MELUHA INTERNATIONAL SCHOOL

HYDERABAD

SECTION:: SENIOR | **JEE MAINS UNIT TEST-I** | **Date: 20-04-2020**

Time: 3 Hours | **Max. Marks: 300 M**

JEE MAIN MODEL

MATHEMATICS

Section	Question type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 01 – 20)	Questions with Single Answer Type	4	-1	20	80
Sec – II(Q.N : 21 – 25)	Questions with Numerical Answer Type (+/ - Decimal Numbers)	4	0	5	20
Total				25	100

PHYSICS

Section	Question type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 26 – 45)	Questions with Single Answer Type	4	-1	20	80
Sec – II(Q.N : 46 – 50)	Questions with Numerical Answer Type (+/ - Decimal Numbers)	4	0	5	20
Total				25	100

CHEMISTRY

Section	Question type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 51 – 70)	Questions with Single Answer Type	4	-1	20	80
Sec – II(Q.N : 71 – 75)	Questions with Numerical Answer Type (+/ - Decimal Numbers)	4	0	5	20
Total				25	100

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (A), (B), (C) and (B) 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

SYLLABUS: ALGEBRA

1. **If $\alpha,\beta,\gamma,\delta$ are roots of $x^4-100x^3+2x^2+4x+10=0$, then $\frac{1}{\alpha}+\frac{1}{\beta}+\frac{1}{\gamma}+\frac{1}{\delta}$ is equal to**

1) $\frac{2}{5}$ 2) $\frac{1}{10}$ 3) 4 4) $-\frac{2}{5}$

2. **Let r,s,t be the roots of the equation $8x^3+1001x+2008=0$. The value of $(r+s)^3+(s+t)^3+(t+r)^3$ is**

1) 251 2) 751 3) 735 4) 753

3. **The roots of $a_1x^2+b_1x+c_1=0$ are reciprocal of the roots of the equation $a_2x^2+b_2x+c_2=0$ if**

1) $\frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2}$ 2) $\frac{b_1}{b_2}=\frac{c_1}{a_2}=\frac{a_1}{c_2}$ 3) $\frac{a_1}{a_2}=\frac{b_1}{c_2}=\frac{c_1}{b_2}$ 4) $a_1=\frac{1}{a_2},b_1=\frac{1}{b_2},c_1=\frac{1}{c_2}$

4. **The quadratic equations $x^2-6x+a=0$ and $x^2-cx+6=0$ have one root in common. The other roots of the first and second equations are integers in the ratio $4:3$. The common root is**

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

5. **Let $x^2+2ax+10-3a>0$ for every real value of x, then**

1) $a>5$ 2) $a<-5$ 3) $-5<a<2$ 4) $2<a<5$

6. **The coefficient of x^7 in the expansion of $(1-x-x^2+x^3)^6$ is**

1) 144 2) -132 3) -144 4) 132

7. $\sum_{k=0}^{10} {}^{20}C_k =$

1) $2^{19}+\frac{1}{2}{}^{20}C_{10}$ 2) 2^{19} 3) ${}^{20}C_{10}$ 4) 2^{18}

8. **The coefficient of the middle term in the binomial expansion in powers of x of $(1+\alpha x)^4$ and of $(1-\alpha x)^5$ is the same if α equal to**

1) $\frac{-5}{3}$ 2) $\frac{10}{3}$ 3) $-\frac{3}{10}$ 4) $\frac{3}{5}$

9. **Find the number of numbers which can be formed with digits 0,1,2,3,4 greater than 1000 and less than 4000 is repetition is allowed**

1) 125 2) 400 3) 375 4) 374

10. **A shelf contains 20 books, of which 4 are single volume and the others are 8, 5 and 3 volumes respectively. In two many ways can these books be arranged on the shelf so that the order of the volumes of same work is maintained?**

1) 2.7! 2) 7! 3) 8.7! 4) 6.7!

11. **Taking three same and one different letters from the letters of the word "PROPORTION", the number of words which can be formed is**

1) 18 2) 360 3) 20 4) 21

12. **If** $f(x)=\begin{vmatrix} x+a & x+2 & x+1 \\ x+b & x+3 & x+2 \\ x+c & x+4 & x+3 \end{vmatrix}$ **and** $a-2b+c=1$ **then**

1) $f(50)=1$ 2) $f(-50)=-1$ 3) $f(+50)=501$ 4) $f(50)=-501$

13. $A_{3\times3}$ **is a matrix such that** $|A|=a, B=(adjA)$ **such that** $|B|=b$. **Find the value of** $\left(ab^2+a^2b+1\right)S$ **where** $\frac{S}{2}=\frac{a}{b}+\frac{a^2}{b^3}+\frac{a^3}{b^5}+....$ **upto** ∞, **and** $a=3$

1) 225 2) 0 3) 300 4) +220

14. **If matrix** $A=\begin{bmatrix} 1 & 0 & -1 \\ 3 & 4 & 5 \\ 0 & 6 & 7 \end{bmatrix}$ **and its inverse is denoted by** $A^{-1}=\begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$, **then the value of** a_{23} **is equal to _____**

1) $\frac{21}{20}$ 2) $\frac{1}{5}$ 3) $\frac{-2}{5}$ 4) $\frac{2}{5}$

15. **If** $f(x)=\frac{4^x}{4^x+2}, f(x)+f(1-x)=a$ **and** $f\left(\frac{1}{97}\right)+f\left(\frac{2}{97}\right)+....+f\left(\frac{96}{97}\right)=b,$ **then order pair** (a,b) **is**

1) $(2,20)$ 2) $(1,48)$ 3) $(1,24)$ 4) $(2,96)$

16. **The function f satisfies the equation** $3f(x)+2f\left(\frac{x+59}{x-1}\right)=10x+30$ **for all real** $x\neq1$. **The value of** $f(7)$ **is**

1) 8 2) 4 3) -8 4) 11

17. **Domain of the function** $f(x)=\frac{\sin[x-1]}{[x-1][x+2]}$ **where** $[x]$ **denotes the greatest integer function less than** x, **is**

1) all real x 2) $[-2,-1)$ 3) $R-[-2,-1)\cup[1,2)$ 4) $R-[-2,2]$

18. **If A, B and C are three sets such that** $A\cap B=A\cap C$ **and** $A\cup B=A\cup C$ **then**

1) $A=C$ 2) $B=C$ 3) $A\cap C=\phi$ 4) $A=B$

19. **If** $A=\{x\in R:|x|<2\}$ **and** $B=\{x\in R:|x-2|\geq3\}$: **then:**

1) $A-B=[-1,2)$ 2) $A\cup B=R-(-2,5)$

3) $B-A=R-(-2,5)$ 4) $A\cap B=(-2,-1)$

20. **If** $X=\{4^n-3n-1:n\in N\}$ **and** $Y=\{9(n-1):n\in N\}$, **where N is the set of natural numbers, then** $X\cup Y$ **is equal to**

1) N 2) $Y-X$ 3) X 4) Y

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. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which **ONLY ONE** option can be correct.
Marking scheme: +4 for correct answer, 0 in all other cases.

21. **The least value of n such that $(n-2)x^2+8x+n+4>0, \forall x \in R$ where $(n \in N)$ is _____**

22. **The value of** $\left(\sum_{r=0}^{10} {}^{10}C_r\right)\left(\sum_{k=0}^{10}(-1)^k \frac{{}^{10}C_k}{2}\right)$ _____

23. **In a** ΔABC, **if** $\begin{vmatrix} 1 & a & b \\ 1 & c & a \\ 1 & b & c \end{vmatrix} = 0$, **then the value of** $16\left(\sin^2 A+\sin^2 B+\sin^2 C\right)$ **must be _____**

24. **Let** $X=\{n \in N : 1 \le n \le 50\}$. **If** $A=\{n \in X :$ is a multiple of $2\}$. $B=\{n \in X : n$ is a multiple of $7\}$, **then the number of elements in the smallest subset of X containing both A and B**

25. **An urn contains 5 red marbles, 4 black marbles and 3 white marbles. Then the number of ways in which 4 marbles can be drawn so that at the most three of them are red is**

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.

PHYSICS

SYLLABUS: ***MECHANICS***

26. **The deceleration experienced by a moving motor boat after its engine is out off, is given by dv/dt** $=-KV^3$ **where K is a constant. If v is the magnitude of the velocity at cut-off the magnitude of the velocity at a time t after the cut-off is**

1) $V_0/\sqrt{(2V_0^2Kt+1)}$ 2) V_0e^{-kt} 3) $V_0/2$ 4) V_0

27. **A stone falls freely under gravity. It covers distance** h_1, h_2 **and** h_3 **in the first 5 seconds, the next 5 seconds and the next 5 seconds respectively. The relation between** h_1, h_2 **and** h_3 **is**

1) $h_1 = h_2/3 = h_3/5$ 2) $h_2 = 3h_1$ & $h_3 = 3h_2$

3) $h_1 = h_2 = h_3$ 4) $h_1 = 2h_2 = 3h_3$

28. **A projectile is given an initial velocity of** $(\hat{i}+2\hat{j})m/s$ **where** $\hat{i}$ **is along the ground and** $\hat{j}$ **is along the vertical. If** $g = 10\, m/s^2$, **the equation of its trajectory is.**

1) $y = x = -5x^2$ 2) $y = 2x-5x^2$ 3) $4y = 2x-5x^2$ 4) $4y = 2x-25x^2$

29. **A projectile is fired at an angle of** 45^0 **with the horizontal. Elevation angle of the projectile at its highest point as seen from the point of projection is**

1) 60^0 2) $\tan^{-1}(1/2)$ 3) $\tan^{-1}(\sqrt{3}/2)$ 4) 45^0

30. **A player stops a football weighing 0.5 kg which comes flying towards him with a velocity of 10 m/s. If the impact lasts for 1/50th sec. and the ball bounces back with a velocity of 15 m/s, then the average force involved is**

1) 250N 2) 1250N 3) 500N 4) 625N

31. **A satellite in a force free space sweeps stationary interplanetary dust at a rate (dM/dt)=av. The acceleration of satellite is**

1) $-2\alpha v^2/M$ 2) $-\alpha v^2/M$ 3) $-\alpha v^2/2M$ 4) $-\alpha v^2$

32. A ball of mass 10g moving perpendicular to the lane of the wall strikes it and rebounds in the same plane with the same velocity. If the impulse experienced by the wall is 0.54 Ns, the velocity of the ball is

1) $27\,ms^{-1}$ 2) $3.7\,ms^{-1}$ 3) 1/3 m 4) 1/2 m

33. A bullet is fired from a gun. The force on the bullet is given by $F = 600 - 3\times10^5 t$, F is in neuton and t in seconds. The force on the bullet becomes zero as soon as it leaves the barrel. What is the average impulse imparted to the bullet?

1) 1.8 N-s 2) Zero 3) 9 N-s 4) 0.9 N-s

34. A block of mass m is placed on the surface with a vertical cross section given by $y = x^3/6$. If the coefficient of friction is 0.5, the maximum height above the ground at which the block can be placed without slipping is.

1) 1/6 m 2) 2/3 m 3) 1/3 m 4) 1/2 m

35. A block A of mass m_1 rest on a horizontal table. A light string connected to it passes over a frictionless pulley at the edge of table and from its other end another black B of mass m_2 is suspended. The coefficient of kinetic friction between the block and the table is μ_k. When the block A is sliding on the table, the tension in the string

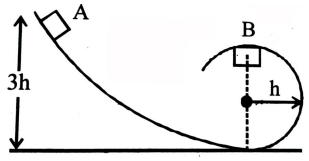
1) $(m_2 - \mu_k m_1)g/(m_1 + m_2)$ 2) $m_1 m_2 (1+\mu_k) g/(m_1 + m_2)$

3) $m_1 m_2 (1-\mu_k) g/(m_1 + m_2)$ 4) $(m_2 + \mu_k m_1)g/(m_1 + m_2)$

36. Water falls from a height 60 m at the rate of $15\,kg/s$ to operate a turbine. The losses due to frictional force are 10% of energes, How much power is generated by the turbine? $(g = 10\,m/s^2)$

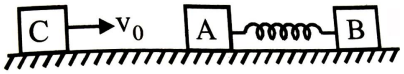
1) 8.1 KW 2) 10.2 KW 3) 12.3 KW 4) 7.0 KW

37. In the figure shown, a particle of mass m is released from the position A on a smooth track. When the particle reaches at B, then normal reaction on it by the track is



1) mg 2) 2mg 3) 2/3 mg 4) $m^2 g/h$

38. A block C of mass m is moving with velocity V_0 and collides elastically with block A of mass m and connected to another block B of mass 2m through spring constant K. What is K if X_0 is compression of spring when velocity of A and B is same ?



1) mv_0^2/x_0^2 2) $mv_0^2/2x_0^2$ 3) $3mv_0^2/2x_0^2$ 4) $2mv_0^2/3x_0^2$

39. A vertical spring with force constant k is fixed on a table. A ball of mass m at a height h above the free upper end of the spring falls vertically on the spring so that the spring is compressed by a distance d. The net work done in the process is

1) $mg(h+d) - \frac{1}{2}kd^2$ 2) $mg(h-d) - \frac{1}{2}kd^2$ 3) $mg(h-d) + \frac{1}{2}kd^2$ 4) $mg(h+d) + \frac{1}{2}kd^2$

40. A body of mass m kg is ascending on a smooth inclined plane of inclination $\theta\left[\sin\theta=\frac{1}{x}\right]$ with constant acceleration of a m/s^2. The final velocity of the body is v m/s. The work done by the body during the motion is (initial velocity of a body =0)

1) $\frac{1}{2}mv^2(g+xa)$ 2) $mv^2\left(\frac{g}{2}+a\right)$ 3) $t^{-1/2}$ 4) $t/\sqrt{m}$

41. A glass marble dropped from a certain height above the horizontal surface reaches the surface in time t and then continues to bounce up and down. The time in which the marble finally comes to rest in

1) $e^n t$ 2) $e^2 t$ 3) $t\left[\frac{1+e}{1-e}\right]$ 4) $t\left[\frac{1-e}{1+e}\right]$

42. A spring of spring constant $5\times10^3\,N/m$ is stretched initially by 5 cm from the unstrutched position. Then the work required to stretch it further by another 5 cm is

1) 12.50 Nm 2) 18.75 Nm 3) 25.00 Nm 4) 6.25 Nm

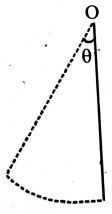
43. From a solid sphere of mass M and radius R a cube of maximum possible volume is cut. Moment of inertia a of cube about an axis passing through its centre and perpendicular to one of its focus is

1) $4MR^2/9\sqrt{3}\pi$ 2) $4MR^2/3\sqrt{3}\pi$ 3) $MR^2/32\sqrt{2}\pi$ 4) $MR^2/16\sqrt{2}\pi$

44. A rings of mass M and radius R is rotating about its axis with angular velocity ω. Two identical bodies each of mass M are now gently attached at the two end of a diameter of the ring. Become of this, the kinetic energy loss will be

1) $\frac{m(M+2m)}{M}\omega^2R^2$ 2) $\frac{Mm}{(M+m)}\omega^2R^2$ 3) $\frac{Mm}{(M+2m)}\omega^2R^2$ 4) $\frac{(M+m)M}{(M+2m)}\omega^2R^2$

45. A uniform rod of length l is free to rotate in a vertical plane about a fixed horizontal axis through O. The rod begins rotating from rest from its unstable equilibrium position. When it has turned through an angle θ its angular velocity ω is given as



1) $\sqrt{\frac{6g}{l}}\sin\theta$ 2) $\sqrt{\frac{6g}{l}}\sin\frac{\theta}{2}$ 3) $\sqrt{\frac{6g}{l}}\cos\frac{\theta}{2}$ 4) $\sqrt{\frac{6g}{l}}\cos\theta$

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. Each question has 4 options (A), (B), (C) and (D) for its answer, out of which **ONLY ONE** option can be correct.
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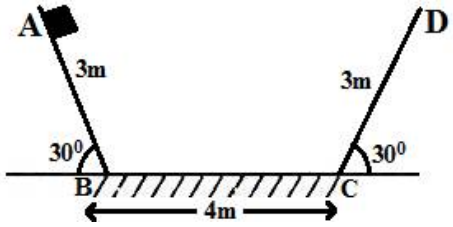
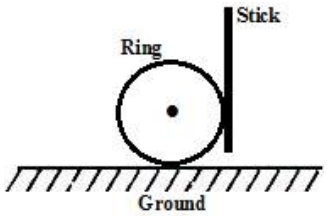
46. **A particle tied to a string describes a vertical circular motion of radius r continually. If it has a velocity $\sqrt{3gr}$ at the highest point then value of ratio of respective tensions in the string holding it at highest and lowest points is**

47. **A rain drop of mass 1g falling from height of 1km hits the ground with a speed of $50\,ms^{-1}$. If the resistive force is proportional to the speed of the drop, then the work done by the resistive force is $\left(\text{Take } g = 10\ \text{ms}^{-2}\right)$ $\left(\text{INS.I Units}\right)$**

48. **A track has two surfaces AB and CD each of length 3m and angle of inclination of 30^0 with the horizontal and a central horizontal part of length 4m as shown in figure. A block of mass 0.2kg slides from rest from point A. The inclined surface are frictionless. If the coefficient of friction between the block and the horizontal flat surface is 0.2 where will the block finally come to rest from point B. (In S.I Units)**

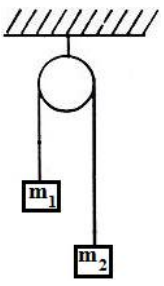


49. **A boy is pushing a ring of mass 2kg and radius 0.5m with a stick as shown in the figure. The stick applies a force of 2N on the ring and rolls it without slipping with an acceleration of 0.3ms^{-2}. The coefficient of friction between the ground and the ring is large enough that rolling always occurs. Then the coefficient of friction between the stick and the ring is.**



50. **Two masses m_1=1kg and m_2=2kg are connected by a light inextensible string and suspended by means of a weightless pulley as shown in the figure. Assuming that both the masses start from rest, the distance travelled by centre of mass in two seconds is _____ in S.I system**

$\left(\text{take g=10 ms}^{-2}\right)$



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

SYLLABUS: ***FIRST YEAR IN ORGANIC CHEMISTRY***

51. Among Al_2O_3, SiO_2, P_2O_3 and SO_2 the correct order of acid strength is

1) $Al_2O_3 < SiO_2 < P_2O_3 < SO_2$ 2) $SO_2 < P_2O_3 < SiO_2 < AlO_3$

3) $SiO_2 < SO_2 < Al_2O_3 < P_2O_3$ 4) $Al_2O_3 < SiO_2 < SO_2 < P_2O_3$

52. The electronic configuration of four elements are given below. Arrange these elements in the correct of the magnitude (without sign) of their electron affinity.

(I) $2s^2 2p^5$ (II) $3s^2 3p^5$ (III) $2s^2 2p^4$ (IV) $3s^2 3p^4$

Select the correct answer using the codes given below:

1) III<IV<II<I 2) III<IV<I<III 3) I<II<IV<III 4) II<I<IV<III

53. The electron affinity of chlorine is 3.7 eV. How much energy in kcal is released when 4 g of chlorine is completely converted into Cl ion in gaseous state. (Given: 1 eV = 23.06 kcal mol^{-1})

1) 9.6 kcal 2) 19.6 kcal 3) 4.8 kcal 4) 11.6 kcal

54. 10 mL of H_2O_2 solution on treatment with KI and titration of liberated I_2, required 10 mL of 1 N hypo. Thus H_2O_2 is.

1) 1N 2) 5.6 volume 3) $17\,g\,L^{-1}$ 4) all are correct

55. D_2O (heavy water) and H_2O differ in following except in.

1) freezing point 2) density

3) ionic product of water 4) its reaction with sodium

56. H, D and T (isotopes of hydrogen) have nuclear spin quantum number respectively as:

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

57. Among the following species, identify the isostructural pairs:

$NF_3, NO_3^-, BF_3, H_3O^+, HN_3$

1) $\{NF_3, NO_3^-\}$ and $\{BF_3, H_3O^+\}$ 2) $\{NF_3, HN_3\}$ and $\{NO_3^-, BF_3\}$

3) $\{NF_3, H_3O^+\}$ and $\{NO_3^-, BF_3\}$ 4) $\{NF_3, H_3O^+\}$ and $\{HN_3, BF_3\}$

58. Four diatomic species are listed below in different sequences. Which of these presents the correct order of their increasing bond order?

1) $C_2^{2-} < He_2^- < NO < O_2^-$ 2) $He_2^- < O_2^- < NO < C_2^{2-}$

3) $O_2^- < NO < C_2^{2-} < He_2^+$ 4) $NO < C_2^{2-} < O_2^- < He_2^+$

59. Which of the following types of bonds are present in $CuSO_4, 5H_2O$?

I. Electrovalent II. Covalent III. Coordinate

Select the correct answer using the code given below:

1) I and II only 2) I and III only 3) I, II and III 4) II and III only

60. The enamel of teeth is.

1) CaF_2 2) $Ca_3(PO_4)_2$ 3) $3Ca_3(PO_4)_2.CaF_2$ 4) $CaSO_4$

61. Na_2O_2 :

1) is diamagnetic in nature
2) is a salt of dibasic acid H_2O_2
3) oxides Cr^{3+} (green) to CrO_4^{2-} (yellow)
4) all are correct properties of Na_2O_2

62. Which cannot be used to generate H_2?

1) $Al + NaOH$
2) $Zn + NaOH$
3) $Mg + NaOH$
4) $LiH + H_2O$

63. $B(OH)_3 + NaOH \rightarrow Na\left[B(OH)_4\right]_{(aq)}$

Which of the following is the best catalyst to take this reaction in forward direction

1) cis-1,2 diol
2) trans-1,2 diol
3) borax
4) Na_2HBO_4

64. $Al_2O_3 + C + Cl_2 \xrightarrow{1273K} X \uparrow + Y \uparrow$. **Correct statements regarding X & Y**

1) Both X and Y contain dative bonds in one of their forms
2) Both contains Ionic bond
3) Both contains Oxygen
4) Both contains chlorine

65. Which of the following is the correct order of reducing power of hydrides?

1) $CH_4 < SiH_4 < GeH_4 < SnH_4 < PbH_4$
2) $CH_4 > SiH_4 > GeH_4 > SnH_4 > PbH_4$
3) $CH_4 > GeH_4 > SiH_4 > PbH_4 > SnH_4$
4) $SiH_4 < CH_4 < SnH_4 < GeH_4 < PbH_4$

66. The correct order of increasing "$C-O$" bond length of CO, CO_3^{-2} and CO_2 is

1) CO_3^{-2}, CO_2, CO
2) CO_2, CO_3^{-2}, CO
3) CO, CO_3^{-2}, CO_2
4) CO, CO_2, CO_3^{-2}

67. Name the structure of silicates in which three oxygen atoms of $\left[SiO_4\right]^{4-}$ are shared is

1) pyrosilicate
2) sheet silicate
3) linear chain silicate
4) three dimensional silicate

68. 500 ml of a sample *COD* of water required 19 .6 mg of $K_2Cr_2O_7$ of water sample is

1) 8 ppm
2) 6.4 ppm
3) 16.8 ppm
4) 4.9 ppm

69. The gas leaked from a storage tank of the Union Carbide plant in Bhopal gas tragedy was.

1) Methylamine
2) Ammonia
3) Phosgene
4) Methylisocyanate

70. A water sample has ppm level concentration of following anions

$F^- = 10; SO_4^{2-} = 100; NO_3^- = 50$

The anion/anions that make/makes the water sample unsuitable for drinking is/are?

1) only SO_4^{2-}
2) only NO_3^-
3) both SO_4^{2-} and NO_3^-
4) only F^-

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. 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 in all other cases.

71. Number of hydrogen bonds in $H_9O_4^+$ species is

72. A 1 g sample of H_2O_2 solution containing x per cent H_2O_2 by weight required x mL of $KMnO_4$ for complete oxidation in acidic medium. Calculate normality of $KMnO_4$ solution.

73. A student suggested that calcium should be made if calcium oxide is reacted with aluminum powder. Was the student correct?

$\Delta G_f^0(CaO) = -604.2\,kJ\,mol^{-1}$

$\Delta G_f^0(Al_2O_3) = -1582.4\,kJ\,mol^{-1}$

74. How many oxygen atoms of $\left[SiO_4\right]^{4-}$ are shared in three dimensional sheet silicate?

75. How many units of SiO_4^{4-} will be required for the formation of pyrosilicates?

******

KEY SHEET

MATHEMATICS

1) **4**	2) **4**	3) **2**	4) **3**	5) **3**	6) **4**	7) **1**	8) **3**	9) **4**	10) **3**
11) **3**	12) **1**	13) **1**	14) **1**	15) **2**	16) **2**	17) **3**	18) **2**	19) **3**	20) **4**
21) **5**	22) **1**	23) **144**	24) **29**	25) **490**					

PHYSICS

26) **1**	27) **1**	28) **2**	29) **2**	30) **4**	31) **2**	32) **1**	33) **4**	34) **1**	35) **2**
36) **1**	37) **1**	38) **4**	39) **1**	40) **4**	41) **3**	42) **2**	43) **1**	44) **3**	45) **3**
46) **0.25**	47) **-8.75**	48) **0.5**	49) **0.4**	50) **2.22**					

CHEMISTRY

51) **1**	52) **2**	53) **1**	54) **4**	55) **4**	56) **1**	57) **3**	58) **2**	59) **3**	60) **3**
61) **4**	62) **3**	63) **1**	64) **1**	65) **1**	66) **4**	67) **2**	68) **2**	69) **4**	70) **4**
71) **3**	72) **0.59**	73) **230.2**	74) **4**	75) **2**					

MATHS

1. $\frac{1}{\alpha},\frac{1}{\beta},\frac{1}{\gamma},\frac{1}{\delta}$

$x \to \frac{1}{x} \Rightarrow \frac{1}{x^4}-\frac{100}{x^3}+\frac{2}{x^2}+\frac{4}{x}+10=0$

$\Rightarrow 10x^4+4x^3+2x^2-100x+1=0$

$\frac{1}{\alpha}+\frac{1}{\beta}+\frac{1}{\gamma}+\frac{1}{\delta}=\frac{-4}{10}=\frac{-2}{5}$

2. $S_1 = r+s+t=0$

$(r+s)+(s+t)+(t+r)=0$

$(r+s)^3+(s+t)^3+(t+r)^3=3(s+r)(s+t)(t+r)$

$=3(-t)(-r)(-s) \ =-3trs$

$=-3\left(\frac{-2008}{8}\right)=753$

3. $a_1x^2+b_1x+c_1=0$

α,β are roots of equation

$\frac{1}{\alpha}\frac{1}{\beta}$.....

$\frac{1}{\alpha}=x$

$\frac{a_1}{x^2}+\frac{b_1}{x}+c_1=0$

$a_1+b_1x+c_1x^2=0 \to (1)$

$\frac{c_1}{a_2}=\frac{b_1}{b_2}=\frac{a_1}{c_2}$

$a_2x^2+b_2x+c_2=0 \to (2)$

$\frac{1}{\alpha},\frac{1}{\beta}$ are roots in equation

4. Common root α

$\alpha, 4\beta$ are root of $x^2-6x+a=0$

$\alpha+4\beta=6$

$\alpha+4\left(\frac{1}{\alpha}\right)=6 \Rightarrow \alpha=2$

$\alpha,3\beta$ are roots of $x^2-cx+6=0$

$\alpha(3\beta)=6$

$\beta=\frac{2}{d}$ integer

5. $a>0,\ y>0,\ D>0$

$a^2+3a-10<0$

$-5<a<2$

6. $\left[(1-x)-x^2(1-x)\right]^6=(1-x)^6(1-x^2)^6$

$={}^6C_{r_1}(1)^{6-r}{}_1(-x)^{r1}\ {}^6C_{r_2}(1)^{6-r}\ {}^2(-x)^{r_2}$

$={}^6C_{r_1}\,{}^6C_{r_2}(-1)^{r_1}(-1)^{r_2}x^{r_1+2r_2}$

$\Rightarrow {}^6C_1\,{}^6C_3+{}^6C_3\,{}^6C_2(-1)+{}^6C_5\,{}^6C_1$

$=132$

$r_1+2r_2=7$

$r=0 \quad x$

$r_1=1,\ r_2=3$

$r_1=3,\ r_2=2$

$r_1=5,\ r_2=1$

7. ${}^{20}C_0+{}^{20}C_1+....+{}^{20}C_{10}=\lambda$

${}^{20}C_0+{}^{20}C_1+....+{}^{20}C_{10}+{}^{20}C_0+{}^{20}C_1+....{}^{20}C_{10}=2\lambda$

${}^{20}C_0+{}^{20}C_1+....+{}^{20}C_{10}+{}^{20}C_{11}+....{}^{20}C_{19}+{}^{20}C_{20}+{}^{20}C_{10}=2\lambda$

$20^{20}+{}^{20}C_{10}=20$

$\lambda=2^{19}+\frac{1}{2}\ {}^{20}C_{10}$

8. $(1+\alpha x)^4 \to {}^4C_2(1)^{4-2}(\alpha x)^2$

$(1-\alpha x)^6 \to {}^6C_3(1)^{6-3}(-\alpha x)^3$

${}^4C_2\alpha^2={}^6C_3(-\alpha)^3$

$\alpha=\frac{-3}{10}$

9. $\underline{\ }\ \underline{\ }\ \underline{\ }\ \underline{\ }\ \underline{\ }$

$3\times5\times5\times5 \Rightarrow 375-1=374$

10. P C M B $\boxed{H_1H_2.....H_8}$ $G_1.....G_5$ $F_1F_2F_3$

$7!\ 2\times2\times2=8\times7!$

11. PP, RR, OOO T I N

3 same and one different

$={}^1C_1\times{}^5C_1\times\frac{4!}{3!}=20$

12. $R_1 \to R_1+R_3-2R_2$

$$f(x)=\begin{vmatrix} 2x+a+c-2x-2b & 0 & 0 \\ x+b & x+3 & x+2 \\ x+c & x+4 & x+3 \end{vmatrix}$$

$f(x)=(x+3)^2-(x+4)(x+2)$

$f(x)=1$

$f(50)=1$

13. $|B|=|adjA|$

$b=|A|^{3-1}=a^2$ $\qquad \frac{S}{2}=\frac{\frac{a}{b}}{1-\frac{a}{b^2}}=\frac{1/3}{1-1/27}$

$a=3, b=a$ $\qquad s=\frac{9}{13}$

$(ab^2+a^2b+1)s=225$

14. $a_{23} \Rightarrow \dfrac{\text{cofactor of } 6}{|A|}=\dfrac{-21}{-20}=\dfrac{21}{20}$

15. $a=f(x)+f(1-x)=\dfrac{4^x}{4^x+2}+\dfrac{2}{2+4^4}=1 \Rightarrow a=1$

$b=f\left(\dfrac{1}{97}\right)+f\left(\dfrac{2}{97}\right)+....+f\left(1-\dfrac{2}{97}\right)+f\left(1-\dfrac{1}{97}\right)$

$b=48a=48 \qquad a=1, b=48$

16. $x=7 \Rightarrow 3f(7)+2f(1)=100 \rightarrow (1)$

$x=11 \Rightarrow 3f(11)+2f(7)=140 \rightarrow (2)$

$(1)\times 3-(2)\times 2$

$\Rightarrow 5f(7)=20$

$\Rightarrow f(7)=4$

17. Not defined if $[x-1]=0$ or $[x+2]=0$

$[x]=1 \qquad [x]=-2$

$1 \le x < 2 \qquad -2 \le x < -1$

$R-\{[1,2)\cup[-2,-1)\}$

18. $B\cap(A\cup B)=B\cap(A\cup C)$

$\Rightarrow B=(B\cap A)\cup(B\cap C)$

$=(A\cap C)\cup(B\cap C)$

$(A\cup B)\cap C$

$B=(A\cup C)\cap C=C \Rightarrow B-C$

19. $A=-2<x<2$

$\left.\begin{array}{l} x-2\ge 3 \Rightarrow x\ge 5 \\ 2-x\ge 3 \Rightarrow x\le -1 \end{array}\right\}=B$

$A\cap B=\{x: x\in(-2,-1)\}$

$A\cup B=\{x: x\in(-\infty,2)\cup[5,\infty)\}$

$A-B=\{x: x\in(-1,2)\}$

$B-A=\{x: x\in(-\infty,-2)\cup[5,\infty)\}$

20. Set x contains elements of the form

$4^n-3n-1=(1+3)^n-3n-1$

$=9\left[3^{n-2}+{}^nC_{n-1}3^{n-1}+.....{}^nC_2\right]$

Set x has natural numbers which are multiplies of 9 set y has all multiplies of 9

$X\cup Y=Y$

21. $ax^2+bx+1>0 \quad a>0 \quad D<0$

$n-2>0 \rightarrow (1) \quad D<0$

$64-4(n-2)(n+4)<0$

$4(-n^2-2n+24)<0$

$n^2+2n-24>0$

$(n+6)(n-4)>0 \rightarrow (2)$

From (1) and (2) $n>4 \Rightarrow n=5$

22. $\left(\sum_{r=0}^{10}{}^{10}C_r\right)\left(\sum_{k=0}^{10}{}^{10}C_k\left(-\dfrac{1}{2}\right)\right)^k$

$=2^{10}\left(1-\dfrac{1}{2}\right)^{10}=1$

23. $1(c^2-ab)-a(c-a)+b(b-c)=0$

$\Rightarrow a^2+b^2+c^2-ab-bc-ca=0$

$\Rightarrow (a-b)^2+(b-c)^2+(c-a)^2=0$

Which is possible when only when

$a=b=c \ \therefore A=B=C=\dfrac{\pi}{3}$

$16\left(\sin^2\pi/3+\sin^2\pi/3+\sin^2\pi/3\right)=144$

24. $n(X)=50;\ n(A)=25;\ n(B)=7;\ n(A\cap B)=3$

$n(A\cup B)=n(A)+n(B)-n(A\cap B)$

$=25+7-3=29$

25. 0Red 1Red 2Red 3Red

Number of ways

$={}^7C_4+{}^5C_1.{}^7C_3+{}^5C_2.{}^7C_2+{}^5C_3.{}^7C_1$

$=35+175+210+70=490$

PHYSICS

26. $\dfrac{dv}{dt}=-kv^3$ (or) $\dfrac{dv}{v^3}=-kdt$

Integrating we get, $\dfrac{-1}{2V^2}=-kt+c.....(1)$

At $t=0, v=v_0 \ \therefore -\dfrac{1}{2v_0^2}=c$

Putting in (1)

$-\dfrac{1}{2v^2}=-kt-\dfrac{1}{2v_0^2}\ (or)\ \dfrac{1}{2v_0^2}\dfrac{-1}{2v^2}=-kt$ (or)

$\left(\dfrac{1}{2v_0^2}+kt\right)=\dfrac{1}{2v^2}$ or $\left[1+2v_0^2kt\right]=\dfrac{v_0^2}{v^2}$ or

$v^2=\dfrac{v_0^2}{1+2v_0^2kt}$ or $v=\dfrac{v_0}{\sqrt{1+2v_0^2kt}}$

27. $\because h=\dfrac{1}{2}gt^2$

$\because h_1=\dfrac{1}{2}g(5)^2=125$

$h_1+h_2=\dfrac{1}{2}g(10)^2=500$

$\Rightarrow h_2=375$

$h_1 + h_2 + h_3 = \frac{1}{2} g (15)^2 = 1125$

$\Rightarrow h_3 = 625$

$h_2 = 3h_1,\ h_3 = 5h_1$

or $h_1 = \frac{h_2}{3} = \frac{h_3}{5}$

28. $\vec{u} = i + 2\hat{j} = u_x \hat{i} + u_y \hat{j} \Rightarrow u\cos\theta = 1, u\sin\theta = 2$

$y = x\tan\theta - \frac{1}{2}\frac{gx^2}{u_x^2}$

$\therefore y = 2x - \frac{1}{2} g x^2 = 2x - 5x^2$

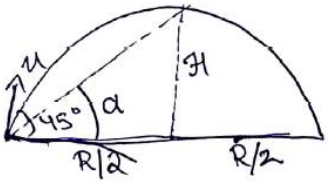
29. $H = \frac{u^2 \sin^2 45^0}{2g} = \frac{u^2}{4g} ...(1)$

$R = \frac{u^2 \sin 90}{g} = \frac{u^2}{g}$

$\therefore \frac{R}{2} = \frac{u^2}{2g} ...(2)$

$\therefore \tan\theta = \frac{H}{R/2}$

$= \frac{\frac{u^2}{4g}}{\frac{u^2}{2g}} = \frac{1}{2} \ \therefore \alpha = \tan^{-1}\left[\frac{1}{2}\right]$



30. Here m =0.5 kg; u=-10m/s; t=1/50s;
v=+15 ms^{-1}
force $= m(v-u)t = 0.5(10+15)\times 50 = 625N$

31. Thrust on the satellite,
$F = \frac{-vdm}{dt} = -v(\alpha v) = -\alpha v^2$
Acceleration $= F/m = -\alpha v^2 / M$

32. As the ball, m=10g =0.01 kg rebounds after striking that wall
$\therefore$ Change in momentum
$= mv - (-mv) = 2mv$
Impulse =Change in momentum =2mv
$\therefore v = \frac{\text{Impulse}}{2\text{m}} = \frac{0.54Ns}{2\times 0.01Kg} = 27 ms^{-1}$

33. Given $F = 600 - (2\times 10^5 t)$
The force is zero at time t, given by
$0 = 600 - 2\times 10^5 t$

$\Rightarrow t = \frac{600}{2\times 10^5} = 3\times 10^{-3}$ seconds

$\therefore$ Impulse $= \int_0^t F dt = \int_0^{3\times 10^{-3}} \left(600 - 2\times 10^5 t\right) dt$

$= \left[600t - \frac{2\times 10^5 t^2}{2}\right]_0^{3\times 10^{-3}}$

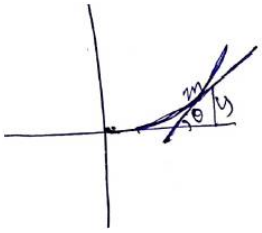
$= 600\times 3\times 10^{-3} - 10^5 \left(3\times 10^{-3}\right)^2$

$= 1.8 - 0.9 = 0.9\, Ns$

34. At limiting equilibrium, $\mu = \tan\theta$

$\tan\theta = \mu = \frac{dy}{dx} = \frac{x^2}{z}$ (from question)

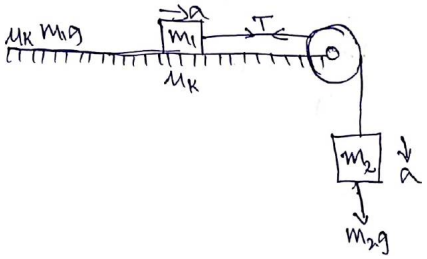
$\because$ Coefficient of friction $\mu = 0.5$



$\therefore 0.5 = \frac{x^2}{2} \ \Rightarrow x = \pm 1$

Now, $y = \frac{x^3}{6} = \frac{1}{6} m$

35. For the motion of both the blocks
$m_1 a = T - \mu_k m_1 g$
$m_2 g - T = m_2 g$



$a = \frac{m_2 g - \mu_k m_1 g}{m_1 + m_2}$

$m_2 g - T = (m_2)\left[\frac{m_2 g - \mu_k m_1 g}{m_1 + m_2}\right]$

Solving we get tension in the string
$T = \frac{m_1 m_2 (1+\mu_k) g}{m_1 + m_2}$

36. Given, $h = 60m, g = 10 ms^{-2}$
Rate of flow of water $= 15 kg/s$
$\therefore$ Power of the falling water
$= 15 kgs^{-1} \times 10 ms^{-2} \times 60m = 900\, watt$
Loss in energy due to friction

$= 9000 \times \frac{10}{100} = 900\, watt$

$\therefore$ Power generated by the turbine

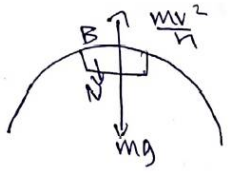
$= (9000 - 900)$ watt $= 8100$ watt $= 8.1kw$

37. By conservation of energy

$mg(3h) = mg(2h) + \frac{1}{2}mv^2$ (v=velocity at B)

$mgh = \frac{1}{2}mv^2;\ v = \sqrt{2gh}$

From free body diagram of block at B



$N + mg = \frac{mv^2}{h} = 2mg;\ N = mg$

38. When C strikes A

$\frac{1}{2}mv_0^2 = \frac{1}{2}mv^2 + \frac{1}{2}kx_0^2$ (v^1 = velocity of A)

$kx_0^2 = m(v_0^2 - v^2).....(i)$

$\frac{1}{2}2mv^2 = \frac{1}{2}kx_0^2$

(When A and B block attains K.E)

$\therefore \frac{1}{2}Kx_0^2 = mv^2.....(ii)$

From (i) and (ii)

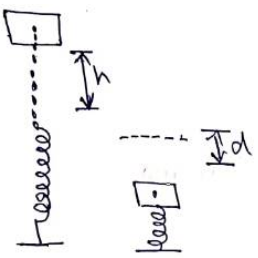
$kx_0^2 = mv_0^2 - mv^2 = mv_0^2 - \frac{k}{2}x_0^2$

$\Rightarrow kx_0^2 + \frac{k}{2}x_0^2 = mv_0^2$

$\frac{3}{2}kx_0^2 = mv_0^2\ \therefore k = \frac{2}{3}m\frac{v_0^2}{x_0^2}$

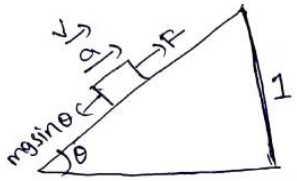
39. Gravitational potential energy of ball gets converted into elastic potential energy of the spring $mg(h+d) = \frac{1}{2}kd^2$

Net work done $= md(h+d) - \frac{1}{2}kd^2 = 0$



40. $\sin\theta = \frac{1}{x}$

From free body diagram of the body



$F - mg\sin\theta = ma$

$F = m(g\sin\theta + a) = m\left(\frac{g}{x} + a\right).....(1)$

Displacement of the body till its velocity reaches v

$v^2 = 0 + 2as \Rightarrow s = \frac{v^2}{2a}$

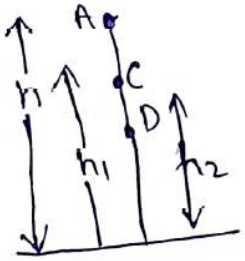
Now, work done

$= Fs\cos\theta^0 = \frac{m}{x}(g + ax)\frac{xv^2}{2a}$

$= \frac{mv^2}{2ax}(g + ax)$

41. $t_{AB} = \sqrt{\frac{2h}{g}}$

$t_{BC} + t_{CB} = 2\sqrt{\frac{2h_1}{g}}$



$= 2\sqrt{\frac{2e^2h}{g}} = 2e\sqrt{\frac{2h}{g}}$

$t_{BD} + t_{DB} = 2e^2\sqrt{\frac{2h}{g}}$

$\therefore$ Total time taken by the body in coming to rest

$= \sqrt{\frac{2h}{g}} + 2e\sqrt{\frac{2h}{g}} + 2e^2\sqrt{\frac{2h}{g}} + ...$

$= \sqrt{\frac{2h}{g}} + 2e\sqrt{\frac{2h}{g}}\left[1 + e + e^2 + ...\right]$

$= \sqrt{\frac{2h}{g}} + 2e\sqrt{\frac{2h}{g}} \times \frac{1}{1-e} = \sqrt{\frac{2h}{g}}\left[\frac{1+e}{1-e}\right] = t\left[\frac{1+e}{1-e}\right]$

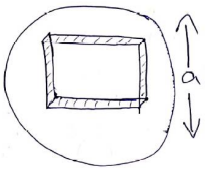
42. $k = 5 \times 10^3\ N/M$

$$w=\frac{1}{2}k\left(x_2^3-x_1^2\right)=\frac{1}{2}\times5\times10^3\left[(0.1)^2-(0.05)^2\right]$$

$$=\frac{5000}{2}\times0.15\times0.05=18.75\,Nm.$$

43. Here $a=\frac{2}{\sqrt{3}}R$

Now, $\frac{M}{M'}=\frac{\frac{4}{3}\pi R^3}{a^3}$



$$\frac{\frac{4}{3}\pi R^3}{\left(\frac{2}{\sqrt{3}}R\right)^3}=\frac{\sqrt{3}}{2}\pi.\quad M'=\frac{2M}{\sqrt{3}\pi}$$

Moment of inertia of the about the given axis, $I=\frac{M'a^2}{6}=\frac{\frac{2M}{\sqrt{3}\pi}\times\left[\frac{2}{\sqrt{3}}R\right]^2}{6}=\frac{4MR^2}{9\sqrt{3}\pi}.$

44. Kinetic energy (rotational) $K_R=\frac{1}{2}I\omega^2$

Kinetic energy (translational) $K_T=\frac{1}{2}MV^2$

M.I. (initial) $I_{(ring)}=MR^2+2mR.$

$$\omega'_{(system)}=\frac{M\omega}{M+2m}$$

Solving we get loss in $K.E=\frac{M.m}{(M+2m)}\omega^2R^2$

45. $\frac{1}{2}1\omega^2=$ Loss of potential energy

$$\frac{1}{2}\times\frac{ml^2}{3}\omega^2=\frac{mgl}{2}(1+\cos\theta)$$

$$\Rightarrow\omega^2=\frac{3g}{l}\left[2\cos^2\theta/2\right]\Rightarrow\omega=\sqrt{\frac{6g}{l}}\cos\frac{\theta}{2}$$

46. $T_{top}=\frac{mv^2}{r}-mg=2mg\ \left[\because V_{top}=\sqrt{3gr}\right]$

$$T_{bottom}=2mg+6mg=8mg$$

$$T_{top}:T_{bottom}=1:4=0.25$$

47. $w_{gravitational}+w_{friction}=\frac{1}{2}mv^2-\frac{1}{2}mu^2$

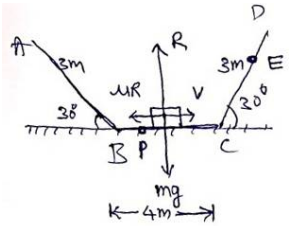
$$w_{friction}=\frac{1}{2}mv^2-w_{gravitational\ force}$$

$$=\frac{1}{2}mv^2-2mgh$$

$$=1.25-10$$

$$=-8.75\text{ Joule}$$

48. At point A, the energy of the block is intirely potential =mgh, where h is the height of A from surface $h=AB\sin\theta=3\sin3\theta=1.5m$



When the block is released, it reaches point B where the entire PE is converted into KE. It will, move on tack BC. On reaching 'C' it will rise on the surface CD to a point E and will then return to C moving towards B and the process goes on until the block loses all its energy and comes to rest. The body loses energy while moving on the horizontal part BC of the track.

If S is the total distance travelled on horizontal part, the work done against friction is $\omega=\mu RS=\mu mgs$

From the principle of conservation of energy, we have $mgh=\mu mgs$

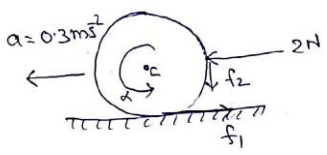
$$s=\frac{h}{\mu}=\frac{1.5}{0.2}=7.5m$$

i.e., the block travels a total distance of 7.5m on the horizontal track BC before coming to rest. Starting from B. It travels 4m from B to C and 3.5m from C to a ppoint P where it comes to rest. Hence the block comes to rest at point P at a distance of 0.5m from B.

49. $2=f_1=Ma$

$f_1=2-Ma=2-2\times0.3$

$f_1=1.4N$



Taking torque about C

$f_1R - f_2R = I_c \propto$

$(f_1 - f_2) = MR^2 \dfrac{a}{R^2} \left[\propto = \dfrac{a}{R}\right]$

$f_1 - f_2 = Ma$

$f_2 = f_1 - Ma$

$= 1.4 - 2 \times 0.3$

$f_2 = 0.8N = 2\mu$

$\mu = \dfrac{0.8}{2} = 0.4$

50. Acceleration of each block $a = \left(\dfrac{m_2 - m_1}{m_1 + m_2}\right)g$

blocks move in opposite directions.

$a_{cm} = \dfrac{m_1a_1 + m_2a_2}{m_1 + m_2} = \dfrac{1(-a) + 2(a)}{1+2} = \dfrac{10}{9}$

$s = \dfrac{1}{2}a_{cm}t^2 = \dfrac{1}{2} \times \dfrac{10}{9} \times (2)^2 = \dfrac{20}{9}m = 2.22m$

CHEMISTRY

51. As acidic nature increases left to right in a period with increase in electronegativity.
52. Conceptual
53. $\underset{35.5}{Cl} + e^- \rightarrow Cl^- + \underset{3.7 \times 23.06 kcal}{3.7\ eV}$

As energy released for conversion of 4g gaseous chlorine into Cl^- ions

$= \dfrac{3.7 \times 23.06}{35.5} \times 4 = 9.6$ kcal

54. $H_2O_2 + 2I^- \rightarrow I_2$

$I_2 + 2S_2O_3^{2-} \rightarrow S_4O_6^{2-} + 2I^-$

$H_2O_2 \equiv I_2 \equiv 2S_2O_3^{2-}$

$N_1V_1 = N_2V_2$

H_2O_2 hypo

$N_1(H_2O_2) = \dfrac{10 \times 1}{10} = 1N$

(a) True

$\text{Conc.} = N \times E = 17\ gL^{-1}$

(c) True "Volume" conc.

$= 5.6 \times N = \text{"5.6" Volume}$

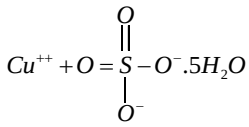
Thus, (b)

Thus all correct (d)

55. Conceptual
56. Conceptual
57. NF_3, H_3O^+ are pyramidal in shape while NO_3^-, BF_3 are planar molecules.
58. $He_2^+ < O_2^- < NO < C_2^{2-}$

Bond order 0.5 1.5 2.5 3.0

59. $CuSO_4\,5H_2O$



Here, ionic and covalent bonds are present in $CuSO_4$ while H_2O molecules are attached by coordinate bonds.

60. Conceptual
61. Na_2O_2 has peroxide on $O_2^{2-}(18e^-)$ and is isoelectronic of F_2. It has all paired electrons and is thus diamagnetic.

$H_2O_2 \rightarrow 2H^+ + O_2^{2-}$

Thus, it is also salt of dibasic acid $H_2O_2.Cr^{3+}$ is oxidized to CrO_4^{2-} in acidic medium.

$Cr^{3+} + O_2^{2-} + 2H^+ \rightarrow CrO_4^{2-} + H_2O$

Thus, (d)

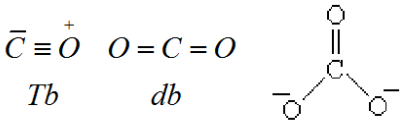
62. Mg does not react with $NaOH$.

$2Al + 2NaOH + 2H_2O \rightarrow 2NaAlO_2 + 3H_2$

$Zn + 2NaOH \rightarrow Na_2ZnO_2 + H_2$

$LiH + H_2O \rightarrow LiOH + H_2$

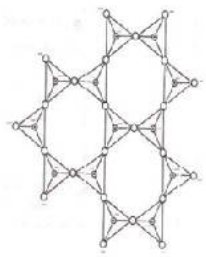
63. Boric acid is a very weak acid. It does not react with alkali explicitly. However, the weak orthoboric acid may be converted into comparatively strong monobasic acid by addition of any cis-1,2 diol to pull the reaction in forward direction significantly.
64. $Al_2O_3 + 3C + 3Cl_2 \xrightarrow{1273K} 2AlCl_3 \uparrow + 3CO \uparrow$
65. Reducing Power α $\dfrac{1}{bond\ strength}$



Tb *db*

66. In between Sb & db
67. In sheet silicates, three out of four oxygen of SiO_4^{4-} unit are shared as shown in below :

Three oxygens of every tetrahedra are shared with others



In pryosilicates, there is only one shared oxygen, in linear chain silicates, two oxygen

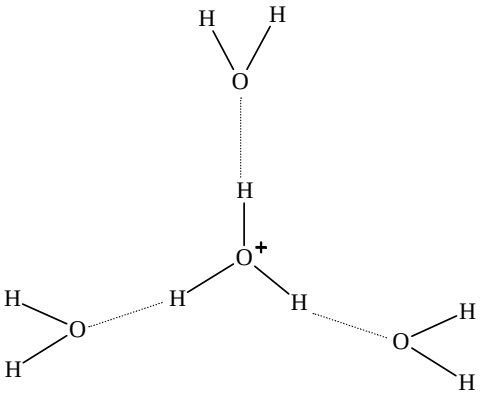
per tetrahedra are shared while in three dimensional silicates, all four oxygens are shared.

68. **19.6×10^{-3}g $K_2Cr_2O_7$.....500ml of H_2O ?**
..... 10^6 ml of H_2O
49g of $K_2Cr_2O_7$ =8g of O_2
39.2g of $K_2Cr_2O_7$ =?
COD = 6.4 ppm

69. It was methyl isocyanate (CH_3NCO)

70. Water becomes harmful if
F^- concentration greater than 10 ppm
$\left[SO_4^{-2}\right]$ greater than 500 ppm
$\left[NO_3^-\right]$ greater than 50 ppm

71.



72. Pure $H_2O_2 = \frac{x}{100}g = \frac{x}{1700}$ equivalent

$KMnO_4 = \frac{xN}{1000}$ equivalent

$\frac{Nx}{1000} = \frac{x}{1700}$

$N = \frac{10}{17} = 0.59N$

73. $3CaO + 2Al \rightarrow Al_2O_3 + 3Ca$

$\Delta G_f^0 = \Delta G_f^0\left(Al_2O_3\right) - 3\Delta G_f^0\left(CaO\right)$

$= -1582.4 - 3(-604.2)$

$= 230.2kJ$

+ve sign indicates that reaction is no spontaneously; thus student's suggestion is incorrect.

74. These silicates involve all four oxygen atom in sharing with adjacent SiO_4^{4-} tetrahedral units.

75.