SRIGAYATRI EDUCATIONAL INSTITUTIONS

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

1. **The number of solutions of the equation** $\cos 6x + \tan^2 x + \cos 6x.\tan^2 x = 1$ **in the interval** $[0, 2\pi]$ **is**

   1) 4 2) 5 3) 6 4) 7

2. **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

3. **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

4. **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

5. **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

6. **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

7. **Let** α **and** β **be any two positive values of x for which 2 cosx |cosx| 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

8. $\sin x + \cos x = y^2 - y + a$ **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) $(\sqrt{3}, \infty)$

9. **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

10. **If** $|2\sin\theta - \cos ec\theta| \geq 1$ **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 45^0. 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 $\frac{C.\delta v}{v^2}$ 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 cos2x 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 denate 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** $\pm 0.04cm$ **in the measurement of the diameter of sphere then the percentage error in its volume, when radius is 10cm**

25. **If there is a possible error of 0.02cm in the measurement of the diameter of a sphere then the possible percentage error in its volume when the radius 10cm is**

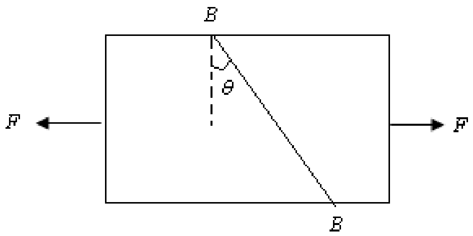
PHYSICS

<u>SYLLABUS</u>: 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 are 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** $\pm 0.01 mm$**. The Young's modulus obtained from the reading is [Take g = 9.8m/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) $(2.0 \pm 0.05)\times 10^{11}\,\text{N/m}^2$

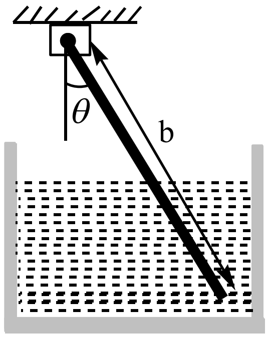
32) **The density of water at the surface of the ocean is** ρ**.If the bulk modulus of water is B, what is the density of ocean water at a depth where the pressure is in** nP_0**, where** P_0 **is he atmospheric pressure ?[Assume % change in density is small]**

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.** $(g = 10ms^{-2})$

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

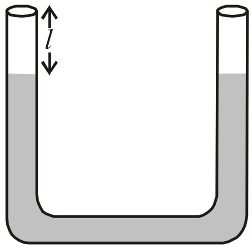
37) **A cylindrical wooden body of height 3 m and mass 80 kg floats vertically in water. If its specific gravity is 0.80, the amount by which it gets depressed when a body of mass 10 kg is placed on its upper surface is**

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) $\frac{a}{Ag}\left(\sqrt{h_1}-\sqrt{h_2}\right)$ (2) $\frac{a}{Ag\sqrt{2}}\left(\sqrt{h_1}-\sqrt{h_2}\right)$

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

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)140cm (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**

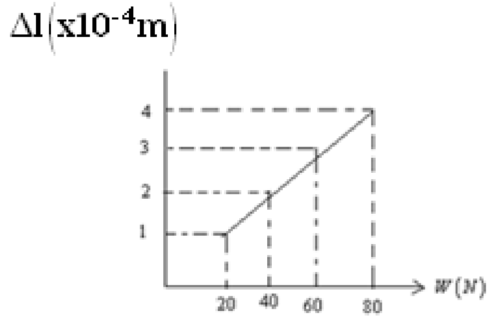
(1) πR^2T (2) 2RT (3)RT (4) $\frac{\pi R^2}{T}$

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**

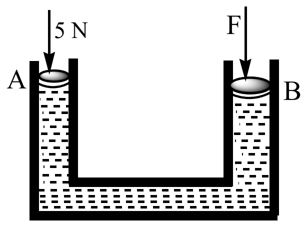
1. $\left(\sqrt{2}-1\right)\frac{A}{a}\sqrt{\frac{H}{g}}$ 2. $\left(\frac{A}{a}\right)\left(\sqrt{\frac{H}{g}}\right)$ 3. $\left(\sqrt{2}-1\right)\sqrt{\frac{H}{g}}$ 4. $Aa\left(\sqrt{2}-1\right)\sqrt{\frac{H}{g}}$

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**



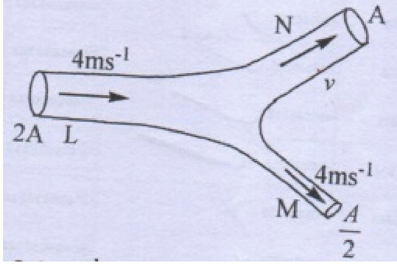
47) **The area of cross-section of the two arms of a hydraulic press are 1cm^2 and 10 cm^2 respectively. A force of 5 N is applied on the water in the thinner arm. What force should be applied on the water in the thicker arm so that the water may remain in equilibrium?**



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**



CHEMISTRY

SYLLABUS: Chemical equilibrium, Hydrogen and its compounds, environmental chemistry

51. **1 mole of NO_2 and 2 moles of co are enclosed in a one litre vessel to attain the following equilibrium $NO_2 + CO \rightleftarrows NO + CO_2$. It was estimated that at the equilibrium 25% of initial amant of CO is consumed. The equilibrium constant kp is**

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

52. **At temperature T.A Compound $AB_{2(g)}$ dissociates according to the reaction $2AB_{2(g)} \rightleftarrows 2AB_{(g)} + B_{2(g)}$ with a degree of dissociation x which is small as compared to unity. The expression for kp in terms of 'X' and total pressure 'P' is**

1) $\frac{PX^3}{2}$ 2) $\frac{PX^2}{3}$ 3) $\frac{PX^3}{3}$ 4) $\frac{PX^2}{2}$

53. **For the reaction $N_2O_{4(g)} \rightleftharpoons 2NO_{2(g)}$. It percentage dissociation of N_2O_4 are $25\%, 50\%, 75\%, 100\%$, then the sequence of observed vapour densities will be**

1) $d_1 > d_2 > d_3 > d_4$ 2) SrO

3) $d_1 = d_2 = d_3 = d_4$ 4) $(d_1 = d_2) > (d_3 = d_4)$

54. **In Haber process 30 litres of dihydrogen and 30 litres of dinitrogen were taken for reaction which yielded only 50% of the expected product what will be the composition of gaseous mixture under the aforesaid condition in the end**

1) 20 litres ammonia, 20 litres nitrogen, 20 litres hydrogen
2) 10 litres ammonia, 25 litres nitrogen, 15 litres hydrogen
3) 20 litres ammonia, 10 litres nitrogen, 30 litres hydrogen
4) 20 litres ammonia, 25 litres nitrogen, 15 litres hydrogen

55. **What is the decreasing order of strength of bases $OH^-, NH_2^-, H-C \equiv C^-, and\ CH_3 - CH_2^-$**

1) $CH_3 - CH_2^-, > NH_2^- > H - C \equiv C^- > OH^-$ 2) $H - C \equiv C^{-1} > CH_3 - CH_2^- > NH_2^- > OH^-$

3) $OH^- > NH_2^- > H - C \equiv C^- > CH_3 - CH_2^-$ 4) $NH_2^- > H - C \equiv C^- > OH^- > CH_3 - CH_2^-$

56. **The dissociation constant of acetic acid of given temperature is 1.69×10^{-5}. The degree of dissociation of 0.01M acetic acid in the presence of 0.01M HCl is equal to**

1) 0.41 2) 0.13 3) 0.169×10^{-2} 4) 0.013

57. **The ksp of $Ag_2CrO_4, AgCl, AgBr\ and\ AgI$ are $1.1 \times 10^{-12}, 1.8 \times 10^{-10}, 5.0 \times 10^{-13}$ and 8.3×10^{-17}, which one solution is added to the solution containg equal mole of NaCl, NaI and Na_2CrO_4**

1) AgI 2) $AgCl$ 3) $AgBr$ 4) Ag_2CrO_4

58. **The values of ksp of two sparingly soluble salts $Ni(OH)_2$ and $AgCN\ are$ 2.0×10^{-15} and 6×10^{-17} respectively. Which salt is more soluble**

1) $Ni(OH)_2$ is more soluble than $AgCN$ 2) $AgCN$ is more soluble than $Ni(OH)_2$

3) Both $Ni(OH)_2$ and $AgCN$ soluble to same extent

4) $Ni(OH)_2$ is soluble but $AgCN$ is insoluble.

59. **A solution of an acid has $PH = 4.70$. Find out the concentration of $OH^-\ ions\ (pkw = 14)$**

1) 5×10^{-10} 2) 6×10^{-10} 3) 2×10^{-5} 4) 9×10^{-5}

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 sulpur $\left(SO_2, SO_3\right)$ are due to

1) burning of sulpur 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 $HbO_2 + CO \rightleftarrows HbCO + O_2$ $HbCO = 3\%\, to\ 4\%$ 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 l 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** $(1ml = 0.001gram\ CaCO_3)$ **were required in titrating 50ml of a sample of hard water to produce good lather. Calculate the degree of hardness in ppm…….**

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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. $\cos 6x = \dfrac{1-\tan^2 x}{1+\tan^2 x} = \cos 2x$

$x = \dfrac{n\pi}{4}$ *and* $x = \pm(2n+1)\dfrac{\pi}{2}$

$x = 0, \dfrac{\pi}{4}, \dfrac{3\pi}{4}, \pi, \dfrac{5\pi}{4}, \dfrac{7\pi}{4}, 2\pi$

2. $\sin^4 x + \cos^4 x = \sin x \cos x$

or

$\left(\sin^2 x + \cos^2 x\right)^2 - 2\sin^2 x \cos^2 x = \sin x \cos x$

or $1 - \dfrac{\sin^2 2x}{2} = \dfrac{\sin 2x}{2}$ or

$\sin^2 2x + \sin 2x - 2 = 0$

or $(\sin 2x + 2)(\sin 2x - 1) = 0$

or $2x = (4n+1)\dfrac{\pi}{4}, n \in Z$

or $x = (4n+1)\dfrac{\pi}{4}, n \in Z$

$= \dfrac{\pi}{4}, \dfrac{5\pi}{4} (\because x \in [0, 2\pi])$

Thus there are two solutions

3. $6\cos 2\theta + 2\cos^2 \dfrac{\theta}{2} + 2\sin^2 \theta = 0$

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 $\cos\theta = -\dfrac{3}{5}, \dfrac{1}{2}$

$\theta = \dfrac{\pi}{3}, \pi - \cos^{-1}\left(\dfrac{3}{5}\right), -\dfrac{\pi}{3}$

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 $x = \dfrac{\pi}{2}$ and $y = \dfrac{\pi}{2}$

Hence $x + y = \pi$

5. We have

$\sqrt{3}\cos\theta - 3\sin\theta = 2(\sin 5\theta - \sin\theta)$

or $\left(\dfrac{\sqrt{3}}{2}\right)\cos\theta - \left(\dfrac{1}{2}\right)\sin\theta = \sin 5\theta$

or

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

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

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

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

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 $\left(1, \dfrac{3\pi}{2}\right)$

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

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

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) $\cos x = 0, \dfrac{1}{2}, -\dfrac{2}{3}$

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

$(\because \alpha, \beta \text{ are } +ve)$

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

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

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

Since $-\sqrt{2} \le \sin x + \cos x \le \sqrt{2}$ the given equation will have no real value x for any y if $a - \dfrac{1}{4} > \sqrt{2}$

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

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

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

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

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

10. $|2\sin\theta - \cos ec\theta| \ge 1$

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

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

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

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

(or) $\left(2\cos 2\theta - 1\right)\left(\cos 2\theta + 1\right) \ge 0$

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

$\left[as \ \cos\theta \ne 0,\ i.e \cos 2\theta \ne -1\right]$

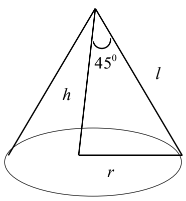
11. $\Delta = \sqrt{s(s-a)(s-b)(s-c)}$

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

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

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

12.



$\tan 45^0 = \frac{r}{h}$

$1 = \frac{r}{h}$

$h = r$

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

$= h^2 + h^2$

$= 2h^2$

$l = \sqrt{2}h$

$s = \pi r l$

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

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

$h = 20, \Delta h = 0.025$

$f(h+\Delta h) \cong f(h) + f^1(h)\Delta h$

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

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

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

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 $\frac{da}{dt} = \frac{x}{2}.\frac{dA}{dt}$

$\therefore \cos A = \frac{1}{2}$ *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. $32x\frac{dx}{dt} + 18y\frac{dy}{dt} = 0$

$32x - 18y = 0$

$16x = 9y$

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

$$\frac{81y^2}{(16)}+9y^2=400$$
$$81y^2+144y^2=400\times16$$
$$225y^2=400\times16$$
$$9y^2=(16)^2$$
$$y=\frac{16}{3}$$
$$x=\frac{9}{16}\left(\frac{16}{3}\right)$$
$$x=3$$
$$(x,y)=(3,16/3)$$

18. Given OA = 8, OB = 6
After 2 seconds OA= 12, OB= 4
$$\Delta=Area=\frac{1}{2}xy$$
$$\frac{d\Delta}{dt}=\frac{1}{2}\left[x\frac{dy}{dt}+y.\frac{dx}{dt}\right]$$
$$=\frac{1}{2}[12(-1)+4(2)]$$ = -2

19. $v=k\sqrt{a^2-x^2}$
Acceleration
$$=\frac{dv}{dt}=\frac{d}{dt}\left(k\sqrt{a^2-x^2}\right)=k.\frac{1}{2\sqrt{a^2-x^2}}.(-2x)\frac{dx}{dt}=-k^2x$$

20. $V\propto x^2$; $V=kx^2\to(1)a=k.2x\ kx^2$
From (1) = $\left(2k^2\right)x^3\Rightarrow a\propto x^3$

21. The given equation is equivalent to
$$2\sin^2\left(\frac{\pi}{2}\right)\cos^2x=2\sin^2\left(\frac{\pi}{2}\right)\sin2x$$
(or)
$$\cos^2x=\sin2x$$
(or)
$$\cos x(\cos x-2\sin x)=0$$
$$\Rightarrow1-2\tan x=0\ \ as\ \cos x\neq0,x\neq(2n+1)\frac{\pi}{2}$$
(or)
$$Tanx=\frac{1}{2}$$
$$\cos2x=\frac{1-\tan^2x}{1+\tan^2x}=\frac{3}{5}=0.6$$

22. $\sin x=\sin y$ ……….i)
$\sqrt{6}\sin y=\tan z$ ………ii)
and $2\sin z=\sqrt{3}\cos x$ ………..iii)
from eq. (iii) we have
$$\sin^2z=\frac{3\cos^2x}{4}$$
From eq. (i)
$\sin^2x=\cos^2y$ (or)
$\sin^2x=\cos^2y$ (or) $\cos^2x=1-\cos^2y$
From (ii)
$$\sin^2y=\frac{\tan^2z}{6}$$
$$=\frac{1}{6}\times\frac{3\cos^2x}{4\left(1-3\cos^2x\right)}$$
$$=\frac{1-\cos^2y}{2\left(4-3+3\cos^2y\right)}=\frac{\sin^2y}{2\left(1+3\cos^2y\right)}$$
$$(or)\sin^2y\left(2+6\cos^2y-1\right)=0$$
(or) $\sin2y=0$ (or) $\cos^2y=-\frac{1}{6}$
(not possible)
$\Rightarrow y=n\pi$
$\Rightarrow\sin^2x=1$ and $\sin^2y=0$ and
$\sin^2z=0$

23. $\pi\log_3\left[\frac{1}{x}\right]=kx,\ k\in I$
$$\log_3\left[\frac{1}{x}\right]=k\ \ or\ \ x=3^{-k}$$
The possible values of ‘k’ are -1, 0, 1, 2, 3, ……….
$$s=3+1+\frac{1}{3}+\frac{1}{3^2}+\frac{1}{3^3}+.........\infty=\frac{3}{1-\frac{1}{3}}=\frac{9}{2}=4.5$$

24. given $\Delta r=\pm\frac{0.04}{2}=\pm0.02;r=10$
Volume, $V=\frac{4}{3}\pi r^3$
Take log on both sides & diff.
$$\Rightarrow\frac{\Delta V}{V}\times100=3.$$
$$\frac{\Delta r}{r}\times100=0.6$$

25. $V=\frac{4}{3}\pi r^3$
$$\log v=\log\left(\frac{4\pi}{3}\right)+3\log r$$
$$\frac{\delta v}{v}\times100=\frac{3\delta r}{r}\times100$$

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

$= 0.3$

PHYSICS

26)

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

From bulk modulus definition

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

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

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

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

27)

Cross –sectional area of the section is

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

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.

There fore stress at this section

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

The elongation dδ = $\frac{\sigma}{Y}dx = \frac{W}{YAL}xdx$

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

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

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

29)

As discussed earlier the tension Tin the string at a distance x form its free end is given as

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

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

Substituting (p) in the Hence

$p = \frac{T}{A} = \frac{F}{Al}x$ Substituting (p) in the formula $U = \frac{1}{2Y}\int P^2 dv$

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

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

30.

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

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

The radial component of tension is

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

Applying Newton’s second law, we get $Fd\theta = (dm)\omega^2 R$

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

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

$F_{\max} = \sigma_b A$

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

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

31.

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

Where

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

L = 2 m(exact) , l = 0.8 mm = $0.8 \times 10^{-3} m$

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

$\Delta d = \pm 0.01mm$

Substituting the values of M, g,L,d and l in Eq (i) we get

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

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 , ΔM = 0 Δg =0 and ΔL = 0 , hence

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

$0.05 + 0.0625 = 0.1125$

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

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

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.

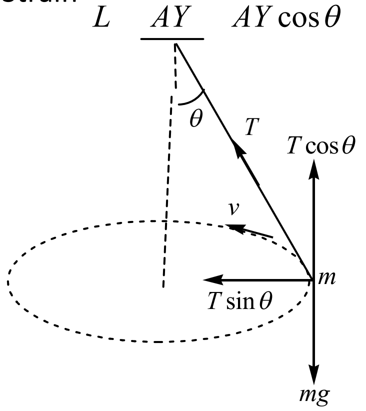
For vertical equilibrium

$T\cos\theta = mg$

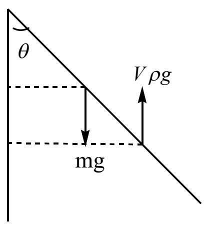
If L is the original length of the wire, the increase in length is

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

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



34.



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

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

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

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

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

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

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

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

35.

Increase in upthrust

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

$= 0.2V\rho g$

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

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

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

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

36.

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

m = 62.7 gram, 96-m = 33.3 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.

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

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

39.

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

40.

$$T = \rho\rho_w \nu g$$

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

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

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

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

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.

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

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)

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

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

47)

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

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 =

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

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

V = 20 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.

	$NO_2 + CO \rightleftharpoons$		$NO + CO_2$	
$t = 0$	1	2	0	0
at equilibrium	$1 - x$	$2 - x$	x	x

given $x = \frac{25}{100} \times 2 = 0.5$

given reaction $\Delta n = 0$

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

52.

$$2AB_{2_g} \rightleftharpoons 2AB_g + B_{2_g}$$

$t = 0 \quad 1 \quad 0 \quad 0$

at equilibrium $\quad 1 - X \quad X \quad \frac{X}{2}$

mole traction $\frac{1-X}{1+\frac{X}{2}} \quad \frac{X}{1+\frac{X}{2}} \quad \frac{\frac{X}{2}}{1+\frac{X}{2}}$

partial pressure

$$\left[\frac{1-X}{1+\frac{X}{2}}\right]P \left[\frac{X}{1+\frac{X}{2}}\right]P \left[\frac{\frac{X}{2}}{1+\frac{X}{2}}\right]P$$

$$\therefore kp = \frac{P_{B_2}.P_{AB^2}}{P_{AB_2^2}}$$

$$= \frac{\left[\frac{\frac{X}{2}}{1+\frac{X}{2}}\right]P.\frac{X^2}{\left(1+\frac{X}{2}\right)^2}.P^2}{\frac{(1-X)^2}{(1+X_2)^2}.P^2}$$

$$= \frac{PX^3}{2\left(1+\frac{X}{2}\right)(1-X)^2}$$

$\therefore X << 1$

$$KP = \frac{PX^3}{2X1X1^2} = \frac{PX^3}{2}$$

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

54. $3H_2 + N_2 \rightarrow 2NH_3$

$3 \quad 1 \quad 2$

$\frac{3}{2} \quad ½ \quad \frac{2}{2} = 1$

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

$H_2 = 30 - 15 = 15$ *litre*

$N_2 = 30 - 5 = 25$*litre*

$NH_3 = 10$*litre*

55. their conjugate acids are $H - OH, NH_3,$ $H - C \equiv C - H$ *and* $CH_3 - CH_3$.

Their acid character are

$$H - OH > CH \equiv CH > NH_3 > CH_3 - CH_3$$

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

57. $Ag_2CrO_4 \rightleftharpoons 2Ag^+ + CrO_4^{-2}$

$Ksp = 4s^3 \;\left(\because ksp = 1.1 \times 10^{-12}\right)$

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

$AgCl \rightleftharpoons Ag^+ + Cl^-$

$ksp = s^2$

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

$AgBr \rightleftharpoons Ag^+ + Br^-$

$ksp = s^2$

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

$AgI \rightarrow Ag^+ + I^-$

$ksp = s^2$

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

$\therefore$ solubility of Ag_2CrO_4 *is highest*

so it will ppt last

58. $Ni(OH)_2 \rightleftharpoons Ni^{+2} + 2OH^-$

S $\quad$ 2S

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

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

$AgCN \rightleftharpoons Ag^+ + CN^-$

S $\quad$ S

$ksp = s^2$

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

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

$\therefore Ni(OH)_2$ *is more so*lub*le than AgCN*

59. $PH + POH = pkw$

$POH = 14 - 4.7 = 9.3$

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

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

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

61. $S + O_2 \rightarrow SO_2$

$2CuFeS_2 + 5SO_2 \rightarrow Cu_2O + 2FeO + 4SO_2$

$SO_2 + H_2O_2 \rightarrow H_2SO_4 \rightarrow H_2O + SO_3$

$SO_2 + O_3 \rightarrow SO_3 + O_2$

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
$H_2O + SO_2 \rightarrow H_2SO_3\left(it\,will\ \right)$
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 asthama, 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 $\left(O^{+2}, O^{+}, NO^{+}\right)$

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

$kc = \frac{0.5 \times (1.5)^3}{12}$

$= 0.75 = \frac{75}{120}$

$= 1.6875 = \frac{16875}{10000} = \frac{27}{16} = 1.6$

72. $NH_2COONH_{4(S)} \rightleftharpoons 2NH_{3g} + CO_{2g}$

at equilibrium 2p p

$P_T = 2P + P = 3P$

$KP = PCO_2 \times PNH_3^2$

$= P \times (2P)^2 = 4P^3$

When entra NH_3 is added

$NH_2COONH_{4S} \rightleftharpoons 2NH_{3g} + CO_{2g}$

$KP = PCO_2 \times PNH_3^2$

$x + (3P)^2 = 9P^2 x$

$4P^3 = 9P^2 x$

$x = \frac{4P^3}{9P^2} = \frac{4}{9}.P$

total pressure now

$= 3P + X$

$= 3P + \frac{4}{9}.P$

$= \frac{31}{9}P$

$\frac{total\ \ pressure\ \ now}{total\ \ pressure\ \ previous}$

$= \frac{\frac{31}{9}P}{3P} = \frac{31}{27} = 1.1$

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 $CaCO_3\,in\,10^6\,gram$

of water $= \frac{10^6 \times 6 \times 10^{-3}}{56} = 120\,gram$

$D.H = 120\,ppm$