SRIGAYATRI EDUCATIONAL INSTITUTIONS

INDIA

UT1+UT2+UT3+UT4+UT5
Time: 3 Hours

JEE MAINS CUM TEST-4

Date: 11-05-2020
Max. Marks: 300 M

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) for its answer, out of which **ONLY ONE** option can be correct.
Marking scheme: +4 for correct answer, 0 if not attempted and -1 if not correct.

MATHEMATICS

1. **If the roots of the quadratic equation $x^2 - 4x - \log a = 0$ are real, then the least value of 'a' is**

a) 81 b) 64 c) $\frac{1}{64}$ d) $\frac{1}{81}$

2. **Let A and B be two sets containing 2 elements and 4 elements respectively. The number of subsets of $A \times B$ having 3 or more elements is**

a) 220 b) 210 c) 211 d) 256

3. **Given line segments of lengths 2,3 ,4,5,6 units. Then the number of triangles that can be formed by joining these lines is**

a) 5 b) 6 c) 7 d) 8

4. $\sum_{r=0}^{n-1} \frac{nc_r}{nc_r + nc_{r+1}} =$

a) $\frac{n}{2}$ b) $\frac{n+1}{2}$ c) $\frac{n(n+1)}{2}$ d) $\frac{n(n-1)}{2(n+1)}$

5. **If $Z = \sqrt{\frac{1-i}{1+i}}$ then argZ =**

a) $\frac{\pi}{4}$ b) $\frac{\pi}{2}$ c) $-\frac{\pi}{2}$ d) $-\frac{\pi}{4}$

6. **Total number of solutions of $\sin^4 x + \cos^4 x = \sin x \cos x$ in $[0, 2\pi]$ is equal to**

a) 2 b) 4 c) 6 d) none of these

7. **The value of α such that $\sin^{-1}\left(\frac{2}{\sqrt{5}}\right), \sin^{-1}\left(\frac{3}{\sqrt{10}}\right)$, $\sin^{-1}\alpha$ are the angles of a triangle is**

a) $-\frac{1}{2}$ b) $\frac{1}{2}$ c) $\frac{1}{\sqrt{3}}$ d) $\frac{1}{\sqrt{2}}$

8. **A flag staff of 5mts high stands on a building of 25 mts high. At an observer at a height 0f 30mts, the flag staff and the building subtend equal angles. The distance of the observer from the top of a flag staff is**

a) $\frac{5\sqrt{3}}{2}mts$ b) $\frac{5\sqrt{2}}{3}mts$ c) $5\sqrt{6}mts$ d) $\frac{5\sqrt{3}}{\sqrt{2}}mts$

9. **The line passing through the point $2\bar{a} + \bar{b}$ and parallel to the vector $\bar{b} - \bar{c}$ and the plane passing through the point $\bar{a}$ and parallel to the vectors $\bar{b} + \bar{c}$ and $\bar{a} + 2\bar{b} - \bar{c}$ intersects at p. The position vector of p is**

a) $\bar{a} + 3\bar{b}$ b) $2\bar{a} + 2\bar{b} - \bar{c}$ c) $\bar{a} + \bar{b} - 2\bar{c}$ d) $2\bar{a} + \bar{c}$

10. **Let $\bar{a}, \bar{b}, \bar{c}$ be non zero vectors such that $(\bar{a} \times \bar{b}) \times \bar{c} = \frac{1}{3}|\bar{b}||\bar{c}|.\bar{a}$. If θ is the angle between the vectors $\bar{b}$ and $\bar{c}$ then $\sin\theta =$**

a) $\frac{1}{3}$ b) $\frac{2\sqrt{2}}{3}$ c) $\frac{2}{3}$ d) $\frac{\sqrt{2}}{3}$

11. The shortest distance between the lines $\frac{x-3}{3}=\frac{y-8}{-1}=\frac{z-3}{1}$ **and** $\frac{x+3}{-3}=\frac{y+7}{2}=\frac{z-6}{4}$ **is**

a) $2\sqrt{30}$ b) 3 c) $\frac{7}{2}\sqrt{30}$ d) $3\sqrt{30}$

12. Let C be the centroid of the triangle with vertices $(3,-1),(1,3)$ **and** $(2,4)$**. Let P be the point of intersection of the lines** $x+3y-1=0$ **and** $3x-y+1=0$**. Then the line passing through the points C and P also passes through the point**

a) $(7,6)$ b) $(-9,-7)$ c) $(9,7)$ d) $(-9,-6)$

13. If $y=mx+4$ **is a tangent to both the parabolas.** $y^2=4x$ **and** $x^2=2by$**, then b is equal to**

a) -64 b) -32 c) -128 d) 128

14. If $3x+4y=12\sqrt{2}$ **is tangent to the ellipse** $\frac{x^2}{a^2}+\frac{y^2}{9}=1$ **for some** $a\in R$**, then the distance between the foci of the ellipse is**

a) $2\sqrt{2}$ b) $2\sqrt{7}$ c) 4 d) $2\sqrt{5}$

15. The integral $\int \frac{dx}{(x+4)^{\frac{8}{7}}(x-3)^{\frac{6}{7}}}$ **is equal to** ($where\ C\ is\ a$ constant of integration)

a) $\left(\frac{x-3}{x+4}\right)^{\frac{1}{7}}+c$ b) $-\frac{1}{13}\left(\frac{x-3}{x+4}\right)^{-\frac{13}{7}}+c$ c) $\frac{1}{2}\left(\frac{x-3}{x+4}\right)^{\frac{3}{7}}+c$ d) $-\left(\frac{x-3}{x+4}\right)^{-\frac{1}{7}}+c$

16. If for all real triplets (a, b, c), $f(x)=a+bx+cx^2$ **; then** $\int_0^1 f(x)\,dx$ **is equal to**

a) $\frac{1}{3}\left\{f(0)+f\left(\frac{1}{2}\right)\right\}$ b) $\frac{1}{2}\left\{f(1)+3f\left(\frac{1}{2}\right)\right\}$

c) $\frac{1}{6}\left\{f(0)++f(1)+4f\left(\frac{1}{2}\right)\right\}$ d) $2\left\{3f(1)+2f\left(\frac{1}{2}\right)\right\}$

17. The area of the region, enclosed by the circle $x^2+y^2=2$ **which is not common to the region bounded by the parabola** $y^2=x$ **and the straight line** $y=x$**, is**

a) $\frac{1}{3}(6\pi-1)$ b) $\frac{1}{3}(12\pi-1)$ c) $\frac{1}{6}(12\pi-1)$ d) $\frac{1}{6}(24\pi-1)$

18. The differential equation of the family of curves, $x^2=4b(y+b)$**,** $b\in R$**, is**

a) $x(y')^2=x-2yy'$ b) $xy''=y'$ c) $x(y')^2=x+2yy'$ d) $x(y')^2=2yy'-x$

19. $\lim_{x\to 0}\frac{\int_0^x t\sin(10t)\,dt}{x}$ **is equal to**

a) $-\frac{1}{10}$ b) $\frac{1}{10}$ c) $-\frac{1}{5}$ d) 0

20. If $f(x)=\begin{cases}\frac{\sin(a+2)x+\sin x}{x}; & x<0\\ b; & x=0\\ \frac{(x+3x^2)^{\frac{1}{3}}-x^{\frac{1}{3}}}{x^{\frac{4}{3}}}; & x>0\end{cases}$ **is continuous at x = 0 then** $a+2b$ **is equal to**

a) 1 **b) 0** **c) -2** **d) -1**

SECTION-II
(Numerical Value Answer Type)

This section contains 5 questions. The answer to each question is a Numerical values comprising of positive or negative decimal numbers.
Marking scheme: +4 for correct answer, 0 in all other cases.

21. **If** $p\lambda^4 + q\lambda^3 + r\lambda^2 + s\lambda + t = \begin{vmatrix} \lambda^2+3\lambda & \lambda-1 & \lambda+2 \\ \lambda^2+1 & 2-\lambda & \lambda-3 \\ \lambda^2-3 & \lambda+4 & 3\lambda \end{vmatrix}$ **then p =**

22. **If** $\begin{bmatrix} a & b \\ c & 1-a \end{bmatrix}$ **is an idempotent matrix and** $f(x) = x - x^2$ **and** $bc = \frac{1}{4}$ **then the value of** $f(a) =$

23. **If the distance between the plane,** $23x - 10y - 2z + 48 = 0$ **and the plane containing the lines** $\frac{x+1}{2} = \frac{y-3}{4} = \frac{z+1}{3}$ **and** $\frac{x+3}{2} = \frac{y+2}{6} = \frac{z-1}{\lambda}$ $(\lambda \in R)$ **is equal to** $\frac{K}{\sqrt{633}}$**, then K is equal to ……**

24. **If the curves,** $x^2 - 6x + y^2 + 8 = 0$ **and** $x^2 - 8y + y^2 + 16 - k = 0$**, (k>0) touch each other at a point, then the largest value of k is ……….**

25. **Let the normal at a point p on the curve** $y^2 - 3x^2 + y + 10 = 0$ **intersect the y-axis at** $\left(0, \frac{3}{2}\right)$**. If m is the slope of the tangent at p to the curve, then** $|m|$ **is equal to ……….**

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(SINGLE CORRECT ANSWER TYPE)

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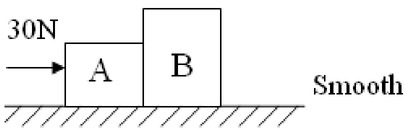
PHYSICS

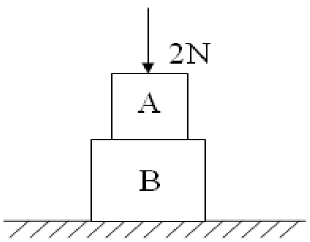
26. **Number of particles are projected simultaneously from a tower with same initial speed u in different directions obliquely at an angle 'α' with horizontal. At any instant during their flight, the particles lie on a circle with centre co-ordinates (Take origin of coordinates on the tower)**

a) $\left(0, -\frac{gt^2}{2}\right)$ **b)** $\left(0, \frac{gt^2}{2}\right)$ **c)** $(0, ut)$ **d)** $(0, -ut)$

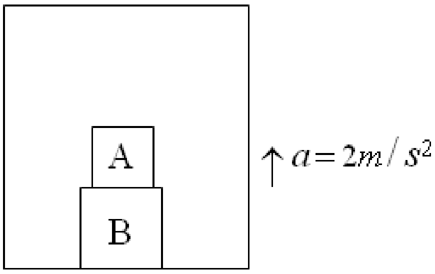
27. **In which of the following cases, contact force between A and B is maximum? [** $m_A = m_B = 1kg$ **and** $g = 10\,m/s^2$ **]**

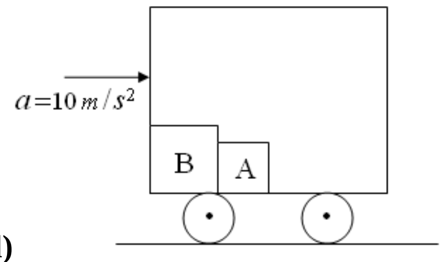


a)

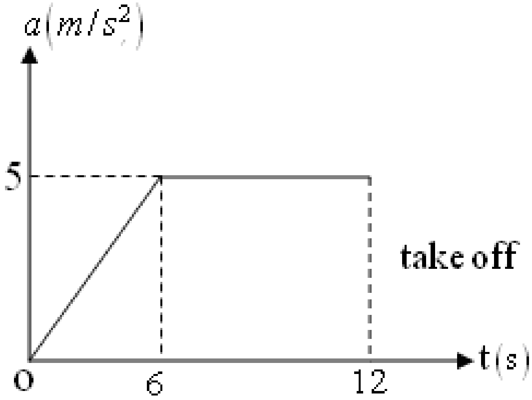


2)

c) 

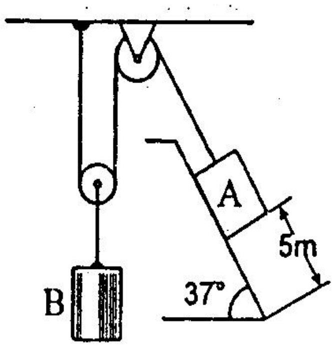
d) 

28. **An experiment on the take off performance of an aeroplane shows that the acceleration varies as shown in the fig and it takes 12 sec to take off from a rest position. Calculate the distance along the runway covered by the aeroplane.**



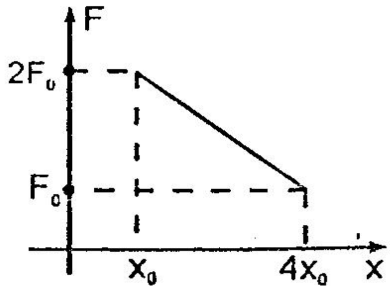
a) 200 m **b) 210 m** **c) 220 m** **d) 230 m**

29. **The blocks A and B shown in the figure have masses M_A= 5 kg and M_B = 4 kg. The system is released from rest. The speed of B after A has travelled a distance 1 m along the incline is**



a) $\frac{\sqrt{3}}{2}\sqrt{g}$ **b)** $\frac{\sqrt{3}}{4}\sqrt{g}$ **c)** $\frac{\sqrt{g}}{2\sqrt{3}}$ **d)** $\frac{\sqrt{g}}{2}$

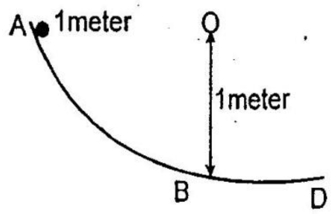
30. **A particle of mass 'm' moving along a straight line experiences force 'F' which varies with the distance x travelled as shown in the figure. If the velocity of the particle at x_0 is** $2\sqrt{\frac{2F_0x_0}{m}}$ **, then velocity at 4 x_0 is:**



a) $2\sqrt{\frac{2F_0x_0}{m}}$ **b)** $2\sqrt{\frac{F_0x_0}{m}}$ **c)** $\sqrt{\frac{2F_0x_0}{m}}$ **d) None of these**

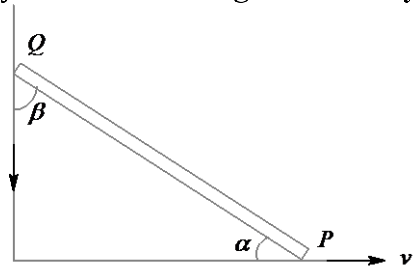
31. **In the track shown in figure section AB is a quadrant of a circle of 1 metre radius. A block is released at A and slides without friction until it reaches B. After B it moves on a rough**

horizontal floor and comes to rest at distance 3 metres from B. What is the coefficient of friction between floor and body?



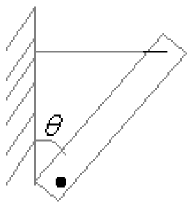
a) 1/3 **b) 2/3** **c) ¼** **d) 3/8**

32. A rod of length *l* has velocity *v* at 'P'. The angular velocity of rod will be



a) $\frac{v\sin\alpha}{l\cos\beta}$ **b)** $\frac{v\cos\alpha}{l\sin\beta}$ **c)** $\frac{v\sin(\alpha+\beta)}{l\cos\alpha}$ **d)** $\frac{v\sin(\beta+\alpha)}{l\cos\beta}$

33. A beam of mass 'm' smoothly pivoted as shown in fig. A string is tied horizontally. The net reaction force at the pivot will be

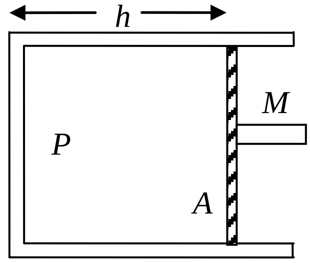


a) $\frac{mg\tan\theta}{2}$ **b)** mg **c)** $\frac{mg}{2}\sqrt{4+\tan^2\theta}$ **d)** $\frac{mg}{2}\left[1+\frac{\tan\theta}{2}\right]$

34. 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 ratio of kinetic energy to T^2 is proportional to :

a) $R^{-10/2}$ **b)** $R^{7/2}$ **c)** $R^{3/2}$ **d)** $R^{9/2}$

35. A cylindrical piston of mass *M* slides smoothly inside a long cylinder closed at one end, enclosing a certain mass of gas. The cylinder is kept with its axis horizontal. If the piston is disturbed from its equilibrium position, it oscillates simple harmonically. The period of oscillation will be: (Assume gas to be ideal and its temperature to be constant. Where P is atmosphere pressure)



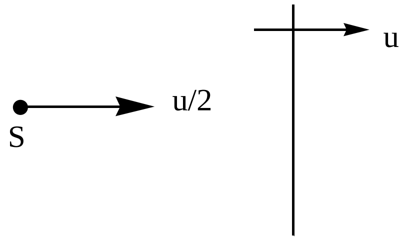
a) $T=2\pi\sqrt{\frac{Mh}{PA}}$ **b)** $T=2\pi\sqrt{\frac{MA}{Ph}}$ **c)** $T=2\pi\sqrt{\frac{M}{PAh}}$ **d)** $T=2\pi\sqrt{MPhA}$

36. A spherical solid ball of volume V is made of a material of density ρ_1. It is falling though a liquid of density $\rho_2\left(\rho_2<\rho_1\right)$. Assume that the liquid applies a viscous force on the ball that

is proportional to the square of its speed υ**, i.e.,** $F_{viscous} = -k\upsilon^2 (k > 0)$**. The terminal speed of the ball is:**

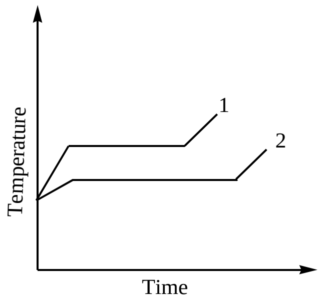
a) $\sqrt{\frac{Vg(\rho_1 - \rho_2)}{k}}$ **b)** $\frac{Vg\rho_1}{k}$ **c)** $\sqrt{\frac{Vg\rho_1}{k}}$ **d)** $\frac{Vg(\rho_1 - \rho_2)}{k}$

37. **A wall is moving with velocity u and a source of frequency f moves with velocity** $\frac{u}{2}$ **in the same direction as shown in the figure. If the velocity of sound is 10u, the apparent wavelength received by the wall is**



a) $\frac{19u}{2f}$ **b)** $\frac{u}{f}$ **c)** $\frac{9u}{f}$ **d)** $\frac{19u}{f}$

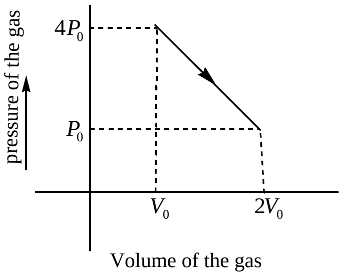
38. **Two solid objects of the same mass are supplied with heat at the same rate** $\Delta Q / \Delta t$**. The temperature of the first object with latent heat** L_1 **and specific heat capacity** c_1 **changes according to graph 1 on the diagram. The temperature of the second object with latent heat** L_2 **and specific heat capacity** c_2 **changes according to graph 2 on the diagram.**



Based on what is shown on the graph, the latent heats L_1 *and* L_2 **and the specific heat capacities** c_1 *and* c_2 **in solid state obey which of the following relationships:**

a) $L_1 < L_2; c_1 < c_2$ **b)** $L_1 < L_2; c_1 > c_2$ **c)** $L_2 < L_1; c_1 > c_2$ **d)** $L_2 < L_1; c_2 > c_1$

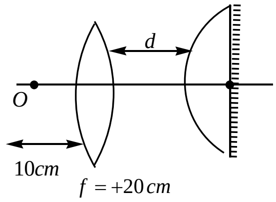
39. **1 mole of monoatomic gas undergoes polytropic process and it's P-V diagram as shown in the figure, then maximum Absolute temperature attained by the gas during that process is (R is the universal gas constant)**



1)

a) $\frac{4P_0V_0}{R}$ **b)** $\frac{49P_0V_0}{12R}$ **c)** $\frac{49P_0V_0}{6R}$ **d)** $\frac{2P_0V_0}{R}$

40. **A convex lens of focal length 20cm and another plano-convex lens of focal length 40cm are placed coaxially (see figure). The plano convex lens is slivered on plane surface. What should be the distance d (in cm) so that final image of the object 'O' is formed on 'O' itself**

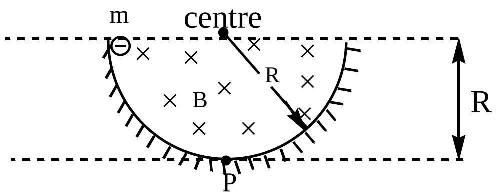


a) 10 **b) 15** **c) 20** **d) 25**

41. **A parallel monochromatic beam of light is incident normally on a narrow slit. A diffraction pattern is formed on a screen placed perpendicular to the direction of the incident beam. At the first minimum of the diffraction pattern, the phase difference between the rays coming from the two edges of the slit is :**

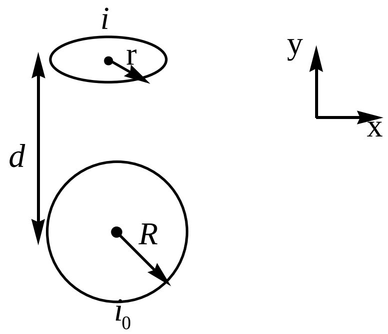
a) zero **b)** $\pi/2$ **c)** π **d)** 2π

42. **A charged particle of mass m and charge –q is released from rest from the given position. In the presence and absence of the magnetic field, the normal reaction acting on the charge at P are** N_1 **and** N_2 **respectively. Neglecting friction and assuming gravity, the value of** $N_1 - N_2 =$



a) $Bq\sqrt{2gR}$ **b)** $-qB\sqrt{2gR}$ **c) zero** **d) none of these**

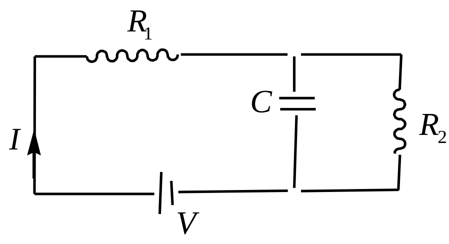
43. **A small current carrying ring, having current** i_0 **and radius R, is kept in x-y plane (the plane of paper) as shown in figure. Another current carrying small ring having radius r (r<<R) is kept at a distance d from the center of first ring in a plane perpendicular to x-y plane such that the centers of both rings lie on the same line. Find the torque acting on the second ring due to the magnetic field of first ring.**



a) $\frac{\mu_0}{4\pi}\frac{ii_0R^2r^2}{d^3}$ **b)** $\frac{\mu_0}{4}\frac{\pi i_0iR^2r^2}{d^3}$ **c)** $\frac{\mu_0}{2}\pi i_0iR^2r^2d$ **d)** $\frac{\mu_0}{4}\frac{i_0iR^2r^2}{d^3}$

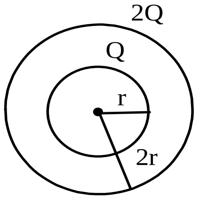
44. **Consider the circuit shown at t = 0, capacitor is uncharged.**

Current $I = I_1$ **at t = 0 and** $I = I_2$ **at** $t \to \infty$**. Then** $\frac{I_1}{I_2} =$



a) $\frac{R_2}{R_1}$ b) $\frac{R_1}{R_2}$ c) $\frac{R_1+R_2}{R_1}$ d) $\frac{R_1+R_2}{R_2}$

45. **Two concentric spheres of radii r and 2r are given charges Q and 2Q. Now if the inner sphere is grounded, the charge that flows into ground is**



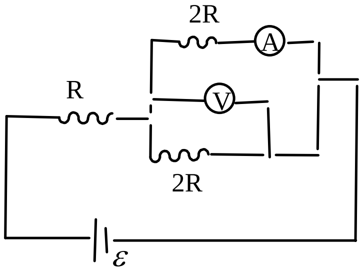
a) Q **b) 2Q** **c) – 2Q** **d) – Q**

SECTION- II
(Numerical Value Answer Type)

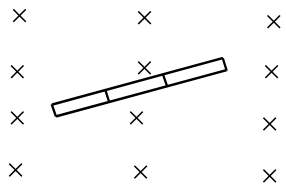
This section contains 5 questions. The answer to each question is a Numerical values comprising of positive or negative decimal numbers.

Marking scheme: +4 for correct answer, 0 in all other cases.

46. **In the circuit shown in figure, reading of voltmeter is 100 V. Reading of ammeter is 5A [Both are ideal] power delivered by battery is (in KW)**



47. **The rod is rotated with a constant angular velocity of 20rad/sec about its centre in a perpendicular magnetic field of 2T. find the potential difference between two ends of one portion of conducting section of the rod (in volts) .**



48. **An LCR circuit contains resistance of 100Ω and a supply of 200 V. The angular frequency of the circuit is 300 rad/s. If only capacitance is taken out from the circuit and the rest of the circuit is joined, current lags behind the voltage by 60^0. If on the other hand, only inductor is taken out the current leads by 60^0 with the applied voltage. The current flowing in the circuit is (in A)**

49. **A wire has a mass (0.3 $\pm$ 0.003)g, radius (0.5 $\pm$ 0.005) mm and length (6 $\pm$ 0.06) cm. The maximum percentage error in the measurement of its density is**

50. **A uniform steel wire of length 4m and area of cross section $3\times10^{-6}m^2$ is extended by 1 mm when the wire is under a uniform tension. If the Young's modulus of steel is $2.0\times10^{11}Nm^{-2}$ the energy stored in the wire is(in J)**

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

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

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

CHEMISTRY

51. The wavelength of a microscopic particle of mass $9.1\times10^{-31}kg$ is 182nm. Its kinetic energy in J is $\left[h=6.625\times10^{-34}J.S\right]$

a) 7.25×10^{-23} b) 7.28×10^{-24} c) 3.24×10^{-23} d) 3.64×10^{-24}

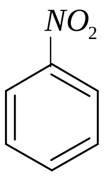
52. The height possible oxidation states of uranium and plutonium, respectively are

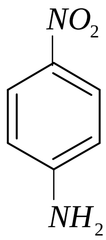
a) 6 and 4 b) 4 and 6 c) 7 and 6 d) 6 and 7

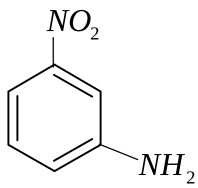
53. The species having pyramidal shape according to VSEPR theory is

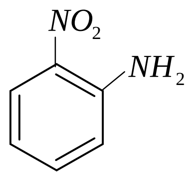
a) SO_3 b) BrF_3 c) SiO_3^{-2} d) OSF_2

54. Which compound exhibits maximum dipole moment among the following

a) 

b) 

c) 

d) 

55. The gas with lowest critical temperature among NH_3, N_2, SO_2 and H_2O is

a) NH_3 b) N_2 c) SO_2 d) H_2O

56. The strength of 11.2 volume solution of H_2O_2 is given that molar mass of $H=1g\ mol^{-1}$ and

a) 3.4% b) 1.7% c) 13.6% d) 34%

57. The amphoteric hydroxide is

a) $Sr(OH)_2$ b) $Mg(OH)_2$ c) $Ca(OH)_2$ d) $Be(OH)_2$

58. For the reaction $A+B \rightleftharpoons 3C$ at 25^0C, a '3' litre vessel contains 1, 2 and 4 moles of A, B and C respectively. Predict the direction of reaction if KC for the reaction is 10.

a) backward b) forward c) equilibrium d) any direction

59. The incorrect expression among the following is

a) $\ln k=\frac{\Delta H^0-T\Delta S^0}{RT}$

b) $K=e^{-\Delta G^0/RT}$

c) $\frac{\Delta G_{system}}{\Delta S_{total}}=-T$

d) In isothermal process $W_{rev}=-nRT\ln\frac{V_f}{V_i}$

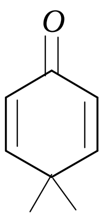
60. In carius method of estimated of halogens, 250mg of an organic compound gave 141mg of AgBr. The percentage bromine in the compound is $\left(At.mass\ of\ Ag=108, Br=80\right)$

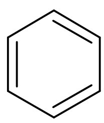
a) 24 b) 36 c) 48 d) 0

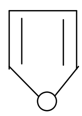
61. $HC\equiv CH \xrightarrow[Quinoline]{Pd-BaSO_4} A \xrightarrow[AlCl_3]{HCl} B \xrightarrow[Dry\ ether]{Na} C$. **Here 'C' is**

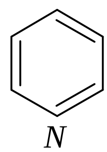
a) C_2H_6 b) C_4H_{10} c) C_2H_5Cl d) C_3H_7Cl

62. Which of the following molecules is least resonance stabilized.

a) 

b) 

c) 

d) 

63. Which of the following exists as covalent crystal in the solid state
a) Iodine b) Silicon c) Sulphur d) Phosphorous

64. The reaction that does not define calcination is
a) $CaCO_3.MgCO_3 \xrightarrow{\Delta} CaO + MgO + 2CO_2$ b) $2Cu_2S + 3O_2 \xrightarrow{\Delta} 2Cu_2O + 2SO_2$
c) $Fe_2O_3.xH_2O \xrightarrow{\Delta} Fe_2O_3 + xH_2O$ d) $ZnCO_3 \xrightarrow{\Delta} ZnO + CO_2$

65. The degenerate orbitals of $\left[Cr(H_2O)_6\right]^{+3}$ are
a) d_{xz} and d_{yz} b) d_{yz} *and* d_{z^2} c) $d_{x^2-y^2}$ *and* d_{xy} d) d_{z^2} *and* d_{xz}

66. The transition element that has lowest enthalpy of atomization is
a) V b) Fe c) Zn d) Cu

67. A water sample has ppm level concentration of following anions
$F^- = 10 \quad SO_4^{-2} = 100 \quad NO_3^- = 50$ **the anion/anions that makes the water sample unsuitable for during is/are**
a) only SO_4^{-2} b) only NO_3^- c) both SO_4^{-2} *and* NO_3^- d) Only F^-

68. Give that $E_{H_2O/H_2/pt} = 0$ at 298K. The pressure of H_2 gas would be
a) $10^{-7} atm$ b) $10^{-14} atm$ c) $10^{-10} atm$ d) $10^{-12} atm$

69. For a reaction, the rate constant is expressed as $K = A.e^{-40000/T}$. The energy of the activation is
a) 40,000 cal b) 88,000cal c) 80,000cal d) 8000cal

70. Which of the following is most reactive
a) Cl_2 b) Br_2 c) I_2 d) ICl

SECTION-II
(Numerical Value Answer Type)

This section contains 5 questions. The answer to each question is a Numerical values comprising of positive or negative decimal numbers.
Marking scheme: +4 for correct answer, 0 in all other cases.

71. The vapour pressure of two pure liquids 1 and 2 are 100 and 80 torr. The total pressure of the solution obtained by mixing '2' mol of '1' and '3' mol. Of '2' would be ……….

72. 50ml of 0.1M acetic acid is shaken with 0.5gm of activated charcoal. The concentration of solution has fallen to 0.05M. The $\frac{'X'}{M}$ value in Freundlich equation would be ……..

73. The number of 'σ' bonds present in P_4O_{10} is ………

74. The number of geometrical isomers of $CH_3 - CH = CH - CH = CH - CH = CHCl$ is……

75. For the following reaction, the mass of water produced from 445g of $C_{57}H_{110}O_6$ is ……..
$2C_{57}H_{110}O_{6(s)} + 163O_{2(g)} \rightarrow 114CO_{2(g)} + 110H_2O_{(l)}$

KEY SHEET

MATHEMATICS

1) **D**	2) **B**	3) **C**	4) **A**	5) **D**	6) **B**	7) **D**	8) **D**	9) **B**	10) **B**
11) **D**	12) **D**	13) **C**	14) **B**	15) **1**	16) **C**	17) **C**	18) **C**	19) **D**	20) **B**
21) **4**	22) **0.25**	23) **3**	24) **26**	25) **4**					

PHYSICS

26) **A**	27) **A**	28) **B**	29) **C**	30) **D**	31) **A**	32) **D**	33) **C**	34) **A**	35) **A**
36) **A**	37) **A**	38) **A**	39) **B**	40) **C**	41) **D**	42) **A**	43) **B**	44) **C**	45) **B**
46) **2**	47) **725**	48) **2**	49) **4**	50) **0.075**					

CHEMISTRY

51) **B**	52) **D**	53) **D**	54) **B**	55) **B**	56) **A**	57) **D**	58) **A**	59) **A**	60) **A**
61) **B**	62) **A**	63) **B**	64) **B**	65) **A**	66) **C**	67) **D**	68) **B**	69) **C**	70) **D**
71) **88**	72) **0.3**	73) **16**	74) **08**	75) **495**					

HINTS & SOLUTIONS

MATHEMATICS

1. Roots are real

$\Rightarrow \Delta \ge 0$

$\Rightarrow 16+4\log_3 a \ge 0$

$\Rightarrow \log_3 a \ge -4$

$\Rightarrow a \ge 3^{-4}$

$\Rightarrow a \ge \dfrac{1}{81}$

2. $2^8 - 8c_0 - 8c_1 - 8c_2$

$= 256 - 1 - 8 - 28$

$= 219$

3. Number of triangles = 513, but line segments of length $(2,3,6)$ or $(2,3,5)$ or $(2,4,6)$ triangles are not formed.

4. $\displaystyle\sum_{r=0}^{n-1} \frac{nc_r}{nc_r + nc_{r+1}}$

$= \displaystyle\sum_{r=0}^{n-1} \frac{nc_r}{(n+1)c_{r+1}}$

$= \displaystyle\sum_{r=0}^{n-1} \frac{r+1}{n+1}$

$= \dfrac{1}{n+1}\{1+2+.....+n\}$

$= \dfrac{n(n+1)}{2(n+1)} = \dfrac{n}{2}$

5. $Z = \sqrt{\dfrac{1-i}{1+i}} = \dfrac{1-i}{\sqrt{2}} = \dfrac{1}{\sqrt{2}} - \dfrac{i}{\sqrt{2}}$

$\therefore \arg Z = -\dfrac{\pi}{4}$

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

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

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

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

$\Rightarrow \left(\sin 2x + 2\right)\left(\sin 2x - 1\right) = 0$

$\Rightarrow \sin 2x = 1$

$\therefore \sin 2x \ne -2$

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

7. Given $\sin^{-1}\left(\dfrac{2}{\sqrt{5}}\right) + \sin^{-1}\left(\dfrac{3}{\sqrt{10}}\right) + \sin^{-1}(\alpha) = \pi$

$\Rightarrow \tan^{-1}(2) + \tan^{-1}(3) + \tan^{-1}\left(\dfrac{\alpha}{\sqrt{1-\alpha^2}}\right) = \pi$

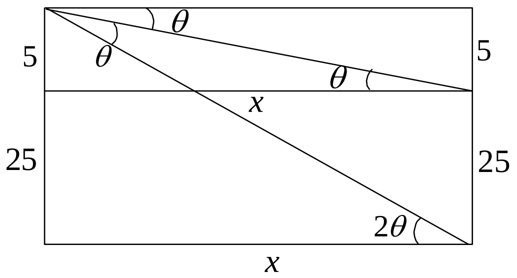
$$\Rightarrow \pi + \tan^{-1}\left(\frac{2+3}{1-2\times 3}\right) + \tan^{-1}\left(\frac{\alpha}{\sqrt{1-\alpha^2}}\right) = \pi$$

$$\Rightarrow \tan^{-1}\left(\frac{\alpha}{\sqrt{1-\alpha^2}}\right) = \frac{\pi}{4}$$

$$\Rightarrow \frac{\alpha}{\sqrt{1-\alpha^2}} = 1$$

$$\Rightarrow \alpha = \frac{1}{\sqrt{2}}$$

8.



$\tan\theta = \frac{5}{x}$ and $\tan 2\theta = \frac{30}{x}$

$$\Rightarrow \tan 2\theta = 6\tan\theta$$

$$\Rightarrow \frac{2\tan\theta}{1-\tan^2\theta} = 6\tan\theta$$

$$\Rightarrow 3 - 3\tan^2\theta = 1$$

$$\Rightarrow \tan^2\theta = \frac{2}{3}$$

$$\Rightarrow \tan\theta = \sqrt{\frac{2}{3}}$$

$$\therefore x = \frac{5}{\tan\theta}$$

$$\Rightarrow x = \frac{5\sqrt{3}}{\sqrt{2}}$$

9. equation of the line $\bar{r} = \left(2\bar{a} + \bar{b}\right) + \lambda\left(\bar{b} - \bar{c}\right)$ and equation of the plane

$\bar{r} = \bar{a} + s\left(\bar{b} + \bar{c}\right) + t\left(\bar{a} + 2\bar{b} - \bar{c}\right)$

Solving and comparing we get

$\lambda = 1, s = 0, t = 1$

$\therefore \bar{r} = 2\bar{a} + 2\bar{b} - \bar{c}$

10. $\left(\bar{a}\times\bar{b}\right)\times\bar{c} = \left(\bar{a}.\bar{c}\right)\bar{b} - \left(\bar{b}.\bar{c}\right)\bar{a}$

$$\therefore \bar{b}.\bar{c} = -\frac{1}{3}|\bar{b}||\bar{c}|$$

$$\Rightarrow |\bar{b}||\bar{c}|\cos\theta = -\frac{1}{3}|\bar{b}||\bar{c}|$$

$$\Rightarrow \cos\theta = -\frac{1}{3}$$

$$\therefore \sin\theta = \frac{2\sqrt{2}}{3}$$

11. $\overline{AB} = -6\bar{i} - 15\bar{j} + 3\bar{k}$

$\overline{p}=3\overline{i}-\overline{j}+\overline{k}$

$\overline{q}=-3\overline{i}+2\overline{j}+4\overline{k}$

$$\overline{p}\times\overline{q}=\begin{vmatrix} i & j & k \\ 3 & -1 & 1 \\ -3 & 2 & 4 \end{vmatrix}=-6\overline{i}-15\overline{j}+3\overline{k}$$

$$S.D=\frac{\left|\overline{AB}.(\overline{p}\times\overline{q})\right|}{|\,\overline{p}\times\overline{q}\,|}=\frac{36+225+9}{\sqrt{36+225+9}}=3\sqrt{30}$$

12. $C=(2,2)$

Point of intersection $P=\left(-\frac{1}{5},\frac{2}{5}\right)$

Equation of line CP

$8x-11y+6=0$ verify options

13. $y=mx+4........i)$

$y^2=4x$ tangent $y=mx+\frac{a}{m}\Rightarrow y=mx+\frac{1}{m}$ ....ii)

From i) and ii)

$4=\frac{1}{m}\Rightarrow m=\frac{1}{4}$

So line $y=\frac{1}{4}x+4$ is also tangent to parabola $x^2=2by$, so solve

$x^2=2b\left(\frac{x+16}{4}\right)$

$\Rightarrow 2x^2-bx-16b=0\Rightarrow D=0$

$\Rightarrow b^2-4\times2\times(-16b)=0$

$\Rightarrow b^2+32\times4b=0$

$b=-128, b=0$ (not possible)

14. $3x+4y=12\sqrt{2}$

$\Rightarrow 4y=-3x+12\sqrt{2}$

$\Rightarrow y=-\frac{3}{4}x+3\sqrt{2}$

Condition of tangency $c^2=a^2m^2+b^2$

$18=a^2.\frac{9}{16}+9$

$a^2.\frac{9}{16}=9$

$a^2=16$

$a=4$

$e=\sqrt{1-\frac{b^2}{a^2}}=\sqrt{1-\frac{9}{16}}=\frac{\sqrt{7}}{4}$

$\therefore ae=\frac{\sqrt{7}}{4}.4=\sqrt{7}$

$\therefore$ *focus are* $\left(\pm\sqrt{7},0\right)$

$\therefore$ distance *between foci* $=2\sqrt{7}$

15. $\int\left(\frac{x-3}{x+4}\right)^{-\frac{6}{7}}\frac{1}{(x+4)^2}dx$

Let $\frac{x-3}{x+4}=t^7$

$\frac{7}{(x+4)^2}dx=7t^6dt$

$\int t^{-6}t^6dt=t+c$

16. $\int_0^1\left(a+bx+cx^2\right)dx=\left[ax+\frac{bx^2}{2}+\frac{cx^3}{3}\right]_0^1=a+\frac{b}{2}+\frac{c}{3}$

$f(1)=a+b+c$

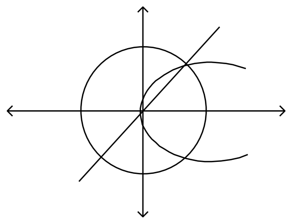
$f(0)=a$

$f\left(\frac{1}{2}\right)=a+\frac{b}{2}+\frac{c}{4}$

Now $\frac{1}{6}\left\{f(1)+f(0)+4f\left(\frac{1}{2}\right)\right\}=\frac{1}{6}\left\{a+b+c+a+4\left(a+\frac{b}{2}+\frac{c}{4}\right)\right\}$

$=\frac{1}{6}\left(6a+3b+2c\right)=a+\frac{b}{2}+\frac{c}{3}$

17. Total area – enclosed area



$2\pi-\int_0^1(\sqrt{x}-x)dx$

$2\pi-\left(\frac{2x^{\frac{3}{2}}}{3}-\frac{x^2}{2}\right)_0^1$

$2\pi-\left(\frac{2}{3}-\frac{1}{2}\right)\Rightarrow 2\pi-\left(\frac{1}{6}\right)\Rightarrow\frac{12\pi-1}{6}$

18. $2x=4by'\Rightarrow b=\frac{x}{2y'}$

So differential equation is $x^2=\frac{2x}{y'}.y+\left(\frac{x}{y'}\right)^2$

$\Rightarrow x\left(\frac{dy}{dx}\right)^2=2y\frac{dy}{dx}+x$

19. using L hospital rule

$\lim_{x\to 0}\frac{x\sin(10x)}{1}=0$

20. $L.H.L=a+3$

$f(0)=b$

$$R.H.L=\lim_{h\to 0}\left(\frac{(1+3h)^{\frac{1}{3}}-1}{h}\right)=1$$

$\therefore a=-2$
$b=1$
$\therefore a+2b=0$

21. $p+q\left(\frac{1}{\lambda}\right)+r\left(\frac{1}{\lambda^2}\right)+s\left(\frac{1}{\lambda}\right)^3+t\left(\frac{1}{\lambda}\right)^4$

$$=\begin{vmatrix}1+\frac{3}{\lambda} & 1-\frac{1}{\lambda} & 1+\frac{3}{\lambda}\\ 1+\frac{1}{\lambda^2} & \frac{2}{\lambda}-1 & 1-\frac{3}{\lambda}\\ 1-\frac{2}{\lambda^2} & 1+\frac{4}{\lambda} & 3\end{vmatrix}$$

Take limit as $\lambda\to\alpha$ on both sides

$$\Rightarrow p=\begin{vmatrix}1 & 1 & 1\\ 1 & -1 & 1\\ 1 & 1 & 3\end{vmatrix}$$

$\Rightarrow p=-4$

22. Given $\begin{bmatrix}a & b\\ c & 1-a\end{bmatrix}$ is an idempotent matrix

$$\Rightarrow\begin{bmatrix}a & b\\ c & 1-a\end{bmatrix}^2=\begin{bmatrix}a & b\\ c & 1-a\end{bmatrix}$$

$\Rightarrow a^2+bc=a$
$\Rightarrow a^2-a=bc$
$\Rightarrow f(a)=bc$
$\Rightarrow f(a)=\frac{1}{4}=0.25$

23. lines must be intersecting

$\Rightarrow(2s-1,4s+3,3s-1)=(2t-3,6t-2,\lambda t+1)$

$2s-1=2t-3,4s+3=6t-2,3s-1=\lambda t+1$

$\Rightarrow t=\frac{1}{2},s=\frac{-1}{2},\lambda=-7$

Distance of plane contains given lines from given plane is same as distance between point $(-3,-2,1)$ from given plane.

Required distance equal to $\frac{|-69+20-2+48|}{\sqrt{529+100+4}}=\frac{3}{\sqrt{633}}$

$=\frac{K}{\sqrt{633}}\Rightarrow K=3$

24. Two circles touches each other if $C_1C_2=|r_1\pm r_2|$

Distance between $C_2(3,0)$ *and* $C_1(0,4)$ is either

$\sqrt{K}+1$ *or* $\left|\sqrt{K}-1\right|$ $(C_1C_2=5)$

$\Rightarrow\sqrt{K}+1=5$ *or* $|\sqrt{K}-1|=5\Rightarrow K=16$ *or* $K=36$

$\Rightarrow$ maximum value of K is 36

25. $P = (x_1, y_1)$

$$2yy' - 6x + y' = 0 \Rightarrow y' = \left(\frac{6x_1}{1+2y_1}\right)$$

$$\left\{\frac{\frac{3}{2} - y_1}{-x_1}\right\} = -\left\{\frac{1+2y_1}{6x_1}\right\}$$

$$9 - 6y_1 = 1 + 2y_1 \Rightarrow y_1 = 1$$

$$\therefore x_1 = \pm 2$$

$$\therefore slope\ of\ \tan gent = \left(\frac{\pm 12}{3}\right) = \pm 4$$

$$\therefore |m| = 4$$

PHYSICS

26. $x = (u \cos\alpha)t$ and $y = (u \sin\alpha)t - \frac{1}{2}gt^2$

Using identity $\sin^2\alpha + \cos^2\alpha = 1$

Equation of the circle can be $x^2 + \left(y - \frac{1}{2}gt^2\right)^2 = (ut)^2$

So coordinate of center will be $\left(0, -\frac{1}{2}gt^2\right)$

27. In the first case F = 15 N

In both second and third case F = 12 N and in the fourth case F = 10 N.

28. From the graph $\frac{da}{dt} = 5/6$ $\quad \frac{d}{dt}\left(\frac{d^2s}{dt^2}\right) = 5/6$

Integrate the above

$$\frac{d^2s}{dt^2} = \frac{5}{6}t$$

Integrate again $\frac{ds}{dt} = \frac{5t^2}{12}$

Integrate again $s = \frac{5t^3}{36}$

Distance travelled from 0 to 6s = $s_1 = \frac{5}{36} \times 6^3 = 30m$

Velocity at $t = 6s$ $\quad v = \frac{5}{12}t^2 = 15\,m/s$

From 6 to 12 s, $u = 15\,m/s$ $\quad a = 5\,m/s^2$

$$s_2 = ut + \frac{1}{2}at^2 = 180m$$

Total distance travelled = $30 + 180 = 210\,m$

29. If A moves down the incline by 1 metre, B shall move up by $\frac{1}{2}$ metre. If the speed of B is v then the speed of A will be 2v.

From conservation of energy:

Gain in K.E. = loss in P.E.

$$\frac{1}{2}m_A(2v)^2+\frac{1}{2}m_Bv^2=m_Ag\times\frac{3}{5}-m_Bg\times\frac{1}{2}$$

Solving we get

$$v=\frac{1}{2}\sqrt{\frac{g}{3}}$$

30. Increase in KE = work done

$$\frac{1}{2}mv_2{}^2-\frac{1}{2}m\times\left(\frac{2F_0x_0}{m}\right)=\frac{1}{2}(2F_0+F_0)3x_0$$

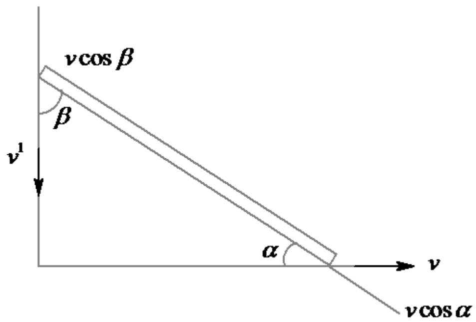
$$v_2=\sqrt{\frac{11F_0x_0}{m}}$$

31. $$mg1=\frac{1}{2}mu^2\Rightarrow u^2=2g---------(1)$$

$$v^2=u^2+2as\Rightarrow 0=2g-2a(3)$$

$$\Rightarrow a=\frac{g}{3}\Rightarrow\because \mu_k g=\frac{g}{3}\qquad \therefore u_K=\frac{1}{3}$$

32.



$$w=\frac{v^1\sin\beta+v\sin\alpha}{l}=\frac{1}{l}\left[\frac{v\cos\alpha.\sin\beta}{\cos\beta}+v\sin\alpha\right]=\frac{v\sin(\alpha+\beta)}{l\cos\beta}$$

33. $$Tl\cos\theta=mg\frac{l}{2}\sin\theta$$

$$T=\frac{mg}{2}\tan\theta$$

$$\therefore N_x=\frac{mg\tan\theta}{2}$$

$$N_y=mg$$

$$N=\sqrt{N_x^2+N_y^2}=mg\sqrt{1+\frac{\tan^2}{4}}$$

$$=\frac{mg}{2}\sqrt{4+\tan^2\theta}$$

34. $$\frac{m\upsilon^2}{R}\propto R^{-5/2}\ \ \&\ \ mR\omega^2\propto R^{-5/2}$$

$$K.E\propto R^{\frac{-5}{2}+1}\ \&\ \frac{4\pi^2}{T^2}\propto R^{-\frac{5}{2}-1}=R^{-\frac{7}{2}}$$

$$K.E\propto R^{-\frac{3}{2}}$$

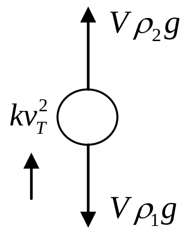
$$\frac{KE}{T^2}=\frac{R^{-\frac{3}{2}}}{R^{7/2}}=R^{-5}$$

35. According to theory section,

$$f=\frac{1}{2\pi}\sqrt{\frac{BA^2}{MV_0}}$$

$$\therefore \quad T=2\pi\sqrt{\frac{MV_0}{BA^2}}=2\pi\sqrt{\frac{M\left(hA\right)}{PA^2}}=2\pi\sqrt{\frac{Mh}{PA}}$$

36. The force acting on the ball are gravity force, buoyancy force and viscous force. When ball acquires terminal speed, it is in dynamic equilibrium, let terminal speed of ball is υ_T.



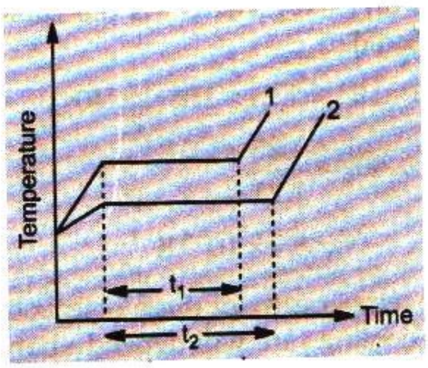
So, $V\rho_{2g}+kv_T^2=V\rho_{1g}$

$$\upsilon_T=\sqrt{\frac{V\left(\rho_1-\rho_2\right)g}{k}}$$

37. $\lambda_i = wavelength\ of\ the\ incident\ sound=\dfrac{10u-\dfrac{u}{2}}{f}=\dfrac{19u}{2f}$

38. $L_2>L_1[\because\ change\ in\ state\ takes\ more\ time\ for\ 2]$

$c_1<c_2[\because\ Final\ temperature\ of\ 1\ is\ more\ for\ solid\ state)$



For 1s solid slope is more initially. So it's c will be lesser i.e.,

$c_1<c_2$

For the curve parallel to time axis

$$\frac{\Delta\theta}{\Delta t}=m\frac{L_1}{t_1}=m\frac{L_2}{t_2}$$

$$L_1=\frac{t_1}{t_2}<1$$

$L_1 < L_2$

39. $$\frac{P-P_0}{V-2V_0}=\frac{4P_0-P_0}{V_0-2V_0}$$

$$P-P_0=\frac{-3P_0}{V_0}\left[V-2V_0\right]$$

$$P-P_0=\frac{-3P_0}{V_0}V+6P_0$$

$$P=\frac{-3P_0}{V_0}V+7P_0$$

$$T=\frac{1}{R}\left[\frac{-3P_0}{V_0}V^2+7P_0V\right]$$

For maximum temperature

$$\frac{dT}{dv}=0$$

$$V=\frac{7V_0}{6}$$

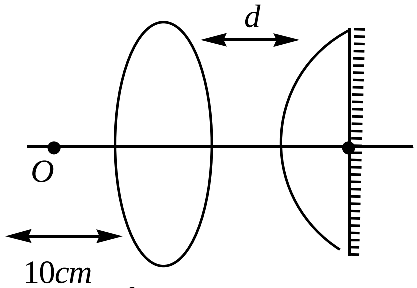
$$T_{\max}=\frac{49P_0V_0}{12R}$$

40. The silvered lens can be replaced by a mirror of focal length given as (DIAGRAM)

$$\frac{1}{F_M}=\frac{1}{f_m}-\frac{2}{f_1}$$

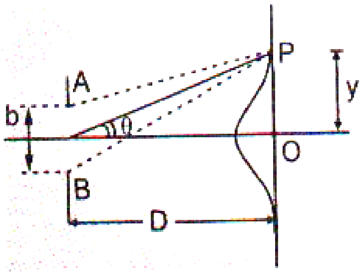
for lens $\upsilon=\frac{uf}{u+f}$

$$\upsilon=\frac{-10\times 20}{-10+20}=-20$$



So this position has to be centre of curvature of mirror in order for the ray to retrace its path so d=40-20=20cm.

41. $$y=\frac{\lambda D}{b}$$



Because of the first minima,

$b\sin\theta = \lambda$ or $b(\frac{y}{D}) = \lambda$ $(as\sin\theta \approx \tan\theta)$

Path difference between BP and AP (rays)

$= \Delta x = \frac{yb}{D} = \lambda$

Corresponding phase difference $(\Delta\phi)$

$\Delta\phi = (\frac{2\pi}{\lambda})\Delta x = 2\pi$

42. $V = \sqrt{2gR}$ at P

With out field $N_2 = mg + \frac{mV^2}{R}$

With field $N_1 = mg + \frac{mV^2}{R} + BqV$

$N_1 - N_2 = Bq\sqrt{2gR}$

43. $B = \frac{\mu_0}{4\pi}\frac{M}{d^3}$

$B = \frac{\mu_0}{4\pi}\frac{i_0\pi R^2}{d^3}$

$\tau = i\pi r^2 \frac{\mu_0}{4\pi}\frac{i_0\pi R^2}{d^3}$; $\tau = \frac{\mu_0}{4}\frac{\pi i_0 i R^2 r^2}{d^3}$

44. $I_1 = \frac{V}{R_1}$ (no current through R_2)

$I_2 = \frac{V}{R_1 + R_2}$

$\frac{I_1}{I_2} = \frac{R_1 + R_2}{R_1}$

45. potential of inner sphere should be zero.

$\frac{2Q}{4\pi\varepsilon_0(2r)} + \frac{Q^1}{4\pi\varepsilon_0 r} = 0$

$\Rightarrow Q' = Q$

Charge flown to ground is 2Q.

46. $V = \frac{\varepsilon}{2}, I_A = \frac{I}{2}$

power $= \varepsilon I = 4\times100\times5 = 2KW$

47. $L = 10.0m$

$$e_{AB} = \int_{2.5}^{5} vB\,dr = \int_{2.5}^{5} (20r)(2)\,dr$$

$$= 20\left[r^2\right]_{2.5}^{5} = 725\,\text{V}$$

48. According to the given question

$\tan 60^0 = \frac{\omega L}{R}$ and $\tan 60^0 = \frac{1/\omega C}{R}$

$\therefore \omega L = (1/\omega C)$ (case of resonance)

Now $Z = \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2} = 2$

$\therefore I_{rms} = \frac{R_{rms}}{Z} = \frac{200V}{100\Omega} = 2A$

49. Density $\rho = \frac{\text{m}}{\pi \text{r}^2 \text{L}}$

$\therefore \frac{\Delta\rho}{\rho} \times 100 = \left(\frac{\Delta m}{m} + 2\frac{\Delta r}{r} + \frac{\Delta L}{L}\right) \times 100 = \left[\frac{0.003}{0.3} + 2\times\frac{0.005}{0.5} + \frac{0.06}{6}\right] \times 100 = 4\%$

After substituting the values, we get the maximum percentage error in density = 4%.

50. Energy stored per unit volume $\frac{1}{2}Y \times \in^2$

Strain $(\in) = \frac{l}{L} = \frac{1mm}{4m} = \frac{1\times10^{-3}m}{4m} = 2.5\times10^{-4}$

Energy stored per unit volume $\frac{1}{2}\times 2.0\times10^{11}\times\left(2.5\times10^{-4}\right)^2 = 6.25\times10^3\,Jm^{-3}$

Volume of the wire = $\pi r^2 L = AL = 3\times10^{-6}\times 4 = 1.2\times10^{-5}m^3 = 75\times10^{-2}\,J$ = 0.075 J

CHEMISTRY

51. According to Debroglie , $\lambda = \frac{h}{mv}$

$$v = \frac{h}{m\lambda} = \frac{6.625\times10^{-34}}{9.1\times10^{-31}\times182\times10^{-9}}$$

$$= 4\times10^3 m/s$$

$$\Rightarrow K.E = \frac{1}{2}mv^2$$

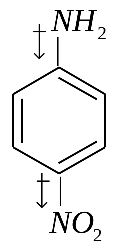
$$= \frac{1}{2}\times 9.1\times10^{-31}\times(4\times10^3)^2$$

$$= 7.28\times10^{-24}J$$

52. The highest oxidation state of ‘U’ and ‘pU’ is +6 and +7 respectively.

53. OSF_2 - has pyramidal shape

54. Dipole moment α electron transfer (or) electron delocalization



e^{-} *transfer* maximum

55. Critical temperature of various gases
$H_2O > NH_3 > CO_2 > O_2 > H_2 > N_2$

56. Volume strength = $11.2 \times molarity = 11.2$
Molarity = 1M
$\Rightarrow \% \ w/w = \frac{34}{1000} \times 100 = 3.4\%$

57. Be-forms amphoteric hydroxide

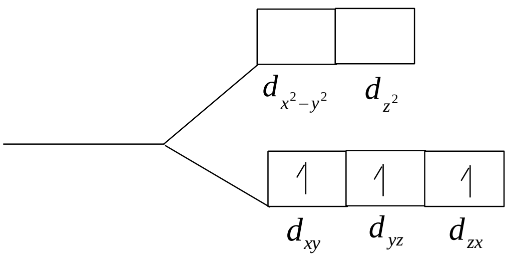
58. $Q_C = \frac{[C]^3}{[A][B]} = \frac{\left(\frac{4}{3}\right)^3}{\left(\frac{1}{3}\right)\left(\frac{2}{3}\right)} = 10.66$
$\therefore Q_C > K_C$
Hence backward reaction is favoured.

59. $\Delta G^0 = \Delta H^0 - T\Delta S^0$
Ln K_{eq} = $-\left(\frac{\Delta H^0 - T\Delta S}{RT}\right)$

60. 188gm AgBr = 180gr Br
$141 \times 10^{-3} gm \ AgBr = ?$
$= 60 \times 10^{-3} gm$
$\therefore \% Br = \frac{0.06}{250 \times 10^{-3}} \times 100 = 24$

61. $HC \equiv CH \xrightarrow[Quinoline]{Pd-BaSO_4} CH_2 = CH_2$
$CH_2 = CH_2 \xrightarrow[AlCl_3]{HCl} C_2H_5Cl$
$C_2H_5Cl \xrightarrow[dry\ ether]{Na} C_4H_{10}$

62. Entire ring does not involve resonance
63. Silicon forms covalent compounds.
64. $Cu_2S + O_2 \rightarrow Cu_2O + 2SO_2$ *is Roasting*
65. Degenerate orbitals of $\left[Cr(H_2O)_6\right]^{+3}$



According to the options given degenerate orbitals are d_{xz} and d_{yz}

66. Due to weak metallic bonding.
67. F^{-} ion concentration for drinking water is 1ppm
68. $2H^{+}_{(aq)} \xrightarrow{+2e^{-}} H_{2(p)}$

$$E_{H^+/H_2} = E^0_{H^+/H_2} - \frac{0.059}{2}\log\frac{P_{H_2}}{\left[H^+_{aq}\right]^2}$$

$$\Rightarrow 0 = 0 - \frac{0.059}{2}\log\frac{P_{H_2}}{\left[H^+\right]^2}$$

$$\log\frac{p_{H_2}}{\left[H^+\right]^2} = 0$$

$$\frac{P_{H_2}}{[H^+]^2} = 1$$

$$P_{H_2} = (10^{-7})^2$$

$$P_{H_2} = 10^{-14}$$

69. $A.e^{-40,000} = A.e^{-Ea/RT}$

$e^{-\frac{40000}{T}} = e^{-Ea/RT}$

$\frac{-40000}{T} = \frac{-Ea}{2T}$

$Ea = 80,000cal$

70. Intra-halogen compounds are more reactive than halogens.

71. $P_{total} = P_A^0 \times A + P_B^0 \times B$

$X_A = 2,\ X_B = 3$

$P_A^0 = 100,\ P_B^0 = 80$

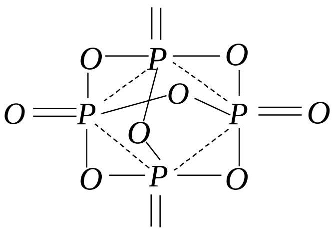
$P_{total} = \frac{2}{5}\times 100 + \frac{3}{5}\times 80 = 40 + 48 = 88\ torr$

72. Mass of acetic acid adsorbed by 0.5gm of charcoal

$= \frac{60(0.1-0.05)50}{1000}$ = 0.15gms

$\therefore \frac{X}{M} = 0.3gms$

73. Structure of P_4O_{10} is



Total 'σ' bonds are 16

74. Two or more conjugated double bonds and the end carbons have dissimilar substituents

No.of geometrical isomers = 2^n

$n = 3$

$\therefore 2^3 = 8$

75. $2\times 890g\ C_{57}H_{110}O_6 = 110\times 18g\ H_2O$

$445g\ C_{57}H_{110}O_6 = ?$

$x = \frac{445\times 110\times 18}{2\times 890} = 495g$