

MELUHA INTERNATIONAL SCHOOL

INDIA

SR MPC

Time: 3 Hours

JEE MAINS MODEL

Date: 31-03-2020

MATHS

SYLLABUS : TRIGONOMETRIC EQUATIONS & INVERSE TRIG. FUNCTIONS, Errors & Rate measure , Mean value theorems, Tangent & Normals

- The number of solutions of the equation $\cos 6x + \tan^2 x + \cos 6x \cdot \tan^2 x = 1$ in the interval $[0, 2\pi]$ is**
1) 4 2) 5 3) 6 4) 7
- The total number of solution of $\sin^4 x + \cos^4 x = \sin x \cos x$ in $[0, 2\pi]$ is equal to**
1) 2 2) 4 3) 6 4) none of these
- The number of solution of equations of $6 \cos 2\theta + 2 \cos^2 \frac{\theta}{2} + 2 \sin^2 \theta = 0, -\pi < \theta < \pi$ is**
1) 3 2) 4 3) 5 4) 6
- If $x, y \in [0, 2\pi]$ and $\sin x + \sin y = 2$ then the value of $x + y$ is**
1) π 2) $\frac{\pi}{2}$ 3) 3π 4) none of these
- One of the general solutions of $\sqrt{3} \cos \theta - 3 \sin \theta = 4 \sin 2\theta \cos 3\theta$ is**
1) $m\pi + \frac{\pi}{18}, m \in Z$ 2) $m\frac{\pi}{2} + \frac{\pi}{6}, \forall m \in Z$ 3) $m\frac{\pi}{3} + \frac{\pi}{18}, m \in Z$ 4) none of these
- The number of ordered pairs which satisfy the equation $x^2 + 2x \sin(xy) + 1 = 0$ are (where $y \in [0, 2\pi]$)**
1) 1 2) 2 3) 3 4) 0
- Let α and β be any two positive values of x for which $2 \cos x$ $|\cos x|$ and $1 - 3 \cos^2 x$ are in G.P. the minimum value of $|\alpha - \beta|$ is**
1) $\frac{\pi}{3}$ 2) $\frac{\pi}{4}$ 3) $\frac{\pi}{2}$ 4) none of these
- $\sin x + \cos x = y^2 - y + a$ has no value of 'x' for any value of y if 'a' belongs to**
1) $(0, \sqrt{3})$ 2) $(-\sqrt{3}, 0)$ 3) $(-\infty, -\sqrt{3})$ 4) $(\sqrt{3}, \infty)$
- The equation $\cos^8 x + b \cos^4 x + 1 = 0$ will have a solution if 'b' belongs to**
1) $(-\infty, 2]$ 2) $[2, \infty)$ 3) $(-\infty, -2]$ 4) none of these
- If $|2 \sin \theta - \operatorname{cosec} \theta| \geq 1$ and $\theta \neq \frac{n\pi}{2}, n \in Z$ then**
1) $\cos 2\theta \geq \frac{1}{2}$ 2) $\cos 2\theta \geq \frac{1}{4}$ 3) $\cos 2\theta \leq \frac{1}{2}$ 4) $\cos 2\theta \leq \frac{1}{4}$

11. With the usual meaning for a, b, c and s if Δ be the area of triangle then the error in Δ resulting from a small error in the measurement of c, is
- 1) $\frac{\Delta}{4}\left(\frac{1}{s} + \frac{1}{s-a} + \frac{1}{s-b} - \frac{1}{s-c}\right)\delta c$ 2) $\frac{1}{4}\left(\frac{1}{s} + \frac{1}{s-a} + \frac{1}{s-b} + \frac{1}{s-c}\right)\delta c$
 3) $\frac{\Delta}{4}\left(\frac{1}{s} + \frac{1}{s-a} + \frac{1}{s-b} + \frac{1}{s-c}\right)$ 4) $\left(\frac{1}{s} + \frac{1}{s-a} + \frac{1}{s-b} + \frac{1}{s-c}\right)\delta c$
12. The semi-vertical angle of a cone is 45° . If the height of the cone is 20.025cm, then the approximate value of its lateral surface area (in sq cm) is
- 1) $401\sqrt{2}\pi$ 2) $400\sqrt{2}\pi$ 3) $402\sqrt{2}\pi$ 4) $405\sqrt{2}\pi$
13. The pressure p and volume v of a gas are connected by the relation $PV = C$ (constant). If δp and δv are the errors respectively in p and v. Then the approximate value of $\frac{C \cdot \delta v}{v^2}$ is
- 1) $-\delta p$ 2) δp 3) $\frac{1}{\delta p}$ 4) $\frac{-1}{\delta p}$
14. The area of square is 9 sq.cms and the error in its is 0.02sq.cm. The percentage error in the measurement of the length of the diagonal of the square is
- 1) $2/9$ 2) $1/9$ 3) $4/9$ 4) $1/3$
15. A variable triangle ABC is inscribed in a circle of diameter x units. If the rate of increase in one of the sides 'a' of the triangle is $\frac{x}{2}$ times the increase in $\angle A$, then $\angle A =$
- 1) $\frac{\pi}{6}$ 2) $\frac{\pi}{3}$ 3) $\frac{\pi}{4}$ 4) $\frac{\pi}{2}$
16. A particle moves along a line by $s = t^3 - 9t^2 + 24t$, then v is decreasing when $t \in$
- 1) (2, 4) 2) $(-\infty, 2) \cup (4, \infty)$ 3) $(-\infty, 2)$ 4) $(4, \infty)$
17. The point on the ellipse $16x^2 + 9y^2 = 400$, at which the ordinate decrease at the same rate at which the abscissa increases is
- 1) $\left(3, \frac{16}{3}\right)$ 2) $\left(-3, \frac{16}{3}\right)$ 3) $\left(3, -\frac{16}{3}\right)$ 4) $\left(-4, -\frac{16}{3}\right)$
18. At a given instant, the sides OA and OB of a right angled triangle AOB are 8cm and 6cms respectively. If OA increases at the rate of 2cm/sec and OB decreases at the rate of 1cm/sec, the rate of decreases of the area of ΔAOB after 2 seconds is
- 1) 2 sq. cm/sec 2) 1 sq. cm/sec 3) 3 sq. cm/sec 4) 4 sq. cm/sec
19. A particle moves along a straight line and its velocity at a distance x from the origin is $k\sqrt{a^2 - x^2}$ then the acceleration of the particle is
- 1) k 2) $-k^2$ 3) kx 4) $-k^2x$
20. If the velocity v of a particle varies as the square of its displacement x then the acceleration varies as
- 1) x^2 2) x^3 3) v^2 4) v^3

INTEGER TYPE QUESTIONS

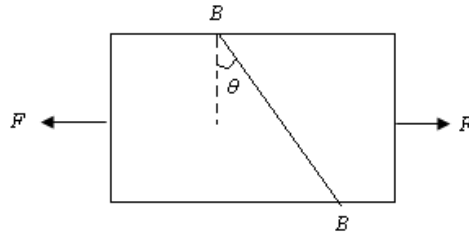
21. If $2\sin^2\left(\frac{\pi}{2}\right)\cos^2 x = 1 - \cos(\pi \sin 2x)$, $x \neq (2n+1)\frac{\pi}{2}, n \in I$ then $\cos 2x$ is equal to

22. If $\sin x = \sin y$, $\sqrt{6} \sin y = \tan z$ and $2 \sin z = \sqrt{3} \cos x$, u, v, w denote respectively $\sin^2 x, \sin^2 y, \sin^2 z$, then the values of $u + v + w$ is
23. The sum of all roots of $\sin \left[\pi \log_3 \left[\frac{1}{x} \right] \right] = 0$ in $(0, 2\pi)$ is
24. If there is an error of $\pm 0.04 \text{ cm}$ in the measurement of the diameter of sphere then the percentage error in its volume, when radius is 10 cm
25. If there is a possible error of 0.02 cm in the measurement of the diameter of a sphere then the possible percentage error in its volume when the radius 10 cm is

PHYSICS

SYLLABUS: Mechanical Properties Of Solids, Mechanical Properties Of Fluids

- 26) A solid sphere of radius R made up of a material of bulk modulus K is surrounded by a liquid in a cylindrical container of area of cross section A . A massless piston of area A floats on the surface of the liquid. When a mass M is placed on the piston to compress the liquid the magnitude of fractional change in the radius of the sphere is
- 1) $\frac{Mg}{AK}$ 2) $\frac{Mg}{3AK}$ 3) $\frac{3Mg}{AK}$ 4) $\frac{Mg}{2AK}$
- 27) A bar of cross section A is subjected to two equal and opposite tensile forces as shown. Consider a cross section BB is shown in figure. The shearing stress on surface BB is



- 1) $\frac{F \cos^2 \theta}{A}$ 2) $\frac{F}{A}$ 3) $\frac{F \sin 2\theta}{2A}$ 4) zero
- 28) A rod of uniform cross-sectional area A and length L has a weight W . It is suspended vertically from a fixed support. If the material of the rod is homogeneous Then the elongation of the wire is
- 1) $\frac{1}{2} \frac{WL}{YA}$ 2) $\frac{1}{3} \frac{WL}{YA}$ 3) $2 \frac{WL}{YA}$ 4) $3 \frac{WL}{YA}$
- 29) A smooth uniform string of natural length ' l ', cross-sectional area A and Young's modulus Y is pulled along its length by a force F on a horizontal surface. Find the elastic potential energy stored in the string
- 1) $U = \frac{F^2 l}{AY}$ 2) $U = \frac{F^2 l}{3AY}$ 3) $U = \frac{F^2 l}{6AY}$ 4) $U = \frac{F^2 l}{2AY}$
- 30) A circular ring of radius R and mass m made of a uniform wire of cross-sectional area A is rotated about a stationary vertical axis passing through its centre and perpendicular to the plane of ring. If the breaking stress of the material of the ring is σ then determine the maximum angular speed ω_{\max} at which the ring may be rotated without causing fracture
- 1) $\sqrt{\frac{2\pi\sigma A}{mR}}$ 2) $\sqrt{\frac{3\pi\sigma A}{mR}}$ 3) $\frac{3\pi\sigma A}{mR}$ 4) $\frac{\pi\sigma A}{2mR}$

31) A student performs an experiment to determine the Young's modulus of a wire, exactly 2m long, by Searle's method. In a particular reading, the student measures the extension in the length of the wire to be 0.8mm with an uncertainty of ± 0.05 mm at a load of exactly 1kg. The student also measures the diameter of the wire to be 0.4 mm with a uncertainty of ± 0.01 mm. The Young's modulus obtained from the reading is [Take $g = 9.8\text{m/s}^2$ exact].

- 1) $(2.0 \pm 0.3) \times 10^{11} \text{N/m}^2$ 2) $(2.0 \pm 0.2) \times 10^{11} \text{N/m}^2$
 3) $(2.0 \pm 0.1) \times 10^{11} \text{N/m}^2$ 4) $(2.0 \pm 0.05) \times 10^{11} \text{N/m}^2$

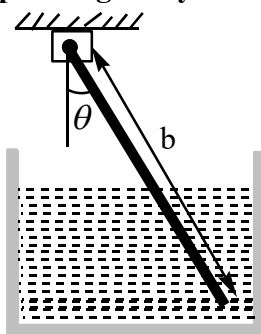
32) The density of water at the surface of the ocean is ρ . If the bulk modulus of water is B, what is the density of ocean water at a depth where the pressure is in nP_0 , where P_0 is the atmospheric pressure? [Assume % change in density is small]

- 1) $\frac{\rho B}{B - (n-1)P_0}$ 2) $\frac{\rho B}{B + (n-1)P_0}$ 3) $\frac{\rho B}{B - nP_0}$ 4) $\frac{\rho B}{B + nP_0}$

33) A stone of mass m is attached to one end of a wire of cross sectional area A and Young's modulus Y. The stone is revolved in a horizontal circle at a speed such that the wire makes a constant angle θ with the vertical. The strain produced in the wire will be

- 1) $\frac{mg \cos \theta}{AY}$ 2) $\frac{mg}{AY \cos \theta}$ 3) $\frac{mg \sin \theta}{AY}$ 4) $\frac{mg}{AY \sin \theta}$

34) A uniform rod of length b capable of turning about its end which is out of water, rests inclined to the vertical. If its specific gravity is $5/9$, find the length immersed in water.



- 1) $\frac{13b}{9}$ 2) $\frac{b}{3}$ 3) $\frac{b}{6}$ 4) $\frac{23b}{9}$

35) A cylinder of area 300 cm^2 and length 10 cm made of material of specific gravity 0.8 is floated in water with its axis vertical. It is then pushed downward, so as to be just immersed. Calculate the work done by the agent who pushes the cylinder into the water. ($g = 10\text{ms}^{-2}$)

- 1) 0.6 J 2) 0.12 J 3) 0.06 J 4) 0.24 J

36) A piece of an alloy of mass 96 gm is composed of two metals whose specific gravities are 11.4 and 7.4. If the weight of the alloy is 86 gm in water, find the mass of each metal in the alloy.

- 1) 62.7 gram, 33.3gram 2) 64 gram, 32 gram
 3) 60 gram, 36 gram 4) 48 gram, 48 gram

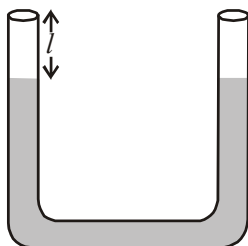
37) A cylindrical wooden body of height 3 m and mass 80 kg floats vertically in water. If its specific gravity is 0.80, the amount by which it gets depressed when a body of mass 10 kg is placed on its upper surface is

- 1) 0.10 m 2) 0.20 m 3) 0.30 m 4) 0.40 m

- 38) Two identical cylindrical vessels with their bases at the same level, each contain a liquid of density ρ . The height of the liquid in one vessel is h_1 and that in the other vessel is h_2 . The area of either base is A . What is the work done by gravity in equalizing the levels when the two vessels are connected?

1) $+h_1h_2A\rho g$ 2) $-h_1h_2A\rho g$ 3) $+A\rho g\left(\frac{h_2-h_1}{2}\right)^2$ 4) $-A\rho g\left(\frac{h_2-h_1}{2}\right)^2$

- 39) A U tube having identical limbs contains mercury (density ρ_m) to a level as shown in the figure. If the left limb is filled to the top with water (ρ_w), then the rise of mercury level in the right limb will be



(1) $\frac{l}{2\rho_m}$ (2) $\frac{l\rho_w}{2\rho_m + \rho_w}$ (3) $\frac{\rho_m l}{\rho_w}$ (4) $\frac{l\rho_w}{2\rho_m - \rho_w}$

- 40) An object of specific gravity ρ is hung from a massless string. The tension in string is T . The object is immersed in water so that one half of its volume is submerged. The new tension in the string is

(1) $\left(\frac{2\rho+1}{2\rho}\right)T$ (2) $\left(\frac{2\rho-1}{2\rho}\right)T$ (3) $\left(\frac{\rho-1}{\rho}\right)T$ (4) $\left(\frac{\rho+1}{\rho}\right)T$

- 41) A large open tank has two holes in the wall. One is a square hole of side L at a depth y from the top and other is a circular hole of radius R at a depth $4y$ from the top. When tank is completely filled with water, the quantities of water flowing out per second from both holes are same. Then R is equal to

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

- 42) In a large tank of cross-sectional area A , there is a small hole of area 'a' at the bottom. The time taken to emptying the tank from height h_1 to h_2 is

(1) $\frac{a}{Ag}(\sqrt{h_1} - \sqrt{h_2})$ (2) $\frac{a}{Ag\sqrt{2}}(\sqrt{h_1} - \sqrt{h_2})$
 (3) $\frac{A\sqrt{2}}{a\sqrt{g}}(\sqrt{h_1} - \sqrt{h_2})$ (4) $\frac{a\sqrt{2}}{A\sqrt{g}}(\sqrt{h_1} - \sqrt{h_2})$

- 43) What is the barometric height of a liquid of density 3.4 g cm^{-3} at a place, where that for mercury barometer is 70 cm ? [Density of mercury is 13.6 g/cc]

(1) 70 cm (2) 140 cm (3) 280 cm (4) 340 cm

- 44) There is a horizontal film of soap solution. On it a thread is placed in the form of a loop. The film is pierce inside the loop and the thread becomes a circular loop of radius R . If the surface tension of the loop be T , then tension in the thread will be

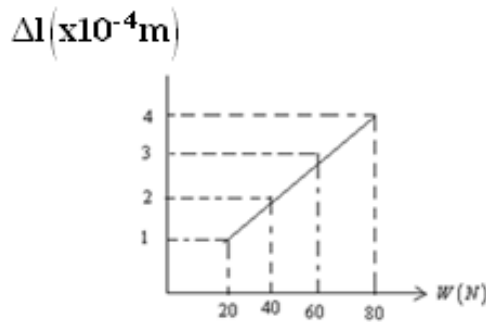
(1) $\pi R^2 T$ (2) $2RT$ (3) RT (4) $\frac{\pi R^2}{T}$

- 45) A cylindrical open tank of cross section A contains a liquid of density up to a height H . There is a hole of cross-section area a , at the bottom of the tank. The time in which the liquid level is reduced to half of its initial value

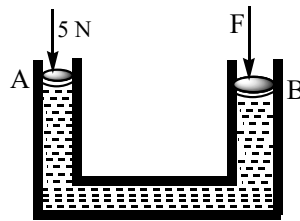
1. $(\sqrt{2}-1)\frac{A}{a}\sqrt{\frac{H}{g}}$ 2. $\left(\frac{A}{a}\right)\left(\sqrt{\frac{H}{g}}\right)$ 3. $(\sqrt{2}-1)\sqrt{\frac{H}{g}}$ 4. $Aa(\sqrt{2}-1)\sqrt{\frac{H}{g}}$

INTEGER TYPE QUESTIONS

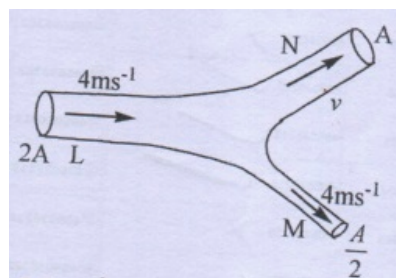
- 46) The adjacent graph shows the extension (Δl) of a wire of length 1m suspended from the top of a roof at one end and with a load W connected to the other end. If the cross-sectional area of the wire is $10^{-6} m^2$, Calculate the Young's modulus of the material of the wire ___ N / m^2



- 47) The area of cross-section of the two arms of a hydraulic press are $1 cm^2$ and $10 cm^2$ respectively. A force of 5 N is applied on the water in the thinner arm. What force should be applied on the water in the thicker arm so that the water may remain in equilibrium?



- 48) A hollow sphere of inner radius 9 cm and outer radius 10 cm floats half-submerged in a liquid of specific gravity 0.8. Calculate the density of the material of which the sphere is made. ___ gm/cc
- 49) A metallic sphere has a cavity inside it. The sphere weighs 40 g wt in air and 20 g wt in water. If density of the material of the sphere is $8 g/cm^3$ then the volume of the cavity will be ___ cm^3
- 50) An incompressible liquid has a streamlined flow through a horizontal tube L,M,N as shown in the figure. Assuming viscosity to be absent, the velocity 'v' of the liquid through the tube 'N' is ___ m/s



60. A buffer solution is a solution whose PH value on keeping in the air
 1) Increases rapidly 2) decreases rapidly
 3) may increase or decrease 4) does not change
61. Oxide of sulphur (SO_2, SO_3) are due to
 1) burning of sulphur containing of fossil fuel 2) Roasting and smelting of sulphide ore
 3) Oxidation by air H_2O_2 and O_3 4) All of the above
62. SO_2 as pollutant can be controlled by
I using solar energy, nuclear energy, hydro electric energy
II low sulphur fuels, natural gas
III desulphonation of high sulphur coal and oil before buring by FGD
IV using water under high pressure
 1) Both I and II 2) Both I and III 3) I, II, IV 4) I, II, III
63. Which of the following statement is not true
 1) PH of drinking water should be between 5.5 to 7.5
 2) Concentration of DO below 6ppm is good for the growth of fish
 3) Clean water would have a BOD value of less than 5 ppm
 4) Oxides of sulphur initrogen and carbon are the most wide spread air pollutant
64. Consider the following equilibrium $HbO_2 + CO \rightleftharpoons HbCO + O_2$ $HbCO = 3\%$ to 4%
 oxygen carrying capacity of blood is
 1) increased 2) remains unchanged
 3) decreased 4) can't be predicted
65. Consider the following diseases from which human being are suffered
I-Asthama II-Dyspepsia III-Bronchitis IV-emphysema
 Diseases due to SO_2 are
 1) I,II, and IV 2) II,III and IV 3) I, II and III 4) Both I and IV
66. Identify incorrect statement from the following
 1) Oxides of nitrogen in the atmosphere can cause the depletion of ozone layer
 2) Ozone absorbs infrared radiation
 3) Depletion of ozone layer is because of its chemical reaction with chlorofluoro alkanes
 4) ozone absorbs the intense ultraviolet radiation of the sun
67. The chemical entilies present in thermosphere of the atmosphere are
 1) O^{+2}, O^+, NO^+ 2) O_3 3) N_2, O_2, CO_2, H_2O 4) O_3, O_2^+, O_2
68. BOD is connected with
 1) microbes and organic matter 2) organic matter
 3) microbes 4) none of these
69. Which of the following is not involve in the formation of photo chemical smog
 1) Hydrocarbon 2) NO 3) SO_2 4) O_3
70. Hydrated barium peroxide treated with CO_2 products are
 1) BaO, CO, O_2 2) $BaCO_3, O_2$ 3) $BaCO_3, H_2O_2$ 4) Ba, C, O_2

INTEGER TYPE QUESTIONS

71. Two moles of NH_3 gas are introduced into previously evacuated one litre vessel in which at partially dissociates at high temperature as $2NH_{3(g)} \rightleftharpoons N_{2(g)} + 3H_{2(g)}$. At equilibrium one I mole of NH_3 is remain. The value of kc is
72. Ammonium carbamate dissociates as $NH_2COONH_{4(s)} \rightleftharpoons 2NH_{3(g)} + CO_{2(g)}$. In a closed vessel containing ammonium carbamate in equilibrium, ammonia is added such that the partial pressure of NH_3 now equals to the original total pressure. The ratio of total pressure now to the original pressure is

73. At equilibrium $N_2O_{4(g)} \rightleftharpoons 2NO_{2(g)}$ the observed molecular weight of N_2O_4 is 80gmol^{-1} at 350 K. The percentage dissociation of $N_2O_{4(g)}$ at 350K. is
74. The pka of acetic acid and pkb of ammonium hydroxide are 4.76 and 4.75 respectively. Calculate the PH of ammonium acetate solution
75. 6ml of standard soap solution ($1\text{ml} = 0.001\text{gram } CaCO_3$) were required in titrating 50ml of a sample of hard water to produce good lather. Calculate the degree of hardness in ppm.....

MELUHA INTERNATIONAL SCHOOL

INDIA

SR MPC

Time: 3 Hours

JEE MAINS MODEL

Date: 31-03-2020

KEY SHEET**MATHS**

1) 4	2) 1	3) 1	4) 1	5) 3	6) 2	7) 4	8) 4	9) 3	10) 1
11) 1	12) 1	13) 1	14) 2	15) 2	16) 1	17) 1	18) 1	19) 4	20) 2
21) 0.6	22) 1	23) 4.5	24) 0.6	25) 0.3					

PHYSICS

26) 2	27) 3	28) 1	29) 3	30) 1	31) 2	32) 1	33) 2	34) 1	35) 3
36) 1	37) 3	38) 3	39) 4	40) 2	41) 1	42) 3	43) 3	44) 2	45) 1
46) 2	47) 50	48) 1.47	49) 15	50) 6					

CHEMISTRY

51) 4	52) 1	53) 1	54) 2	55) 1	56) 3	57) 4	58) 1	59) 1	60) 4
61) 4	62) 4	63) 2	64) 3	65) 1	66) 2	67) 1	68) 1	69) 3	70) 3
71) 1.6	72) 1.1	73) 15	74) 7	75) 120					

HINTS & SOLUTIONS

MATHS-A

1. $\cos 6x = \frac{1 - \tan^2 x}{1 + \tan^2 x} = \cos 2x$
 $x = \frac{n\pi}{4}$ and $x = \pm(2n+1)\frac{\pi}{2}$
 $x = 0, \frac{\pi}{4}, \frac{3\pi}{4}, \pi, \frac{5\pi}{4}, \frac{7\pi}{4}, 2\pi$
2. $\sin^4 x + \cos^4 x = \sin x \cos x$
 or
 $(\sin^2 x + \cos^2 x)^2 - 2\sin^2 x \cos^2 x = \sin x \cos x$
 or $1 - \frac{\sin^2 2x}{2} = \frac{\sin 2x}{2}$ or
 $\sin^2 2x + \sin 2x - 2 = 0$
 or $(\sin 2x + 2)(\sin 2x - 1) = 0$
 or $2x = (4n+1)\frac{\pi}{4}, n \in Z$
 or $x = (4n+1)\frac{\pi}{4}, n \in Z$
 $= \frac{\pi}{4}, \frac{5\pi}{4} (\because x \in [0, 2\pi])$
 Thus there are two solutions
3. $6 \cos 2\theta + 2 \cos^2 \frac{\theta}{2} + 2 \sin^2 \theta = 0$
 or
 $12 \cos^2 \theta - 6 + 1 + \cos \theta + 2 - 2 \cos^2 \theta = 0$
 or $10 \cos^2 \theta + \cos \theta - 3 = 0$
 or $(5 \cos \theta + 3)(2 \cos \theta - 1) = 0$
 or $\cos \theta = -\frac{3}{5}, \frac{1}{2}$
 $\theta = \frac{\pi}{3}, \pi - \cos^{-1}\left(\frac{3}{5}\right), -\frac{\pi}{3}$
4. $x \in [0, 2\pi]$ and $y \in [0, 2\pi]$ and
 $\sin x + \sin y = 2$ this is possible only
 when $\sin x = 1$ and $\sin y = 1$ thus
 $x = \frac{\pi}{2}$ and $y = \frac{\pi}{2}$
 Hence $x + y = \pi$
5. We have
 $\sqrt{3} \cos \theta - 3 \sin \theta = 2(\sin 5\theta - \sin \theta)$
 or $\left(\frac{\sqrt{3}}{2}\right) \cos \theta - \left(\frac{1}{2}\right) \sin \theta = \sin 5\theta$

or
 $\cos\left(\theta + \frac{\pi}{6}\right) = \sin 5\theta = \cos\left(\frac{\pi}{2} - 5\theta\right)$

$$\Rightarrow \theta + \frac{\pi}{6} = 2n\pi \pm \left(\frac{\pi}{2} - 5\theta\right)$$

or $\theta = \frac{n\pi}{3} + \frac{\pi}{18}$

or $\theta = \left(\frac{-n\pi}{2}\right) + \frac{\pi}{6}, \forall n \in Z$

6. Given $x^2 + 2x \sin(xy) + 1 = 0$

or $[x + \sin(xy)]^2 + [1 - \sin^2(xy)] = 0$

or $x + \sin(xy) = 0$ and $\sin^2(xy) = 1$

$\sin^2(xy) = 1$ gives $\sin(xy) = 1$ (or) -1

If $\sin(xy) = 1 \Rightarrow x = -1$

$\Rightarrow \sin(-y) = 1 \Rightarrow \sin y = -1$

Then the ordered pair is $\left(1, \frac{3\pi}{2}\right)$

If $\sin(xy) = -1 \Rightarrow x = 1$

$\sin y = -1 \Rightarrow \left(-1, \frac{3\pi}{2}\right)$

Thus there are two ordered pairs.

7. $\cos^2 x = 2 \cos x(1 - 3 \cos^2 x)$

(or) $6 \cos^3 x + \cos^2 x - 2 \cos x = 0$

(or) $\cos x = 0, \frac{1}{2}, -\frac{2}{3}$

$\Rightarrow x = \frac{\pi}{2}, \frac{\pi}{3}, \cos^{-1}\left(\frac{-2}{3}\right)$

($\because \alpha, \beta$ are +ve)

If $\alpha = \frac{\pi}{2}, \beta = \frac{\pi}{3}$ then we have

$|\alpha - \beta| = \frac{\pi}{6}$

8. $y^2 = y + a = \left(y - \frac{1}{2}\right)^2 + a - \frac{1}{4}$

Since $-\sqrt{2} \leq \sin x + \cos x \leq \sqrt{2}$ the
 given equation will have no real

value x for any y if $a - \frac{1}{4} > \sqrt{2}$

i.e. $a \in \left[\sqrt{2} + \frac{1}{4}, \infty\right)$

$$\Rightarrow a \in (\sqrt{3}, \infty) \text{ as } \left(\sqrt{2} + \frac{1}{4} < \sqrt{3} \right)$$

9. $\cos^8 x + b \cos^4 x + 1 = 0$

$$\Rightarrow b = - \left[\cos^4 x + \frac{1}{\cos^4 x} \right] \leq -2 \quad \forall x \in R$$

$$\Rightarrow b \in (-\infty, -2]$$

10. $|2 \sin \theta - \cos \theta| \geq 1$

(or) $|2 \sin^2 \theta - 1| \geq |\sin \theta|$

(or) $|\cos 2\theta| \geq |\sin \theta|$

(or) $2 \cos^2 2\theta \geq 1 - \cos 2\theta$

(or) $2 \cos^2 2\theta + \cos 2\theta - 1 \geq 0$

(or) $(2 \cos 2\theta - 1)(\cos 2\theta + 1) \geq 0$

$$\Rightarrow \cos 2\theta \geq \frac{1}{2}$$

[as $\cos \theta \neq 0, i.e \cos 2\theta \neq -1$]

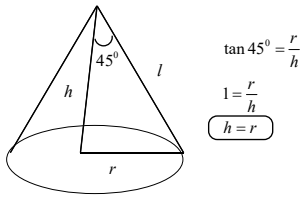
11. $\Delta = \sqrt{s(s-a)(s-b)(s-c)}$

$$\log \Delta = \frac{1}{2} (\log s + \log(s-a) + \log(s-b) + \log(s-c))$$

$$\frac{1}{\Delta} \delta \Delta = \frac{1}{2} \left[\frac{\delta c}{s} + \frac{\delta c}{s-a} + \frac{1}{2} \frac{\delta c}{s-b} - \frac{1}{2} \frac{\delta c}{s-c} \right]$$

$$\delta \Delta = \frac{\Delta}{4} \left[\frac{1}{s} + \frac{1}{s-a} + \frac{1}{s-b} - \frac{1}{s-c} \right] \delta c$$

12.



$$l^2 = h^2 + r^2$$

$$= h^2 + h^2$$

$$= 2h^2$$

$$l = \sqrt{2}h$$

$$s = \pi r l$$

$$= \pi h (\sqrt{2}h)$$

$$f(h) = \sqrt{2} \pi h^2$$

$$h = 20, \Delta h = 0.025$$

$$f(h + \Delta h) \cong f(h) + f'(h) \Delta h$$

$$\cong \sqrt{2} \pi (20)^2 + 2\sqrt{2} \pi (20)(0.025)$$

$$\cong 400\sqrt{2}\pi + \sqrt{2}\pi$$

$$\cong 401\sqrt{2}\pi$$

13. $pv = c$

$$\Rightarrow p \delta v + v \delta p = 0$$

$$c \frac{\delta v}{v^2} = p \frac{\delta v}{v} = -\delta p$$

14. $A = 9, l = \sqrt{2}x$

$$\delta A = 0.02$$

$$A = x^2$$

$$l^2 = 2x^2$$

$$l^2 = 2A$$

$$2 \log l = \log 2 + \log A$$

$$\frac{2}{l} \delta l = \frac{1}{A} \delta A$$

$$= \frac{0.02}{9}$$

$$2 \frac{\delta l}{l} \times 100$$

$$= \frac{0.02}{9} \times 100$$

$$= \frac{1}{9}$$

15. $a = x \sin A \Rightarrow \frac{da}{dt} = (x \cos A) \frac{dA}{dt}$

But it is given that $\frac{da}{dt} = \frac{x}{2} \cdot \frac{dA}{dt}$

$$\therefore \cos A = \frac{1}{2} \text{ and } A = \frac{\pi}{3}$$

16. $s = t^3 - 9t^2 + 24t$

$$\frac{ds}{dt} = 3t^2 - 18t + 24$$

$$v = \frac{ds}{dt} < 0$$

$$3t^2 - 18t + 24 < 0$$

$$t^2 - 6t + 8 < 0$$

$$t \in (2, 4)$$

17. $32x \frac{dx}{dt} + 18y \frac{dy}{dt} = 0$

$$32x - 18y = 0$$

$$16x = 9y$$

$$x = \frac{9y}{16}$$

$$\frac{81y^2}{(16)} + 9y^2 = 400$$

$$81y^2 + 144y^2 = 400 \times 16$$

$$225y^2 = 400 \times 16$$

$$9y^2 = (16)^2$$

$$y = \frac{16}{3}$$

$$x = \frac{9}{16} \left(\frac{16}{3} \right)$$

$$x = 3$$

$$(x, y) = (3, 16/3)$$

18. Given OA = 8, OB = 6
After 2 seconds OA = 12, OB = 4

$$\Delta = \text{Area} = \frac{1}{2}xy$$

$$\frac{d\Delta}{dt} = \frac{1}{2} \left[x \frac{dy}{dt} + y \frac{dx}{dt} \right]$$

$$= \frac{1}{2} [12(-1) + 4(2)] = -2$$

19. $v = k\sqrt{a^2 - x^2}$

Acceleration

$$= \frac{dv}{dt} = \frac{d}{dt} (k\sqrt{a^2 - x^2}) = k \cdot \frac{1}{2\sqrt{a^2 - x^2}} \cdot (-2x) \frac{dx}{dt} = -k^2x$$

20. $V \propto x^2$; $V = kx^2 \rightarrow (1)a = k \cdot 2x \cdot kx^2$

$$\text{From (1)} = (2k^2)x^3 \Rightarrow a \propto x^3$$

21. The given equation is equivalent to

$$2\sin^2\left(\frac{\pi}{2}\right)\cos^2 x = 2\sin^2\left(\frac{\pi}{2}\right)\sin 2x$$

(or)

$$\cos^2 x = \sin 2x$$

(or)

$$\cos x(\cos x - 2\sin x) = 0$$

$$\Rightarrow 1 - 2\tan x = 0 \text{ as } \cos x \neq 0, x \neq (2n+1)\frac{\pi}{2}$$

(or)

$$\tan x = \frac{1}{2}$$

$$\cos 2x = \frac{1 - \tan^2 x}{1 + \tan^2 x} = \frac{3}{5} = 0.6$$

22. $\sin x = \sin y \dots\dots\dots$ i)

$$\sqrt{6} \sin y = \tan z \dots\dots\dots$$
ii)

$$\text{and } 2\sin z = \sqrt{3} \cos x \dots\dots\dots$$
iii)

from eq. (iii) we have

$$\sin^2 z = \frac{3\cos^2 x}{4}$$

From eq. (i)

$$\sin^2 x = \cos^2 y \text{ (or)}$$

$$\sin^2 x = \cos^2 y \text{ (or)} \cos^2 x = 1 - \cos^2 y$$

From (ii)

$$\sin^2 y = \frac{\tan^2 z}{6}$$

$$= \frac{1}{6} \times \frac{3\cos^2 x}{4(1 - 3\cos^2 x)}$$

$$= \frac{1 - \cos^2 y}{2(4 - 3 + 3\cos^2 y)} = \frac{\sin^2 y}{2(1 + 3\cos^2 y)}$$

$$\text{(or)} \sin^2 y(2 + 6\cos^2 y - 1) = 0$$

$$\text{(or)} \sin 2y = 0 \text{ (or)} \cos^2 y = -\frac{1}{6}$$

(not possible)

$$\Rightarrow y = n\pi$$

$$\Rightarrow \sin^2 x = 1 \text{ and } \sin^2 y = 0 \text{ and}$$

$$\sin^2 z = 0$$

23. $\pi \log_3 \left[\frac{1}{x} \right] = kx, k \in I$

$$\log_3 \left[\frac{1}{x} \right] = k \text{ or } x = 3^{-k}$$

The possible values of 'k' are -1, 0, 1, 2, 3,

$$s = 3 + 1 + \frac{1}{3} + \frac{1}{3^2} + \frac{1}{3^3} + \dots\dots\dots \infty = \frac{3}{1 - \frac{1}{3}} = \frac{9}{2} = 4.5$$

24. given $\Delta r = \pm \frac{0.04}{2} = \pm 0.02; r = 10$

$$\text{Volume, } V = \frac{4}{3}\pi r^3$$

Take log on both sides & diff.

$$\Rightarrow \frac{\Delta V}{V} \times 100 = 3.$$

$$\frac{\Delta r}{r} \times 100 = 0.6$$

25. $V = \frac{4}{3}\pi r^3$

$$\log v = \log \left(\frac{4\pi}{3} \right) + 3\log r$$

$$\frac{\delta v}{v} \times 100 = \frac{3\delta r}{r} \times 100$$

$$= 3 \times \frac{0.01}{10} \times 100$$

$$= 0.3$$

PHYSICS

26)

Change in pressure due to placing of mass on piston is $\Delta p = \frac{Mg}{A}$

From bulk modulus definition

$$K = \frac{-dp}{dV/V}$$

$$\left| \frac{dV}{V} \right| = \frac{\Delta p}{K} = \frac{Mg}{AK}$$

$$V = \frac{4}{3} \pi r^3$$

Form

$$\frac{dV}{V} = \frac{3dR}{R} \Rightarrow \frac{dR}{R} = \frac{1}{3} \frac{dV}{V} = \frac{Mg}{3AK}$$

27)

Cross-sectional area of the section is

$$A' = \frac{A}{\cos \theta}$$

$$\text{Shearing stress} = \frac{F \sin \theta}{A'} = \frac{F \sin 2\theta}{2A}$$

28)

The stress at the position of this element is produced by the weight of the rod of length x lying below it, i.e. $(W/L)x$.

Therefore stress at this section

$$\sigma = \frac{(W/L)x}{A} = \frac{Wx}{AL}$$

$$\text{The elongation } d\delta = \frac{\sigma}{Y} dx = \frac{W}{YAL} x dx$$

Thus total elongation produced in the rod can be calculated as $\delta = \int d\delta$

$$\delta = \frac{W}{YAL} \int_0^x x dx = \frac{W}{YAL} \left[\frac{x^2}{2} \right]_0^L \text{ or}$$

$$\sigma = \frac{1}{2} \frac{WL}{YA}$$

29)

As discussed earlier the tension T in the string at a distance x from its free end is given as

$$T = \frac{F}{l} x$$

$$\text{Hence, } P = \frac{T}{A} = \frac{F}{Al} x$$

Substituting (p) in the Hence

$$p = \frac{T}{A} = \frac{F}{Al} x \quad \text{Substituting (p$$

) in the formula $U = \frac{1}{2Y} \int P^2 dv$

$$\text{We have } U = \frac{1}{2Y} \int_0^l \frac{F^2}{A^2 l^2} x^2 dv$$

$$\text{Where } dv = Adx; \text{ This gives } U = \frac{F^2 l}{6AY}$$

30.

Every element of the ring rotates in a circular path of radius R about the axis of rotation. The radial component of tension in the wire provides the centripetal forces. The figure shows a free body diagram of a small element of mass dm of the ring

$$dm = (m/2\pi) d\theta$$

The radial component of tension is

$$F_r = 2F \sin \frac{d\theta}{2} = 2F \left(\frac{d\theta}{2} \right) \approx F d\theta$$

Applying Newton's second law, we get $F d\theta = (dm) \omega^2 R$

$$F d\theta = \left(\frac{m d\theta}{2\pi} \right) \omega^2 R \text{ or } F = \frac{m \omega^2 R}{2\pi}$$

If the breaking stress is σ_b , then the maximum value of F can be

$$F_{\max} = \sigma_b A$$

$$\frac{m \omega_{\max}^2 R}{2\pi} = \sigma_b A$$

$$\omega_{\max} = \sqrt{\frac{2\pi \sigma_b A}{mR}}$$

31.

$$Y = \frac{FL}{Al} = \frac{4Mgl}{\pi d^2 l}$$

Where

$$M = 1.0 \text{ kg (exact), } g = 9.8 \text{ ms}^{-2} \text{ (exact)}$$

$$L = 2 \text{ m (exact), } l = 0.8 \text{ mm} =$$

$$0.8 \times 10^{-3} \text{ m}$$

$$\Delta l = \pm 0.05 \text{ mm, } d = 0.4 \text{ mm} = 0.4 \times 10^{-3} \text{ m}$$

$$\Delta d = \pm 0.01 \text{ mm}$$

Substituting the values of M, g, L, d

and l in Eq (i) we get

$$Y = 2.0 \times 10^{11} \text{ Nm}^{-2}$$

From Eq (1) the proportionate uncertainty in Y is given by

$$\frac{\Delta Y}{Y} = \frac{\Delta M}{M} + \frac{\Delta g}{g} + \frac{\Delta L}{L} + \frac{2\Delta d}{d} + \frac{\Delta l}{l}$$

Since the values of M, g and L are exact, $\Delta M = 0$, $\Delta g = 0$ and $\Delta L = 0$, hence

$$\frac{\Delta Y}{Y} = \frac{2\Delta d}{d} + \frac{\Delta l}{l} = \frac{2 \times 0.01 \text{ mm}}{0.4 \text{ mm}} + \frac{0.05 \text{ mm}}{0.8 \text{ mm}}$$

$$0.05 + 0.0625 = 0.1125$$

$$\Delta Y = 0.1125 \times Y = 0.1125 \times 2.0 \times 10^{11}$$

$$= 0.225 \times 10^{11} \text{ Nm}^{-2}$$

32.

Pressure at the surface of the ocean = P_0 , the atmospheric pressure

Pressure at a depth = nP_0

\therefore Increase in pressure

$$(\Delta P) = nP_0 - P_0 = (n-1)P_0$$

Let v be the volume of a certain mass

m of water at the surface, so that

$M = \rho V$. The decrease in volume

under pressure ΔP is

$$\Delta V = \frac{V \Delta P}{B}$$

\therefore volume of the same mass M of water at the given depth is

$$V' = V - \Delta V = V - \frac{V \Delta P}{B} = V \left(1 - \frac{\Delta P}{B} \right) = \frac{V}{B} (B - \Delta P)$$

Density of water at that depth is

$$\rho' = \frac{M}{V'} = \frac{\rho V}{V'} = \frac{\rho V}{\frac{V}{B} (B - \Delta P)}$$

$$\frac{\rho B}{B - \Delta p} = \frac{\rho B}{B - (n-1)p_0}$$

33.

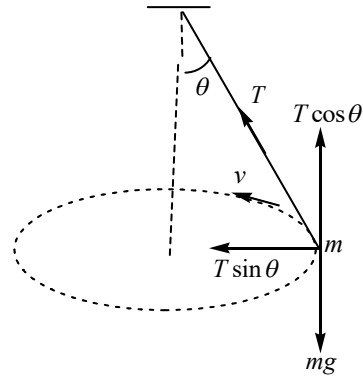
For vertical equilibrium

$$T \cos \theta = mg$$

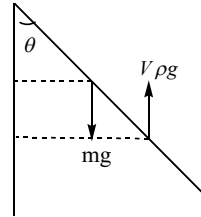
If L is the original length of the wire, the increase in length is

$$l = \frac{TL}{AY}$$

$$\text{Strain } \frac{l}{L} = \frac{T}{AY} = \frac{mg}{AY \cos \theta}$$



34.



$$mg \frac{b}{2} \sin \theta = v \rho g \left(b - \frac{x}{2} \right) \sin \theta$$

$$\Rightarrow \frac{5b}{9} \frac{b}{2} = b \left(b - \frac{x}{2} \right)$$

$$\Rightarrow \frac{5}{9} \frac{b^2}{2} = \left(b^2 - \frac{bx}{2} \right)$$

$$\frac{bx}{2} = b^2 - \frac{5b^2}{18}$$

$$\frac{x}{2} = b - \frac{5b}{18}$$

$$\frac{x}{2} = \frac{13b}{18}$$

$$x = \frac{13b}{9}$$

$$x = \frac{13b}{9}$$

35.

Increase in upthrust

$$= V \rho g - 0.8V \rho g$$

$$= 0.2V \rho g$$

$$\therefore \text{Work done} = \frac{0.2V \rho g}{2} \times 0.02$$

$$= 2V \rho g \times 10^{-3}$$

$$= 2 \times 3000 \times 10^{-6} \times 10^3 \times 10 \times 10^{-3}$$

$$= 6 \times 10^{-2} = 0.06 \text{ J}$$

36.

$$96 - 86 = \left(\frac{m}{11.4} + \frac{96 - m}{7.4} \right)$$

$$m = 62.7 \text{ gram}, \quad 96 - m = 33.3 \text{ gram}$$

37.

$$dF = x\rho g(dx)2\pi r$$

$$F = \rho g 2\pi r \frac{h^2}{2} = h\rho g \pi r^2$$

$$\Rightarrow h = r$$

38.

$$W = \left(\frac{h_1 + h_2}{2}\right)^2 A\rho g - \left(\frac{h_1^2}{2} + \frac{h_2^2}{2}\right) A\rho g$$

$$= -A\rho g \left(\frac{h_2 - h_1}{2}\right)^2$$

39.

$$P_0 + (l+h)\rho_w g = P_0 + 2h\rho_m g$$

40.

$$T = \rho\rho_w v g$$

$$T' = \rho\rho_w v g - \rho_w \frac{v}{2} g$$

$$= \rho_w v g - \left[\rho - \frac{1}{2}\right]$$

$$T' = \frac{T}{\rho} \left[\rho - \frac{1}{2}\right]$$

$$T' = \left[\frac{2\rho - 1}{2\rho}\right] T$$

41.

$$A_1 V_1 = A_2 V_2$$

$$L^2 \sqrt{2gy} = \pi r^2 \sqrt{2g4y}$$

$$r = \frac{L}{\sqrt{2\pi}}$$

42.

$$-\frac{dy}{dt} A = a\sqrt{2gy}$$

$$-\int_{h_1}^{h_2} \frac{dy}{\sqrt{y}} = \frac{a\sqrt{2g}}{A} \int_0^t dt$$

43.

$$P_0 + h \times 3.4 \times g = P_0 + 70 \times 13.6 \times g$$

$$h = \frac{70 \times 13.6}{3.4} = 280 \text{ cm}$$

44.

$$2F \sin \frac{d\theta}{2} = T R d\theta$$

$$F = TR$$

45.

$$t = \frac{A}{a} \sqrt{\frac{2}{g}(h_1 - h_2)}$$

$$t_1 = \frac{A}{a} \sqrt{\frac{2}{g} \left(H - \frac{3H}{4}\right)}$$

$$t_2 = \frac{A}{a} \sqrt{\frac{2}{g} \left(\frac{3H}{4}\right)}$$

46)

$$Y = \frac{F/A}{\Delta l/l} = \frac{F}{A} \times \frac{l}{\Delta l} = \frac{20 \times 1}{10^{-6} \times 10^{-4}}$$

$$= 2 \times 10^{11} \text{ N/m}$$

47)

$$\frac{5}{1} = \frac{F}{10} \Rightarrow F = 50 \text{ N}$$

48)

$$\frac{4}{3} \times \frac{22}{7} \times (1000 - 729) 10^{-6} \times \rho$$

$$= \frac{1}{2} \times \frac{4}{3} \times \frac{22}{7} \times 10^3 \times 10^{-6} \times 0.8$$

$$= 500 \times \frac{8}{10} = 400$$

$$\Rightarrow 271 \times \rho$$

$$\Rightarrow \rho = \frac{400}{271}$$

59)

Volume of material of sphere =

$$\frac{40}{8} = 5 \text{ cc}$$

$$(40 - 20) \times 10 = 1 \times V \times 10$$

$$V = 20 \text{ cc [total volume]}$$

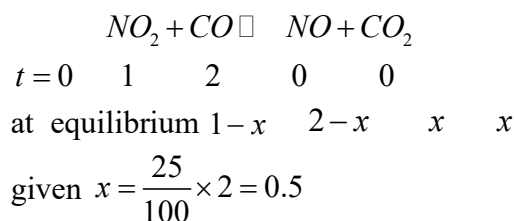
Volume of cavity = 20 - 5 = 15 cc.

50)

$$A_1 V_1 = A_2 V_2 + A_3 V_3$$

CHEMISTRY

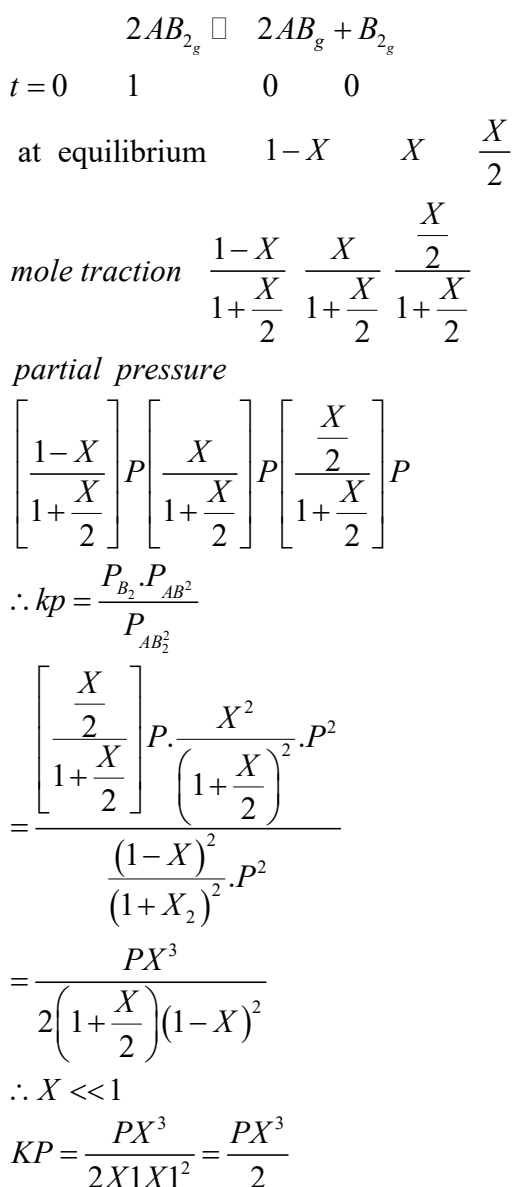
51.



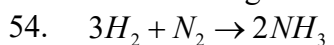
given reaction $\square n = 0$

$$\therefore kp = kc = \frac{0.5 \times 0.5}{0.5 \times 1.5} = \frac{1}{3}$$

52.



53. lesser is the percentage dissociation grater is the vapour density



$$\begin{array}{ccc}
 3 & 1 & 2 \\
 \frac{3}{2} & \frac{1}{2} & 1
 \end{array}$$

from limiting agent

$$10 \times \frac{3}{2} \quad 10 \times \frac{1}{2} \quad 10 \times 1$$

$$15 \quad 5 \quad 10$$

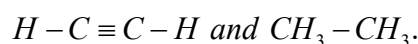
composition of gaseous mixture under the aforesaid condition in the end

$$H_2 = 30 - 15 = 15 \text{ litre}$$

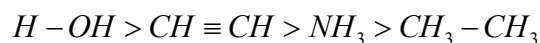
$$N_2 = 30 - 5 = 25 \text{ litre}$$

$$NH_3 = 10 \text{ litre}$$

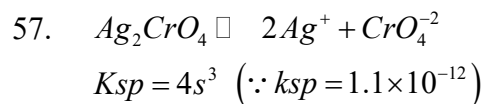
55. their conjugate acids are $H-OH, NH_3,$



Their acid character are



56. $\alpha = \frac{1.69 \times 10^{-5}}{0.01} = 0.169 \times 10^{-2}$



$$s = 0.65 \times 10^{-4}$$



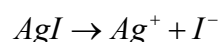
$$k_{sp} = s^2$$

$$s = \sqrt{1.8 \times 10^{-10}} = 1.34 \times 10^{-5}$$



$$k_{sp} = s^2$$

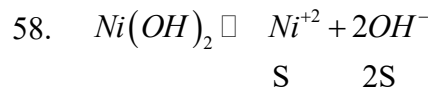
$$s = \sqrt{k_{sp}} = 0.71 \times 10^{-6}$$



$$k_{sp} = s^2$$

$$s = 0.9 \times 10^{-8}$$

\therefore solubility of Ag_2CrO_4 is highest so it will ppt last



$$4S3 = 2 \times 10^{-15}$$

$$S = 0.58 \times 10^{-4}$$

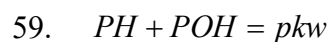


$$k_{sp} = s^2$$

$$s = \sqrt{6 \times 10^{-17}}$$

$$= 7.8 \times 10^{-9}$$

$\therefore Ni(OH)_2$ is more soluble than $AgCN$

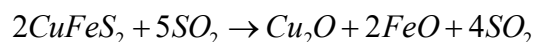
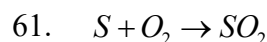


$$POH = 14 - 4.7 = 9.3$$

$$POH = -\log[OH^-] = 9.3$$

$$(OH^-) = 5 \times 10^{-10}$$

60. buffer solution is the solution whose PH value does no change



- $SO_2 + H_2O_2 \rightarrow H_2SO_4 \rightarrow H_2O + SO_3$
 $SO_2 + O_3 \rightarrow SO_3 + O_2$
62. Controlled by using alternate source of energy
 For burning, as nuclear energy, solar Energy, hydroelectric energy.
 Sulphur containing fuels are desulphonated before burning by FGD (fuel gas desulfurization) under high pressure
 $H_2O + SO_2 \rightarrow H_2SO_3$ (it will)
 lower PH of the soil and thus fertility is decreased
63. Ideal value of DO for growth of fishes is 8 mg/lit. 7mg/lit is desirable value below this value fishes get susceptible to disease. A value of 2mg/lit or below is lethal for fishes
64. O_2 carrying capacity of blood is decreased
65. even lowconc of SO_2 causes respiratory diseases asthma, bronchitis emphysema in human beings (irritation eyes)
66. ozone does not absorbs infrared radication at all. It absorbs uv radiation coming from Sun in the upper atmosphere and acts as an umbrella thus protecting human being living on earth
67. Thermosphere is the fourth layer Of the earth atmosphere and is Located above the mesosphere. The high temperature in the thermosphere can cause molecules to ionize (O^{+2}, O^+, NO^+)
68. BOD is connected with microbes and organic matter
69. photochemical smog does not involve SO_2
70. $BaO_2 + CO_2 + H_2O \rightarrow BaCO_3 \downarrow + H_2O_2$
71. $2NH_{3(g)} \rightleftharpoons N_{2(g)} + 3H_{2(g)}$
 T=0 2 0 0
 Equilibrium 2-2x x 3x
 given 2-2x=1
 x=0.5

- $$K_c = \frac{0.5 \times (1.5)^3}{12}$$
- $$= 0.75 = \frac{75}{120}$$
- $$= 1.6875 = \frac{16875}{10000} = \frac{27}{16} = 1.6$$
72. $NH_2COONH_{4(s)} \rightleftharpoons 2NH_{3g} + CO_{2g}$
 at equilibrium 2p p
 $P_T = 2P + P = 3P$
 $KP = P_{CO_2} \times P_{NH_3}^2$
 $= P \times (2P)^2 = 4P^3$
 When entra NH_3 is added
 $NH_2COONH_{4s} \rightleftharpoons 2NH_{3g} + CO_{2g}$
 $KP = P_{CO_2} \times P_{NH_3}^2$
 $x + (3P)^2 = 9P^2x$
 $4P^3 = 9P^2x$
 $x = \frac{4P^3}{9P^2} = \frac{4}{9}P$
 total pressure now
 $= 3P + X$
 $= 3P + \frac{4}{9}P$
 $= \frac{31}{9}P$
 $\frac{\text{total pressure now}}{\text{total pressure previous}}$
 $= \frac{\frac{31}{9}P}{3P} = \frac{31}{27} = 1.1$
73. degree of dissociation
 $x = \frac{M - m}{(n - 1)m}$
 $x = \frac{92 - 80}{(2 - 1)80} = \frac{12}{80} = 0.15$
 percentage dissociation = 15
74. $PH = 7 + \frac{1}{2}(pka - pkb)$
 $7 + \frac{1}{2}(4.76 - 4.75)$
 $= 7 + \frac{1}{2}(0.01) = 7 + 0.005$
 $= 7.005$
75. Weight of $CaCO_3$ in 50 gram

of water = $6 \times 0.001 = 6 \times 10^{-3}$ gram
weight of CaCO_3 in 10^6 gram

$$\text{of water} = \frac{10^6 \times 6 \times 10^{-3}}{56} = 120 \text{ gram}$$
$$D.H = 120 \text{ ppm}$$