_6]Cl_3$ is x×10 here x is
(1) 3.5 (2) 2.7 (3) 3.3 (4) 3.6

50. In $[Co(NH_3)_6]Cl_3$, the number of covalent bonds is
(1) 3 (2) 6 (3) 9 (4) 18

51. Which of the following is coloured?
(1) $[Sc(H_2O)_6]^{3+}$ (2) $[Ti(H_2O)_6]^{3+}$ (3) $ScCl_3$ (4) $TiCl_4$

52. The purple colour of $KMnO_4$ is due to
(1) Incomplete d-subshell (2) Ionic nature of $KMnO_4$
(3) Charge transfer (4) Resonance in MnO_4^- ion

53. In which case there is change in oxidation number?
(1) Aq. solution of CrO_4^{2-} is acidified (2) SO_2 gas is passed into $Cr_2O_7^{2-}/H^+$
(3) $Cr_2O_7^{2-}$ solution is made alkaline (4) CrO_2Cl_2 is dissolved in NaOH

54. If Hund's Rule is not followed magnetic moment of Fe^{+2}, Mn^+ and Cr all having 24 electron will be in order
(1) $Mn^+ = Cr > Fe^{+2}$ (2) $Mn^+ < Cr > Fe^{+2}$
(3) $Mn^+ > Cr > Fe^{-2}$ (4) $Fe^{+2} > Cr > Mn^+$

55. Which of the following compound will not give positive chromyl chloride test :
(1) $CuCl_2$ (2) KCI (3) $HgCl_2$ (4) $C_6H_5NH_3^{\oplus}$ CI

56. Which of the following statement is not correct:
(1) $La(OH)_3$ is less basic than $Lu(OH)_3$
(2) In Lanthanide series ionic radius decreases from La^{+3} to Lu^{+3} ion
(3) La is actually an element of transition series rather than Lanthanide
(4) Atomic radius of Zr and Hf are same because of Lanthanide contraction

57. In the first transition series the melting point of Mn is low, because :
(1) Metallic bonds are strong due to d^{10} configuration
(2) Metallic bonds are weak due to d^5 configuration
(3) Metallic bonds are weak due to d^7 configuration
(4) d-orbitals have less unpaired electrons

58. Which one of the following is not a condition for complex salt formation :
(1) Small size
(2) Higher nuclear charge
(3) Availability of vacant d-orbitals
(4) Variable oxidation states

59. d- block elements form colours ions because these elements :
(1) Cannot absorb the radiation in the visible region
(2) Involve d-d transitions which fall in the visible region
(3) Allows d-s transition
(4) Absorb other colours except those required for d-d transition

60. The correct order of acidic strength is
(1) $Cl_2O_7 > SO_2 > P_4O_{10}$
(2) $CO_2 > N_2O_5 > SO_3$
(3) $Na_2O > MgO > Al_2O_3$
(4) $K_2O > CaO > MgO$

61. The true statement for the acids of phosphorus, H_3PO_2, H_3PO_3 and H_3PO_4 is
(1) The order of their acidity is $H_3PO_4 > H_3PO_3 > H_3PO_2$
(2) All of them are reducing in nature.
(3) All of them are tribasic acids.
(4) The geometry of phosphorus is tetrahedral in all the three.

62. In which of the following acids, P–P bond is present?
(1) Hypophosphoric acid ($H_4P_2O_6$)
(2) Pyrophosphoric acid ($H_4P_2O_7$)
(3) Orthophosphoric acid (H_3PO_4)
(4) Polymetaphosphoric acid $(HPO_3)_n$

63. Choose the correct statement regarding
$K_2Fe[Fe(CN)_6]$ and $K\,Fe[Fe(CN)_6]$
(1) Both are blue coloured due to *d-d* transition
(2) Both are of different colour but colour is due to charge transfer
(3) $K_2Fe[Fe(CN)_6]$ is white but $K\,Fe[Fe(CN)_6]$ is blue coloured
(4) Both are blue coloured due to charge transfe

64. Amongst $Ni(CO)_4$, $[Ni(CN)_4]^{2-}$ and $[NiCl_4]^{2-}$
(1) $Ni(CO)_4$ and $(NiCl_4)^{2-}$ are diamagnetic and $[Ni(CN)_4]^{2-}$ is paramagnetic
(2) $[NiCl_4]^{2-}$ and $[NI(CN)_4]^{2-}$ are diamagnetic and $Ni(CO)_4$ is paramagnetic
(3) $Ni(CO)_4$ and $[Ni(CN)_4]^{2-}$ are diamagnetic and $[NiCl_4]^{2-}$ is paramagnetic
(4) $Ni(CO)_4$ is diamagnetic, $[NICl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ are paramagnetic

65. Which statement about co-ordination number of a cation is true ?
(1) Metal ions exhibit only a single characteristic co-ordination number
(2) The co-ordination number is equal to the number of ligands bonded to the metal atom
(3) The co-ordination number is determined solely by the number of empty -*d*-orbitals in the atom
(4) Co-ordination number is equal to the number of coordinate bonds between metal cation and ligands

66. In which of following pairs of species the number of unpaired electrons are same ?

(1) $[CoF_6]^{3-}$, $[FeF_6]^{3-}$ (2) $[Fe(CN)_6]^{3-}$, $[Fe(CN)_6]^{4-}$

(3) $[Fe(CN)_6]^{3-}$, $[Ni(CN)_4]^{2-}$ (4) $[CoF_6]^{3-}$, $[Fe(H_2O)_6]^{2+}$

67. A metal ion has d^6 configuration. In octahedral complex entity of low spin, the number of electrons present in e_g set of orbitals is

(1) 6 (2) 4 (3) 0 (4) 2

68. The IUPAC name of the complex $Ni[C_4H_7O_2N_2)_2]$, formed by the reaction between Ni^{2+} and dimethylglyoxime, is

(1) bis(methylglyoxal)nickel(II)

(2) bis(dimethylyoxime)nickel

(3) bis(2,3–butanediol dioximato)nickel(II)

(4) bis(2,3–butanedione dioximato)nickel(II)

69. The pair $[Co(NH_3)_5NO_3]SO_4$ and $[Co(NH_3)_5SO_4]NO_3$ will exhibit

(1) hydrate isomerism (2) linkage isomerism

(3) ionization isomerism (4) coordinate isomerism

70. Which of the following will have three stereoisomeric forms?

(i) $[Cr(NO_3)_3(NH_3)_3]$ (ii) $K_3[Co(C_2O_4)_3]$

(iii)$K_3[Co(C_2O_4)_2Cl_2]$ (iv)$[Co(en)_2ClBr]$

(where en = ethylene diamine)

(1) (iv) and (iii) (2) (iv) and (i)

(3) (iii) and (ii) (4) (i) and (ii)

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MELUHA INTERNATIONAL SCHOOL

HYDERABAD

SR MPC JEE MAINS | **UNIT – II ASSIGNMENT – 3** | **Date: 23-04-2020**

Time: | | **Max. Marks:**

MATHS

1) **2**	2) **1,2,3**	3) **2**	4) **2**	5) **4**	6) **1**	7) **3**	8) **4**	9) **4**	10) **3**
11) **2**	12) **3**	13) **4**	14) **3**	15) **2**	16) **1**	17) **3**	18) **2**	19) **1**	20) **2,3**
21) **2,3**	22) **1,2**	23) **1,2**	24) **1,2,4**	25) **2,4**	26) **2**	27) **2**	28) **1**	29) **1**	30) **2**
31) **3**	32) **2**	33) **4**	34) **2**	35) **3**	36) **3**	37) **2**	38) **2**	39) **2**	40) **3**
41) **1**	42) **3**	43) **2**	44) **4**	45) **3**	46) **2**	47) **2**	48) **3**	49) **4**	50) **1**
51) **3**	52) **3**	53) **4**	54) **1**	55) **4**	56) **2**	57) **2**	58) **2**	59) **3**	60) **1**
61) **1**	62) **4**	63) **2**	64) **2**	65) **3**	66) **3**	67) **2**	68) **4**	69) **4**	70) **2**
71) **1**	72) **2**	73) **1**	74) **2**	75) **4**	76) **3**	77) **2**	78) **2**	79) **4**	80) **4**
81) **3**	82) **3**	83) **2**	84) **1**	85) **3**					

PHYSICS

1) **2**	2) **4**	3) **2**	4) **1**	5) **2**	6) **2**	7) **3**	8) **1**	9) **3**	10) **2**
11) **2**	12) **3**	13) **1**	14) **4**	15) **4**	16) **4**	17) **3**	18) **1**	19) **2**	20) **2**
21) **1**	22) **1**	23) **4**	24) **4**	25) **4**	26) **2**	27) **1**	28) **4**	29) **3**	30) **3**
31) **2**	32) **3**	33) **2**	34) **1**	35) **2**	36) **1**	37) **1**	38) **1**	39) **1**	40) **2**
41) **1**	42) **3**	43) **3**	44) **1**	45) **3**	46) **2**	47) **3**	48) **3**	49) **2**	50) **4**
51) **3**	52) **3**	53) **3**							

CHEMISTRY

1) **1**	2) **3**	3) **1**	4) **3**	5) **2**	6) **3**	7) **4**	8) **1**	9) **2**	10) **1**
11) **3**	12) **3**	13) **2**	14) **3**	15) **1**	16) **3**	17) **2**	18) **4**	19) **3**	20) **2**
21) **1**	22) **2**	23) **3**	24) **4**	25) **2**	26) **3**	27) **3**	28) **1**	29) **1**	30) **3**
31) **2**	32) **1**	33) **3**	34) **4**	35) **3**	36) **2**	37) **2**	38) **1**	39) **4**	40) **2**
41) **1**	42) **1**	43) **3**	44) **2**	45) **4**	46) **3**	47) **2**	48) **3**	49) **3**	50) **4**
51) **2**	52) **3**	53) **2**	54) **1**	55) **3**	56) **1**	57) **2**	58) **4**	59) **2**	60) **1**
61) **4**	62) **1**	63) **3**	64) **3**	65) **4**	66) **4**	67) **3**	68) **4**	69) **3**	70) **2**

HINTS & SOLUTIONS
MATHS

1. 1,2

$\sqrt{1-\sin A} = \left|\sin\frac{A}{2} - \cos\frac{A}{2}\right|$ $= \sin\frac{A}{2} - \cos\frac{A}{2}$ if $\sin\frac{A}{2} \geq \cos\frac{A}{2}$

ie $\frac{\pi}{4} \leq \frac{A}{2} \leq \frac{5\pi}{4}$ $\Rightarrow 0 \leq \frac{A}{2} - \frac{\pi}{4} \leq \pi$.

2. **1,2,3**

$2^{1 + |\sin x| + |\sin 2x| + |\sin 3x| + \ldots} = 2$

$\Rightarrow$ $|\sin x| + |\sin 2x| + |\sin 3x| + \ldots = 0$

$\Rightarrow$ $\sin x = \sin 2x = \sin 3x = \ldots = 0$

$\Rightarrow$ $x = n\pi,\ n \in I$.

26. (2)

$\sqrt{|a|(-1)}\sqrt{b}$

27. (2)

$(i+i^2)+(i^2+i^3)(i^3+i^4)+\ldots+(i^{13}+i^{14})$

$i+2(i^2+i^3+\ldots+i^{13})+i^{14}$

$i+2(0)+(-1)$

28. (1)

Take conjugate both sides and then multiplying both equations.

29. (1)

$(b+ia)^5 = i^5(a-ib)^5 = i(\alpha - i\beta)$

30. (2)

Expression = $(1+i)2i+(-2i)^3$

31. (3)

$\bar{z} = x - iy$

$z = x + iy$

$\bar{z} - z = -2iy$

$\frac{1}{2}\left(i\left(\bar{z}-z\right)\right) = y$

32. (2)

$9y^2 - 4 - 10ix = 8y^2 + 20i$

$9y^2 - 4 = 8y^2$ and $-10x = 20$

$y = \pm 2$ and $x = -2$

33. (4)

$\sin x - i\cos 2x = \cos x + i.\sin 2x$

sinx = cos x and cos2x = – sin 2x

tanx = 1 and tan2x = – 1

Not possible both simultaneously.

34. (2)

$|1+i\tan\alpha|$ and $\tan\alpha > 0$

35. (3)

If $z = x+iy, \sqrt{(x+1)^2+y^2} = x+2$ and 0 = y + 2

36. (3)

$|z_1+z_2|=|z_1|+|z_2|$ can hold when $0, z_1, z_2$ are collinear with 0 at one end.

37. (2)

$\arg\left(\sqrt{3}+i\right)-\arg\left(\sqrt{3}-i\right)$

$\tan^{-1}\left(\frac{1}{\sqrt{3}}\right)-\tan^{-1}\left(\frac{-1}{\sqrt{3}}\right)=\frac{\Pi}{6}+\frac{\Pi}{6}$

38. (2)

Rationalising the given expression $\frac{(2+3i\sin\theta)(1+2i\sin\theta)}{1+4\sin^2\theta}$

For the given expression to be purely imaginary, real part of the above expression should be equal to zero

$\Rightarrow \frac{2-6\sin^2\theta}{1+4\sin^2\theta}=0 \Rightarrow \sin^2\theta=\frac{1}{3}$

$\Rightarrow \sin\theta=\pm\frac{1}{\sqrt{3}}$

39. (2) Let $z=1+i\alpha, \alpha\in\mathbb{R}$

$z^2=(1+i\alpha)(1+i\alpha)$

$x+iy=\left(1+2i\alpha-\alpha^2\right)$

On comparing real and imaginary parts, we get

$x=1-\alpha^2, y=2\alpha$

Now, consider option (2), which is $y^2+4x-4=0$

L.H.S. : $y^2+4x-4=(2\alpha)^2+4\left(1-\alpha^2\right)-4$

$=4\alpha^2+4-4\alpha^2-4$

= 0 = RHS

Hence, $y^2+4x-4=0$

41. (1)

Consider $\arg\left(\frac{z_1}{z_4}\right)+\arg\left(\frac{z_2}{z_3}\right)$

$=\arg(z_1)-\arg(z_4)+\arg(z_2)-\arg(z_3)$

$=\left(\arg(z_1)+\arg(\overline{z}_1)\right)-\left(\arg(z_3)+\arg(\overline{z}_3)\right)$

$=\left(\arg(z_1)-\arg(z_1)\right)-\left(\arg(z_3)-\arg(z_3)\right)$

= 0 – 0 = 0

42. (3) Given $|z|=1, \arg z=\theta$

As we know, $\overline{z}=\frac{1}{z}$

$\therefore \arg\left(\frac{1+z}{1+\overline{z}}\right)=\arg\left(\frac{1+z}{1+\frac{1}{z}}\right)=\arg(z)=\theta$

43. (2)

$|z_1+z_2|^2+|z_1-z_2|^2=|z_1|^2+|z_2|^2+2|z_1||z_2|+|z_1|^2+|z_2|^2-2|z_1||z_2|$

$=2|z_1|^2+2|z_2|^2=2\left[|z_1|^2+|z_2|^2\right]$

44. (4)

Tangent to the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ is

$y=mx\pm\sqrt{a^2m^2-b^2}$

Given that $y=\alpha x+\beta$ is the tangent of hyperbola

$\Rightarrow \quad m=\alpha$ and $a^2m^2-b^2=\beta^2$

$\therefore \quad a^2\alpha^2-b^2=\beta^2$

Locus is $a^2x^2-y^2=b^2$ which is hyperbola.

45. (3)

The tangent at $(2\sec\phi, 2\tan\phi)$ is $x\sec\phi-y\tan\phi=2$

$\therefore \quad a_1=2\cos\phi, b_1=-2\cot\phi$

The normal at $(2\sec\phi, 2\tan\phi)$ is $x\sec\phi+y\tan\phi=8$

$\therefore \quad a_2=8\sec\phi, b_2=8\tan\phi$

$\therefore \quad a_1a_2+b_1b_2=16\cos\phi\sec\phi+(-2\cot\phi)(8\tan\phi)=16-16=0$

46. (2)

$\frac{1-i}{1+i}=\frac{(1-i)^2}{1-i^2}=\frac{-2i}{2}=-i$

$\therefore \quad \left(\frac{1-i}{1+i}\right)^n=(-i)^n=\text{imaginary}\Rightarrow \quad n=1,3,5,...$

47. (2)

$\tan^{-1}\frac{y}{x-1}=\tan^{-1}\frac{y+3}{x} \qquad \therefore \quad xy=(x-1)(y+3) \Rightarrow \quad 3(x-1)=y$

48. (3)

$x^2+y^2=2k^2, \text{Re}\left\{(x+iy)^2\right\}=0$ i.e., $x^2-y^2=0$

Solving these, $x=\pm k, y=\pm k$

49. (4)

50. (1)

$\log_{1/2}\frac{|z|^2+2|z|+4}{2|z|^2+1}<0=\log_{1/2}1 \Rightarrow \quad \frac{|z|^2+2|z|+4}{2|z|^2+1}>1$

Or $|z|^2+2|z|+4>2|z|^2+1$

Or $|z|^2-2|z|-3<0$

Or $(|z|+1)(|z|-3)<0$

$\therefore \quad |z|-3<0$

51. (3)

$|z-1|=|z+1| \quad \Rightarrow \quad (x-1)^2+y^2=(x+1)^2+y^2$

$\Rightarrow$ x = 0, which represents a straight line.

52. (3)

$\frac{z+4}{2z-i}=\frac{(x+4)+iy}{2x+i(2y-1)}=\frac{\{(x+4)\_iy\}\{2x-i(2y-1)\}}{\{2x+i(2y-1)\}\{2x-i(2y-1)\}}$

$= \dfrac{2x(x+4)+y(2y-1)+i\{2xy-(x+4)(2y-1)\}}{4x^2+(2y-1)^2}$

$\text{Re}\left(\dfrac{z+4}{2z-i}\right)=\dfrac{1}{2}$

$\Rightarrow \dfrac{2x(x+4)+y(2y-1)}{4x^2+(2y-1)^2}=\dfrac{1}{2}$

$\Rightarrow 16x+2y=1$, which represents a straight line.

53. (4)

The required angle = amp $\dfrac{1}{(\sqrt{3}-i)^{25}}$

Now, $(\sqrt{3}-i)^{25}=\left(\dfrac{-1-\sqrt{3}i}{2}.\dfrac{2}{-i}\right)^{25}=\left(\dfrac{2\omega}{-i}\right)^{25}=2^{25}.\dfrac{\omega^2}{-i}$

$\therefore$ The required angle

$=amp\dfrac{1}{2^{25}\omega^2.i}=amp\left(\dfrac{-\omega i}{2^{25}}\right)$

$=amp\dfrac{-i.\dfrac{-1+\sqrt{3}i}{2}}{2^{25}}$

$=amp\dfrac{\sqrt{3}+i}{2^{26}}=\tan^{-1}\dfrac{1}{\sqrt{3}}=\dfrac{\pi}{6}$

54. (1)

$|z_1|$ = the distance of the point representing z_1 from the orgin. So, the distances of the four points from the origin are equal.

55. (4)

56. (2)

if $\left|\dfrac{z-1}{z+1}\right|=r$ then $\dfrac{z-1}{z+1}=r\left(\cos\dfrac{\pi}{3}+i\sin\dfrac{\pi}{3}\right)=r\left(\dfrac{1}{2}+i\dfrac{\sqrt{3}}{2}\right)$

or $\dfrac{(x-1)+iy}{(x+1)+iy}=\dfrac{r}{2}+i\dfrac{r\sqrt{3}}{2}$

or $(x-1)+iy=\dfrac{r}{2}(x+1)-\dfrac{yr\sqrt{3}}{2}+i\left\{\dfrac{ry}{2}+\dfrac{r\sqrt{3}}{2}(x+1)\right\}$

$\Rightarrow x-1=\dfrac{r}{2}(x+1)-\dfrac{yr\sqrt{3}}{2}$

$y=\dfrac{ry}{2}+\dfrac{r\sqrt{3}}{2}(x+1) \Rightarrow \dfrac{x-1}{y}=\dfrac{x+1-y\sqrt{3}}{y+\sqrt{3}(x+1)}$

On simplification, $\sqrt{3}(x^2+y^2)-2y-\sqrt{3}=0$, which is a circle.

57. (2)

$x^2+y^2+(4-3i)(x+iy)+(4+3i)(x-iy)+5=0$

Or $x^2+y^2+8x+6y+5=0$

$\therefore$ radius = $\sqrt{4^2+3^2-5}=2\sqrt{5}$

58. (2)

$\left|z-\omega\right|^2+\left|z-\omega^2\right|^2=\lambda$

$\Rightarrow\ \lambda=\left|\omega-\omega^2\right|^2$

59. (3)

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

Or $x^2+(y-1)^2-x^2-(y+1)^2=k\left\{\sqrt{x^2+(y-1)^2}-\sqrt{x^2+(y+1)^2}\right\}$

$\therefore\ \sqrt{x^2+(y-1)^2}-\sqrt{x^2+(y+1)^2}=\frac{-4y}{k}$…………..(2)

From (1) and (2), $2\sqrt{x^2+(y-1)^2}=k-\frac{4y}{k}$

$\Rightarrow\ 4x^2+\left(4-\frac{16}{k^2}\right)y^2=k^2-4$

For an ellipse, $4-\frac{16}{k^2}>0, k^2-4>0$

For k = 1, 2 the coefficient of y^2 is negative or zero.

60. (1) It is a hyperbola if $4-\frac{16}{k^2}<0$, i.e., $k^2-4>0$

$\therefore\ -2<k<2$

61. (1)

$x+iy=1-t\sqrt{t^2+t+2}\ \Rightarrow\ x=1-t, y=\sqrt{t^2+t+2}$

Eliminating t, $y^2=t^2+t+2=(1-x)^2+1-x+2=\left(x-\frac{3}{2}\right)^2+\frac{7}{4}$

Or $y^2-\left(x-\frac{3}{2}\right)^2=\frac{7}{4}$, which is a hyperbola.

62. (4)

63. (2) $\left(1+\sqrt{3}\,i\right)^{n/2}=\left\{2\left(\frac{1}{2}+\frac{\sqrt{3}}{2}i\right)\right\}^{n/2}$

$=2^{n/2}\left(\cos\frac{\pi}{3}+i\sin\frac{\pi}{3}\right)^{n/2}$

$=2^{n/2}\left(\cos\frac{n\pi}{3}+i\sin\frac{n\pi}{3}\right)^{1/2}$

Clearly, the least positive integral value of n for which $\cos\frac{n\pi}{3}+i\sin\frac{n\pi}{3}$ is positive real is 6.

64. (2)

65. (3)

$\left(\frac{\sqrt{3}+i}{\sqrt{3}-i}\right)^n=\left\{\frac{1}{i}.\frac{-1+\sqrt{3}i}{-1-\sqrt{3}i}(-i)\right\}^n$

$=\left\{-\frac{\frac{-1+\sqrt{3}i}{2}}{\frac{-1-\sqrt{3}i}{2}}\right\}^n=\left(-\frac{1}{\omega}\right)^n=1$, where n = 0, 6,…

66. (3)

Product of root of equation $z^5 - 1 = 0$

67. (2)

$\left(1-\omega\right)\left(1-\omega^2\right)\left(1+\omega\right)\left(1+\omega^2\right)$

$= \left(1-\omega^2\right)\left(1-\omega^4\right)$

$= \left(1-\omega^2\right)\left(1-\omega\right)$

$= 1-\left(\omega+\omega^2\right)+\omega^3$

= 3

68. (4)

$3^{49}\left(ky+iy\right)=\left(\sqrt{3}\right)^{100}\left(\frac{\sqrt{3}}{2}+\frac{i}{2}\right)^{100}$

$=3^{49}.3\left(-i\omega\right)^{100}$

$=3^{49}\left(3\omega\right)$

$=3^{49}\left(\frac{-3}{2}+\frac{3\sqrt{3}\,i}{2}\right)$

$k=-\frac{1}{\sqrt{3}}$

69. (4)

$\left(2\left(\frac{\sqrt{3}}{2}-\frac{i}{2}\right)\right)^n=2^n$

$\Rightarrow \left(e^{-\frac{\pi}{6}}\right)^n=1$

$n=12$

70. (2)

$z^7=-1$

Expression = $\left(z^7\right)^{12}.z^2+\left(z^7\right)^{25}+\left(z^7\right)^{41}.z^2$

$=\left(-1\right)^{12}.z^2+\left(-1\right)^{25}+\left(-1\right)^{41}.z^2$

$=z^2-1-z^2=-1$

71. (1)

$\alpha^5=1$

$\therefore$ Index = $\left|1+\alpha+\alpha^2+\alpha^3-\alpha^4\right|$

$=\left|1+\alpha+\alpha^2+\alpha^3-\alpha^4-2\alpha^4\right|$

$=\left|\frac{1-\alpha^5}{1-\alpha}-2\alpha^4\right|=\left|-2\alpha^4\right|=2\left|\alpha\right|^4=2\times1=2$

72. (2)

$|z|+|z-2|\geq 2$

73. (1)

$5\leq|z|=\left|z+\frac{2}{z}-\frac{2}{z}\right|$

$\Rightarrow \quad 5 \le \left|z+\frac{2}{z}\right|+\left|\frac{2}{z}\right|$

$\Rightarrow \quad 5 \le \left|z+\frac{2}{z}\right|+\frac{2}{z} \;\Rightarrow\; \frac{23}{5} \le \left|z+\frac{2}{z}\right|$

74. (2)

$A \equiv (1,0); B \equiv \left(\frac{1}{2}.\frac{\sqrt{3}}{2}\right)$

$AB = \sqrt{\left(\frac{3}{2}\right)^2+\left(\frac{\sqrt{3}}{2}\right)^2}$

$= \sqrt{\frac{12}{4}} = \sqrt{3}$

Area = $\frac{3\sqrt{3}}{4}$

75. (4)

The required angle = amp $\frac{1}{\left(\sqrt{3}-i\right)^{25}}$

Now, $\left(\sqrt{3}-i\right)^{25} = \left(\frac{-1-\sqrt{3}\,i}{2}.\frac{2}{-i}\right)^{25} = \left(\frac{2\omega^2}{-i}\right)^{25} = 2^{25}.\frac{\omega^2}{-i}$

$\therefore$ the require angle = amp $\frac{1}{2^{25}\omega^2 .i} = amp\left(\frac{-\omega i}{2^{25}}\right)$

$= amp\,\frac{-i\,\frac{-1+\sqrt{3}i}{2}}{2^{25}}$

$= amp\,\frac{\sqrt{3}+i}{2^{26}} = \tan^{-1}\frac{1}{\sqrt{3}} = \frac{\pi}{6}$

76. (3)

$\text{amp}\left(e^{i\pi/2}.e^{\frac{2i\pi}{2}}\right)+\text{amp}\left(e^{i\pi/2}.e^{\frac{-2i\pi}{2}}\right)$

$= \left(\frac{\pi}{2}+\frac{2\pi}{3}-2\pi\right)+\left(\frac{\pi}{2}-\frac{2\pi}{3}\right)+2\pi$

77. (2)

$z = \frac{i\left(\sqrt{3}+i\right)^4}{4\left(1-\sqrt{3}\,i\right)^2} = \frac{i}{4}.\frac{\left(2+\sqrt{3}i\right)^2}{-2-2\sqrt{3}i} = \frac{i\left(-2+2\sqrt{3}\,i\right)}{2\left(-1-\sqrt{3}\,i\right)} = \frac{\sqrt{3}+i}{1+\sqrt{3}\,i}$

$= \frac{\left(\sqrt{3}+i\right)\left(1-\sqrt{3}\,i\right)}{1+3} = \frac{2\sqrt{3}-2i}{4} = \frac{\sqrt{3}}{2}-\frac{i}{2}$

$\therefore \; amp\, z = -\tan^{-1}\frac{1}{\sqrt{3}}$

78. (2)

$z^7 = -1$

$\therefore$ expression = $\left(z^7\right)^{12} . z^2 + \left(z^7\right)^{25} + \left(z^7\right)^{41} . z^2$

$= (-1)^{12} . z^2 + (-1)^{25} + (-1)^{41} . z^2$

$= z^2 - 1 - z^2 = -1$

79. (4)

$\left(2\left(\frac{\sqrt{3}}{2} - \frac{i}{2}\right)\right)^n = 2^n$

$\Rightarrow \left(e^{-\frac{\pi}{6}}\right)^n = 1$

$n = 12$

80. (4) $\text{Im}\left(z_1 \bar{z}_2\right) = 1 \Rightarrow bp - aq = 1$

$\omega_1 \bar{\omega}_2 = (a + ip)(b - iq) = (ab + pq) + i(bp - aq)$

$\therefore \text{Im}\left(\omega_1 \bar{\omega}_2\right) = 1$

81. (3)

Product of roots of $z^5 - 1 = 0$

82. (3)

$\left(\frac{\sqrt{3}+i}{\sqrt{3}-i}\right)^n = \left\{\frac{1}{i} . \frac{-1+\sqrt{3}i}{-1-\sqrt{3}i} . (-i)\right\}^n$

$= \left\{\frac{\frac{-1+\sqrt{3}i}{2}}{\frac{-1-\sqrt{3}i}{2}}\right\}^n = \left(-\frac{1}{\omega}\right)^n = 1, when\, n = 0, 6, \ldots$

83. (2)

$1^{1/4} = (\cos 2\pi r + i \sin 2\pi r)^{1/4} = \cos\frac{\pi r}{2} + i \sin\frac{\pi r}{2}; r = 0, 1, 2, 3$

$\therefore 1^{1/4} = 1, i, -1, -i$

$\therefore$ value = $1^2 + i^2 + (-1)^2 + (-i)^2$

84. (1)

$1 + \alpha + \beta = 0, \quad \alpha\beta = 1$

$(1 + 2\alpha + \beta)^3 - (3 + 3\alpha + 5\beta)^3$

$= \alpha^3 - (3(-\beta) + 5\beta)^3$

$= 1 - 8 = -7$

85. (3)

$4 + 5\omega^{334} - 3\left(-\omega^2\right)^{365}$

$= 4 + 5\omega + 3\omega$

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

PHYSICS

6. $\frac{mv^2}{R} \propto R^{-5/2} \therefore v \propto R^{-3/4}$

Now, $T = \frac{2\pi R}{v}$

or $T^2 \propto \left(\frac{R}{v}\right)^2$

or $T^2 \propto \left(\frac{R}{R^{-3/4}}\right)^2$

or $T^2 \propto R^{7/2}$

7. Time period of a satellite very close to earth's surface is 84.6 min. Time period increases as the distance of the satellite from the surface of earth increases. So, time period of spy satellite orbiting a few 100 km above the earth's surface should be slightly greater than 84.6 min. Therefore, the most appropriate option is (3) or 2h.

10. $\frac{GMm}{R^2} = m \times \omega^2 \times R$

$\frac{-GMm}{R^2} + Energy = \frac{-GMm}{3R}$

11. $mv_1r_1 = mv_2r_2$

12. $I_1\omega_1 = I_2\omega_2; \frac{I_1}{T_1} = \frac{I_2}{T_2}, R_2 = \frac{R_1}{n}$

13. $\Delta U = \frac{mgh}{1+\frac{h}{R}}$

Given, h = R

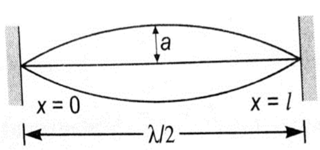
$\Delta U = \frac{mgh}{1+\frac{h}{R}} = \frac{1}{2}mgR.$

14. In case of binary star system angular velocity and hence the time period of both the stars are equal.

19. $g_{eff} = 0$ (on satellite)

So only surface tension works

20.



$l = \frac{\lambda}{2}$ or $\lambda = 2l, k = \frac{2\pi}{\lambda} = \frac{\pi}{l}$

The amplitude at a distance x from

x=0 is given by A=αsin kx

Total mechanical energy at x of length dx is

$$dE = \frac{1}{2}(dm)A^2\omega^2$$

$$= \frac{1}{2}(\mu dx)(a\sin kx)^2(2\pi f)^2$$

or $dE = 2\pi^2\mu f^2 a^2 \sin^2 kx dx$

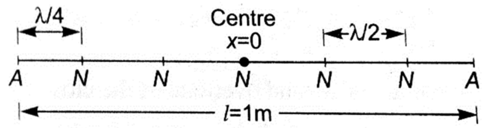
Here, $f^2 = \frac{v^2}{\lambda^2} = \frac{\left(\frac{T}{\mu}\right)}{\left(4l^2\right)}$ and $k = \frac{\pi}{l}$

Substituting these values in Eq. (i) and integrating it from x=0 to x=l, we get total energy of string $E = \frac{\pi^2 a^2 t}{4l}$.

21.

Speed of longitudinal travelling wave in the rod will be

$v = \sqrt{\frac{Y}{\rho}} = \sqrt{\frac{2\times10^{11}}{8000}} = 5000 m/s$



Amplitude at antinode=2A (Here, A is the amplitude of constituent waves)

$= 2\times10^{-6} m$

$\therefore \quad A = 10^{-6} m$

$\Rightarrow \quad l = \frac{5\lambda}{2}$

$\Rightarrow \quad \lambda = \frac{2l}{5} = \frac{(2)(1.0)}{5} m = 0.4m$

Hence, the equation of motion at a distance x from the mid-point will be given by,

$$y = 2A \sin kx \sin \omega t$$

Here, $k = \frac{2\pi}{0.4} = 5\pi$

$\omega = 2\pi f = 2\pi \frac{v}{\lambda}$

$= 2\pi\left(\frac{5000}{0.4}\right) rad/s$

$= 25000\pi$

$\therefore \quad y = \left(2\times10^{-6}\right)\sin(5\pi x)\sin(25000\pi t)$

Therefore, y at a distance $x = 2cm = 2\times10^{-2} m$

is $\quad y = 2\times10^{-6}\sin\left(5\pi\times2\times10^{-2}\right)\sin(25000\pi t)$

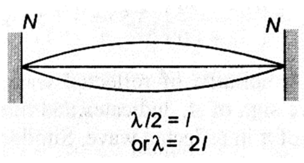
or $\quad y = 2\times10^{-6}\sin(0.1\pi)\sin(25000\pi t)$

The equation of constituent waves are

$y_1 = A sn(\omega t - kx)$ and $y_2 = A\sin(\omega t + kx)$

or $\quad y_1 = 10^{-6}\sin(25000\pi t - 5\pi x)$ and $y_2 = 10^{-6}\sin(25000\pi t + 5\pi x)$.

22.



The temperature area is $\sigma = Y\alpha\Delta\theta$

or tension in the steel wire $t = \sigma A = YA\alpha\Delta\theta$

Substituting the values, we have

$t = \left(2\times10^{11}\right)\left(10^{-6}\right)\left(1.21\times10^{-5}\right)(20) = 48.4N$

Speed of transverse wave on the wire, $v=\sqrt{\frac{T}{\mu}}$

Here, $\mu =$ mass per unit length of wire = 0.1 kg/m

$\therefore \quad v=\sqrt{\frac{48.4}{0.1}}=22\text{m/s}$

Fundamental frequency $f_o=\frac{v}{2l}=\frac{22}{2\times 1}=11\text{Hz}$.

23. Tension due to thermal stresses,

$$T=YA\alpha.\Delta\theta \Rightarrow v=\sqrt{\frac{T}{\mu}}$$

Here, μ = mass per unit length $=\rho A$

$\therefore \quad v=\sqrt{\frac{T}{\rho A}}=\sqrt{\frac{YA\alpha.\Delta\theta}{\rho A}}=\sqrt{\frac{Y\alpha\Delta\theta}{\rho}}$

Substituting the values we have,

$$v=\sqrt{\frac{1.3\times 10^{11}\times 1.7\times 10^{-5}\times 20}{9\times 10^{3}}} = 70.1 \text{ m/s}$$

24. (a) and (c) options satisfy the condition;

$\frac{\partial^2 y}{\partial x^2}=(\text{constant})\ \frac{\partial^2 y}{\partial t^2}$

25. $t_{PQ}=\frac{T}{6}$

After the collision, the block in cantact with spring comes to rest, So Q acts like an extreme position

$\therefore T_{QO}=\frac{T}{4}$

$\therefore t_{PO}=t_{PQ}+t_{QO}=\frac{T}{6}+\frac{T}{4}=\frac{5T}{12}=\frac{5\pi}{6}\sqrt{\frac{m}{K}}$.

26. (i) When m_1 is removed only m_2 is left. Therefore, angular frequency : $\omega=\sqrt{\frac{k}{m_2}}$

(ii) Let x_1 be the extension when only m_2 is left.

Then, $kx_1=m_2g$ or $x_1=\frac{m_2g}{k}$ ….. (1)

Similarly, let x_2 be extension in equilibrium when both m_1 and m_2 are suspended. Then,

$(m_1+m_2)g=kx_2; \therefore x_2=\frac{(m_1+m_2)g}{k}$ …. (2)

From Eqs. (1) and (2) amplitude of oscillation : $A=x_2-x_1=\frac{m_1g}{k}$.

27. Let $T=2\pi\sqrt{\frac{l}{g}};\theta_1=\theta_2$

$\theta\cos\left(\frac{4\pi}{T}t\right)=-\theta\cos\left(\frac{2\pi}{T}t\right);\ \frac{4\pi}{T}t=2n\pi\pm\left(\frac{2\pi}{T}t+\pi\right)$

for n=0, t=T/2 for n=1, t=T/6, 3T/2

the first time meeting, $t=\frac{T}{6}=\frac{\pi}{3}\sqrt{\frac{l}{g}}=1\text{s}$.

28. For a torsional pendulum, angular frequency of small oscillations is $\omega=\sqrt{\frac{C}{I}}$, where $I=\frac{mR^2}{2}$

$\therefore \omega=\sqrt{\frac{2C}{mR^2}}$

It is given that at the mean position, the disc is imparted an angular speed ω_0. So, if the angular amplitude of oscillation is β, then

$\omega_0=\beta\omega=\beta\sqrt{\frac{2C}{mR^2}}$

the energy of oscillation is

$=\frac{1}{2}\left(\frac{mR^2}{2}\right)\left(\frac{2C}{mR^2}\right)\left(\frac{mR^2}{2C}\omega_0^2\right)=\frac{1}{4}mR^2\omega_0^2.$

29. Let, x be the displacement of centre of mass of cylinder from mean position.

$\therefore$ from rolling concept, elongation in spring = 2x

$\therefore$ Restoring torque about point of contact is :

$\tau_{rest}=-2R(2kx)=-4kxR$

but $x=R\theta \Rightarrow \tau_{rest}=-4kR^2\theta=I\alpha$

$=\frac{3}{2}mR^2.\alpha$ and $\alpha=-\omega^2\theta$.

30. Let us say x_0 is the elongation in the spring when the system is in equilibrium

i.e., $2Kx_0\sin\theta=mg$

Let us displace the ring by 'y' downwards, then the further elongation in the spring is '$y\sin\theta$'

$a=\left(\frac{2K\sin^2\theta}{m}\right)y$

$T=2\pi\sqrt{\frac{m}{2K\sin^2\theta}}$

$T=\frac{2\pi}{\sin\theta}\sqrt{\frac{m}{2K}}$.

31. Just after collision with ground, Applying COE

$\frac{1}{2}mv^2+mgx+\frac{1}{2}kx^2=\frac{1}{2}m(2gh)+0+0$

$\Rightarrow\frac{1}{2}mv^2>0\Rightarrow h>4mg/k$.

32. $A=\sqrt{A_1^2+A_2^2+2A_1A_2\cos\phi}$.

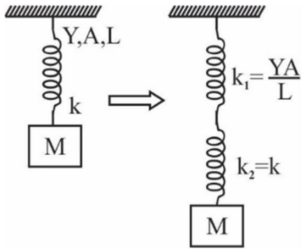
33. $a=-\omega^2x;\ T=\frac{2\pi}{\omega}$

34. For damped oscillator $A=A_0e^{-bt}$

Here $\frac{A_0}{27}=A_0e^{-6b}, A_2=A_0e^{-2b}=A_0\left[e^{-6b}\right]^{\frac{1}{3}}$.

35. $k_{eq}=\frac{k_1k_2}{k_1+k_2}=\frac{\frac{YA}{L}}{\frac{YA}{L}+k}$

$=\frac{YAk}{YA+Lk}$



$\therefore \quad T = 2\pi\sqrt{\frac{m}{k_{eq}}}$

$= 2\pi\sqrt{\frac{m(YA+Lk)}{YAk}}$.

36. Frequency or time period of SHM depends on variable forces. It does not depend on constant external force. Constant external force can only change the mean position. For example, in the given question mean position is at natural length of spring in the absence of electric field. Whereas in the presence of electric field mean position will be obtained after a compression of x_0. Where x_0 is given by

$Kx_0 = QE$ or $x_0 = \frac{QE}{K}$

37. Angular frequency of the system, $\omega = \sqrt{\frac{k}{m+m}} = \sqrt{\frac{k}{2m}}$

Maximum acceleration of the system will be, $\omega^2 A$ or $\frac{kA}{2m}$.

This acceleration to the lower block is provided by friction.

Hence, $f_{max} = ma_{max} = m\omega^2 A = m\left(\frac{kA}{2m}\right) = \frac{kA}{2}$.

38. Between C and D block will move with constant speed of 120 cm/s. Therefore, period of oscillation will be (starting from C).

$T = t_{CD} + \frac{T_2}{2} + t_{DC} + \frac{T_1}{2}$

Here, $T_1 = 2\pi\sqrt{\frac{m}{k_1}}$ and $T_2 = 2\pi\sqrt{\frac{m}{k_2}}$

and $t_{CD} = t_{DC} = \frac{60}{120} = 0.5s$

$\therefore \quad T = 0.5 + \frac{2\pi}{2}\sqrt{\frac{0.2}{3.2}} + 0.5 + \frac{2\pi}{2}\sqrt{\frac{0.2}{1.8}}$

(m=200g=0.2 kg)

$T = 2.82s$

39.

$\sum F_z = 0$

$(T + dT) + \mu g dz - T = 0$

$dT = -\mu g dz$.........(i)

also $T = \mu v^2$

$dT = d\mu v^2 + 2v dv d\mu$

As v is independent of z

dv=0

$dT = v^2 d\mu$ ……(ii)

From equation (1) and (2) we get

$$\mu\int\frac{du}{\mu}=-\frac{g}{v^2}\int_0^z dz$$

or $\mu=\mu_0 e-\left(g/v^2\right)z$

40. The intensity is proportional to the square of the pressure amplitude.

Thus, $\frac{I'}{I}=\left(\frac{p_0'}{p_0}\right)^2$

or $\quad I'=\left(\frac{p_0'}{p_0}\right)^2 I=\left(\frac{2.5}{2.0}\right)^2\times 5.0\times 10^{-7}$ W/m^2

=7.8 ×10–7 W/m^2.

41. Compare the given equation from

$$y=\frac{a}{b+(x\mp ct)^2},\ (x\mp ct)^2=(x-1)^2$$

Ct = 1 for t = 2 sec, so, C = $\frac{1}{2}$ cm/sec

44.

At a distance *y* from bottom end consider a string element of length *dy*.

Tension at this height is, $T=\frac{m}{l}\times yg$

So, $\frac{dy}{dt}=$ velocity of wave $=\sqrt{\frac{T}{\mu}}=\sqrt{gy}$

$$\Rightarrow\qquad \int_0^{2.45}\frac{dy}{\sqrt{gy}}=\int_0^t dt$$

or $\quad$ t=1s.

45.

$$E=\frac{1}{2}\rho\omega^2A^2\times(x\times S)$$

$$E\propto\omega^2$$

46. n_Q = 432 – x

47. First harmonic of closed = Third harmonic of open

$\therefore\quad \frac{v}{4l_1}=3\left(\frac{v}{2l_2}\right)$

$\therefore\quad \frac{l_1}{l_2}=\frac{1}{6}$

$\therefore$ correct option is (3)

48. $n_1 - n_2 = 5$, $n_1 l_1 = n_2 l_2$

50. An open pipe and a closed pipe of equal length cannot have the same frequency at any harmonic.

CHEMISTRY

NO HINTS & SOLUTIONS

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