SRIGAYATRI EDUCATIONAL INSTITUTIONS

INDIA

SR MPC | **(UT1+UT2) CUM TEST-1** | **Date: 25-04-2020**

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

IMPORTANT INSTUCTIONS:-

JEE MAIN MODEL

MATHS

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

MATHEMATICS

SYLLABUS: **Trigonometry (complete), Complex numbers, De theorem, Algebra (UT-1 & UT-2 Syllabus)**

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.

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1. **If** $\sin(\alpha+\beta)=1, \sin(\alpha-\beta)=\frac{1}{2}$ **then** $\tan(\alpha+2\beta)\tan(2\alpha+\beta)=$
(α,β **are acute angles)**
A) 1 B) -1 C) 0 D) 5

2. **In a** ΔABC **if** $\cos A\cos B\cos C=\frac{1}{3}$**, then the value of** $\tan A\tan B+\tan B\tan C+\tan C\tan A$ **is**
A) 1 B) $\frac{4}{3}$ C) 4 D) 3

3. $\sin^4\theta+4\cos^4\theta+2=4\sqrt{2}\sin\alpha\cos\beta, \alpha,\beta\in[0,\pi]$ **then** $\cos(\alpha+\beta)-\cos(\alpha-\beta)$ **is equal to**
A) $-\sqrt{2}$ B) 0 C) $\sqrt{2}$ D) -1

4. **If in** ΔABC **,** $\sin^2 A+\sin^2 B+\sin^2 C=2$ **then the triangle is always**
A) Isosceles triangle B) Right angled C) Acute angled D) Obtuse angled

5. **The number of solutions of the equation** $\sin\left(\frac{\pi x}{2\sqrt{3}}\right)=x^2-2\sqrt{3}x+4$
A) Zero B) Only one C) Only two D) Greater than two

6. α,β **are the values of x satisfying** $\tan^{-1}x+\tan^{-1}(1-x)=\cot^{-1}\frac{7}{9}$ **and** $x\in(0,1)$ **then the values of** $9(\alpha^2+\beta^2)=$
A) 2 B) 5 C) 4 D) -1

7. **In** ΔABC **,** $\pi\frac{(\sin^2 A+\sin A+1)}{\sin A}$ **is always greater than**
A) 9 B) 3 C) 27 D) 36

8. **If** $5\cos x+12\sin y$ **then the min value of** $5\sin x+12\sin y$ **is**
A) 12 B) $\sqrt{120}$ C) $\sqrt{20}$ D) 13

9. **If** $|z|=1$ **and** $z=\pm 1$ **then all the values of** $\frac{z}{1-z^2}$ **is on**
A) A line passing through the origin B) $|z|=\sqrt{2}$
C) X – axis D) Y – axis

10. **The real number k for which the equation** $2x^3+3x+k=0$ **has two distinct real roots in** $[0,1]$
A) Lies between -1 and 0 B) Does not exist
C) Lies between 1 and 2 D) Lies between 2 and 3

11. **Find the value of x satisfying the equation** $\left|\left|x^2-x+4\right|-2\right|-3\Big|=x^2+x-12$
A) 11 B) 22 C) $\frac{11}{2}$ D) $\frac{11}{4}$

12. **The number of distinct rational numbers x such that** $0<x<1$ **and** $x=\frac{p}{q}$ **where** $p,q\in\{1,2,3,4,5,6\}$ **is**

A) 9 B) 10 C) 11 D) 12

13. **If a, b, c are non-zero complex number satisfying** $a^2+b^2+c^2=0$ **and** $\begin{vmatrix} b^2+c^2 & ab & ac \\ ab & c^2+a^2 & bc \\ ac & bc & a^2+b^2 \end{vmatrix}=ka^2b^2c^2$ **then k is equal to**

A) 1 B) 2 C) 3 D) 4

14. **The coefficient of t^4 in the expansion of** $\left(\frac{1-t^6}{1-t}\right)^3$ **is**

A) 12 B) 14 C) 10 D) 15

15. **The number of four letter words that can be formed using the letters of the word BARRACK is**

A) 144 B) 120 C) 270 D) 264

16. $f(x)=\frac{9^x}{9^x+3}$ **then** $f\left(\frac{1}{1996}\right)+f\left(\frac{2}{1996}\right)+.....f\left(\frac{1995}{1996}\right)$

A) 997 B) 997.5 C) 998 D) 998.5

17. **Which of the following relations in R is an equivalence relation?**

A) $xR_1y\Leftrightarrow|x|=|y|$ B) $xR_2y\Leftrightarrow|x|\geq|y|$ C) $xR_3y\Leftrightarrow\frac{x}{y}$ D) $xR_4y\Leftrightarrow x<y$

18. **Let P and Q be** 3×3 **matrices with** $P\neq Q$ **if** $P^3=Q^3$ **and** $P^2Q=Q^2P$ **then the determinant of** P^2+Q^2 **is equal to**

A) 0 B) -1 C) -2 D) 1

19. **If 'f' is a function of real variable x satisfying** $f(x+4)-f(x+2)+f(x)=0$ **then 'f' is a periodic function with period**

A) 6 B) 8 C) 10 D) 12

20. **Let X be the inversal set for A & B. If** $n(A)=200, n(B)=300$ **and** $n(A\cap B)=100$ **then** $n(A^1\cap B^1)$ **is equal to 300 provided** $n(X)$ **is equal to**

A) 600 B) 700 C) 800 D) 900

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) , (2), (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.

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21. **The maximum number of point of intersection made by 5 circles and 3 triangles**

22. **If A and B are two real values of k for which the system of equations** $x+y+z=1$**,** $x+3y+4z=k, x+5y+10z=k^2$ **is constituent, then A + B = _____**

23. **The remainder, if** $1+2+2^2+2^3.....+2^{1999}$ **is divided by 5 is _____**

24. **If 'z' is a complex number satisfying** $z^4+z^3+2z^2+z+1=0$ **then** $|z|=$ **_____**

25. **The number of solutions of the equation** $\tan^2x-\sec^{10}x+1=0$ **in** $(0,10)$ **is**

PHYSICS

SYLLABUS: **Kinetics (1D and 2D), Laws of motion, Work, power energy and Rotational motion, Gravitation, Oscillations and waves**

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.

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26. **A bullet in a riffle accelerates uniformly from rest at a=70000m/s^2. If the velocity of the bullet as it leaves the (barrel) is 500m/s, how long is the riffle barrel?**
A) 1.12 m B) 1.79 m C) 2.85 m D) 2.79 m

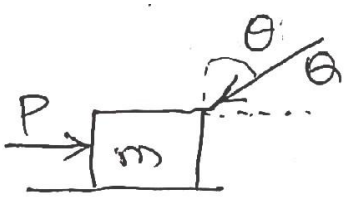
27. **A race car accelerates uniformly form 18.5 m/s to 46.1 m/s in 2.47 seconds. Determine the acceleration of the car and the distance travelled?**
A) a=11.2 m/s^2 D=88.9 m B) a=2.11 m/s^2 d=90.8 C) a=11.2 m/s^2 d=79.8m D) a=1.1 m/s^2 d=100.8m

28. **Displacement (y) of the particle is given by $y = 2t + t^2 - 2t^3$, the velocity of the particle when acceleration is zero is given by**
A) $\frac{5}{2}$ B) $\frac{9}{4}$ C) $\frac{13}{6}$ D) $\frac{17}{8}$

29. **A particle is moving with velocity $\overline{V} = k(y\hat{i} + x\hat{j})$ where k is a constant. The general equation for its path is:**
A) $y^2 = x^2$ +constant B) $y = x^2$ +constant C) $y^2 = x$ +constant D) xy=constant

30. **A jet plane starts from rest on the runway and accelerates foe takeoff at 2.30 m/s^2. It has two jet engines, each of which exerts a thrust 1.4 X 10^{5}N. Weight of the plane is**
A) 1.2 X 10^6 N B) 3.2 X 10^{6}N C) 2.2 X 10^{4}N D) 10 X 10^{3}N

31. **A block of mass m, lying on a horizontal plane is acted upon by a horizontal force 'P' and another force 'Q', inclined at an angle θ to be vertical. The block will remain in equilibrium if the coefficient of friction between it and the surface is (assume P>Q)**



A) $\frac{(P\sin\theta - Q)}{(mg - \cos\theta)}$ B) $\frac{(P - Q\sin\theta)}{(mg + Q\cos\theta)}$ C) $\frac{(P\cos\theta + Q)}{(mg - Q\cos\theta)}$ D) $\frac{(P + Q\sin\theta)}{(mg + Q\cos\theta)}$

32. **A lift is moving upwards with a uniform velocity 'V' in which a block of mass m is lying. The force offered by the block, when coefficient of friction is μ ≥ 0.5, will be**
A) zero B) $\frac{mg}{2}$ C) mg D) 2mg

33. **A particle of mass 'm' is moving in a circular path of constant radius 'r' such that its centripetal acceleration 'a_c' is varying with time 't' as $a_c = k^2rt^2$, where k is a constant. The power delivered to the particle by the force acting on it is**
A) zero B) $mk^2r^2t^2$ C) mk^2r^2t D) mk^2rt

34. The potential energy of a particle of mass 'm' free to move along the x-axis is given by $U=\frac{kx^2}{2}$ for x < 0 and 'U'=0 for x ≥ 0 (x denotes the x- coordinate of the particle and k is a positive constant). If the total mechanical energy of the particle is E, then its speed at $x=-\sqrt{\frac{2E}{k}}$ is ___

A) zero B) $\sqrt{\frac{2E}{m}}$ C) $\sqrt{\frac{E}{m}}$ D) $\sqrt{\frac{3E}{2m}}$

35. A 1 kg stone at the end of 1 m long string is whirled in a vertical circle at a constant speed of 4 m/s. The tension in the string is 6 N when the stone is

A) At the bottom of the circle B) Half way down
C) At the top of the circle D) None of the above

36. A bob of mass 'm' attached to an inextensible string of length 'l' is suspended from a vertical support. The bob rotates in a horizontal circle with an angular speed w rad/s about the vertical. About the point of suspension.

A) Angular momentum is conserved
B) Angular momentum changes in magnitude but not in direction
C) Angular momentum changes in indirection but not in magnitude
D) Angular momentum changes in both indirection & magnitude

37. If the radius of the earth were to shrink by one percent, its mass remaining the same, the acceleration due to gravity on the Earth's surface would

A) Decrease B) Remain unchanged C) Increase D) None

38. A simple pendulum has a time period 'T_1' when on the earth's surface, and 'T_2' when taken to a height 'R' above the earth's surface, where 'R' is the radius of the earth. The value of $\frac{T_2}{T_1}$ is ___

A) 1 B) $\sqrt{2}$ C) 4 D) 2

39. A binary star system consists or two stars 'A' and 'B' which have time periods T_A and T_B, radii R_A and R_B and masses M_A and M_B then

A) If $T_A > T_B$ Then $R_A > R_B$ B) If $T_A < T_B$ Then $M_A > M_B$
C) $\left[\frac{T_A}{T_B}\right]^2=\left[\frac{R_A}{R_B}\right]^5$ D) $T_A = T_B$

40. 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 $R^{\frac{5}{2}}$, Then

A) $T^2\alpha R^3$ B) $T^2\alpha R^{\frac{7}{2}}$ C) $T^2\alpha R^{\frac{3}{2}}$ D) $T^2\alpha R^{\frac{7}{3}}$

41. Due to some force F_1 a body oscillates with period $\frac{4}{5}$ sec and due to other force F_2 oscillates with period $\frac{3}{5}$ sec. If both forces act simultaneously the new period will be ___

A) 0.72 sec B) 0.64 sec C) 0.48 sec D) 0.36 sec

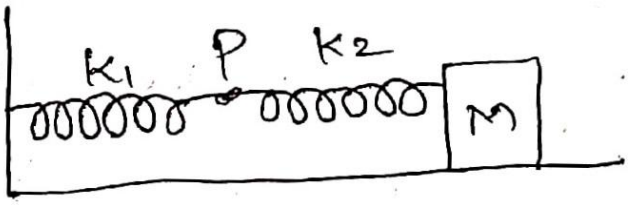
42. Which of the following function represents a simple harmonic oscillation?

A) $Sin\omega t - Cos\omega t$ B) $Sin^2\omega t$ C) $Sin\omega x + Sin2\omega t$ D) $Sin\omega x - Sin2\omega t$

43. A mass M is suspended from a spring of negligible mass. This system has time period T. when mass M is loaded with one more mass m=16 g, new time period is $\frac{5T}{3}$, Find the value of M(ing)

A) 7 B) 8 C) 9 D) 10

44. The mass M shown in the figure oscillates in simple harmonic motion with amplitude A.The amplitude of the point 'P' is



A) $\frac{K_1 A}{K_2}$ B) $\frac{K_2 A}{K_1}$ C) $\frac{K_1 A}{K_1 + K_2}$ D) $\frac{K_2 A}{K_1 + K_2}$

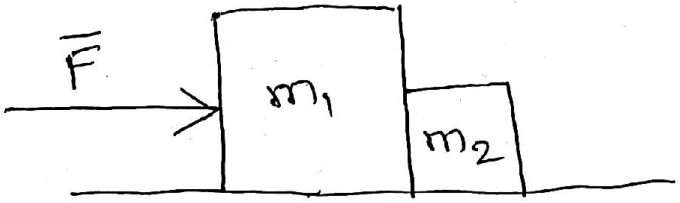
45. In the case of SHM, if the particle is at the mean position, then the particle is in

A) Stable equilibrium B) Unstable equilibrium
C) Neutral equilibrium D) None of these

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.

46. Two blocks are in contact on frictionless table. A horizontal force is applied to one block, as shown in the below figure. The force of contact between the two blocks, if m_1=2.2 kg, m_2=1 kg and F=3.2 N is ____



47. A bus can be stopped by applying a retarding force 'F' when it is moving speed 'V' on a level road. The distance covered by it before coming to rest is 'S'. If the load of the bus increases by 50% because of passengers, for the same speed and same retarding force, the distance covered by the bus to come to rest shall be _____

48. A Tube of length 'L' is filled completely with an incompressible liquid of mass 'M' and closed at both the ends. The tube is then rotated in a horizontal plane about one of its ends with a uniform angular velocity 'ω'. The force exerted by the liquid at the other and is KM ω^2 L, where k=____

49. If the distance between the earth and the sun were half its present value, the number of days in a year _____

50. A spring of force constant K is cut into two pieces such that one piece is double the length of the other. Then long piece will have a force constant of "x k" , where x = ____

CHEMISTRY

SYLLABUS: **Periodic classification of elements & periodicity, Chemical bonding, Alkali metals & alkaline earth metals, 13th, 14th group elements, Environmental chemistry, Hydrogen and its compounds**

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.

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51. The lanthanide contraction is responsible for the fact that
A) Zr and Y have about the same radius. B) Zr and Nb have similar oxidation state
C) Zr and Hf have about the same radius D) Zr and Zn have the same oxidation state

52. The d-orbital involved in sp^{3}d, hybridization is
A) $dx^2 - y^2$ B) dxy C) dz^2 D) dzx

53. The solubility of alkali metal hydroxides follows the order
A) $LiOH < NaOH < KOH < CSOH$ B) $LiOH > NaOH > KOH > RbOH > CSOH$
C) $LiOH > CSOH > RbOH > NaOH > KOH$ D) None

54. Among the following the paramagnetic compound is
A) Na_2O_2 B) O_3 C) N_2O D) KO_2

55. Calculate the hardness of water sample which contain 0.001 mole of $MgSO_4$ disolved per lit of water.
A) 300 ppm B) 200 ppm C) 100 ppm D) 400 ppm

56. Black ash is
A) $CaS + NaHCO_3$ B) $CaSO_4 + Na_2CO_3$ C) $CaSO_4 + NaHCO_3$ D) $CaS + Na_2CO_3$

57. $BCl_3 + LiAlH_4 \rightarrow A + LiCl + AlCl_3$

$A + H_2O \rightarrow B + H_2$

$B \xrightarrow{\text{Red heat}} C$ **In this reaction sequence A,B and C compounds respectively are**
A) B_2H_6, B_2O_3, B B) B_2H_6, H_3BO_3, B_2O_3
C) B_2H_6, H_3BO_3, B D) HBF_4, H_3BO_3, B_2O_3

58. Lead pencil contains
A) Lead B) Lead sulphide C) Graphite and clay D) Ferrous sulphide

59. The TLV of four pollutants A, B, C and D are 9 PPM, 10 PPM, 100 PPM and 500 PPM respectively. The most toxic is
A) A B) B C) C D) D

60. What is the reagent used for testing fluoride ion in water.
A) Zirconium Alizarin-s B) Quinalizarin C) Phendphathalein D) Benzene

61. Which of the following pairs of metal is purified by Van Arkul method?
A) Zr and Ti B) Ga and In C) Ni and Fe D) Ag and Au

62. The percentage of carbon in steel is approximately
A) 1% B) 3% C) 2% D) 10%

63. Extra pure N_2 can be obtained by heating
A) NH_3 with CuO B) NH_4NO_3 C) $(NH_4)_2Cr_2O_7$ D) $Ba(N_3)_2$

64. Acid that contains S-O-S linkage is
A) $H_2S_2O_7$ B) $H_2S_2O_5$ C) $H_2S_2O_6$ D) $H_2S_2O_4$

65. The molecule having one $P^{\pi} - P^{\pi}$ and two $P^{\pi} - d^{\pi}$ bonds is
A) SO_2 B) SO_3 C) CO_2 D) N_2

66. The highest oxidation state of fluorine is
A) -1 B) +1 C) 0 D) +2

67. A radioactive element X decays to give two inert gases.

A) $^{238}_{92}U$ B) $^{226}_{88}Ra$ C) $^{232}_{90}Th$ D) $^{227}_{89}Ac$

68. The relative acidic strength, stability and oxidizing agent of oxy acids of chlorine are

A) $HClO_4 > HClO_3 > HClO_2 > HOCl$ B) $HClO_4 > HClO_2 > HClO_3 > HOCl$

C) $HOCl < HClO_2 > HClO_3 > HClO_4$ D) $HClO_3 > HClO_2 > HClO_4 > HOCl$

69. Which is uses in cancer chemotherapy?

A) Cis-platin B) Zeisse's salt C) Both A & B D) None of these

70. The Equilibrium $Cr_2O_7^{-2} \square 2CrO_4^{2-}$

A) Exists in acidic medium B) Exists in basic medium

C) Exists in neutral medium D) Never exists

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. The ionization energy of lithium is 500 kj mol^{-1}.The amount of energy required to convert 70 mg of Lithium atoms in gaseous state into Li^+ ions is

72. In PO_4^{3-} ion, the formal charge on the oxygen atom of $P-O$ bond is

73. What is the basicity of Pyrophospheric acid?

74. How many $Cl-O$ bonds in Cl_2O_7

75. How many Co-ordinated water molecules is / are present in brown ring complex.

KEY SHEET

MATHS

1	A	**2**	C	**3**	A	**4**	B	**5**	B	**6**	B	**7**	C	**8**	C	**9**	D	**10**	B
11	C	**12**	D	**13**	D	**14**	D	**15**	C	**16**	B	**17**	A	**18**	A	**19**	D	**20**	B
21	128	**22**	3	**23**	0	**24**	1	**25**	3										

PHYSICS

26	B	**27**	C	**28**	C	**29**	A	**30**	A	**31**	B	**32**	A	**33**	C	**34**	A	**35**	C
36	C	**37**	C	**38**	D	**39**	D	**40**	B	**41**	C	**42**	A	**43**	C	**44**	D	**45**	A
46	1N	**47**	1.5	**48**	0.5	**49**	129	**50**	1.5										

CHEMISTRY

51	C	**52**	C	**53**	A	**54**	D	**55**	C	**56**	D	**57**	B	**58**	C	**59**	A	**60**	A
61	A	**62**	A	**63**	D	**64**	A	**65**	B	**66**	C	**67**	B	**68**	A	**69**	A	**70**	C
71	5KJ	**72**	-1	**73**	4	**74**	8	**75**	5										

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HINTS & SOLUTIONS

MATHEMATICS

1. $\alpha+\beta=90^0$

$\alpha-\beta=30^0$

$\alpha=60^0,\beta=30^0$

$\tan(\alpha+2\beta)\tan(2\alpha+\beta)$

$=\tan 120^0\tan 150^0=1$

2. $\sum\tan A\tan B$

$=\dfrac{\sum\sin A\sin B\cos C}{\cos A\cos B\cos C}$

$=\dfrac{\cos A\cos B\cos C-\cos(A+B+C)}{\cos A\cos B\cos C}$

$=\dfrac{\frac{1}{3}+1}{\frac{1}{3}}=4$

3. $AM\geq GM$

$\dfrac{\sin^4\alpha+4\cos^4\beta+1+1}{4}\geq\left(4\sin^4\alpha\cos^4\alpha\right)^{\frac{1}{4}}$

$AM=GM\Rightarrow\sin^4\alpha=4\cos^4\beta=1$

$\Rightarrow\alpha=\dfrac{\pi}{2},\beta=\dfrac{\pi}{4}$

$\Rightarrow -2\sin\alpha\sin\beta=-2\times1\times\dfrac{1}{\sqrt{2}}=-\sqrt{2}$

4. $\sum\sin^2 A=2$

$\Rightarrow\cos^2 A+\cos^2 B-\sin^2 C=0$

$\Rightarrow\cos^2 A+\cos(B+C)\cos(B-C)=0$

$\Rightarrow -\cos A\left[\cos(B+C)+\cos(B-C)\right]=0$

$\Rightarrow -2\cos A\cos B\cos C=0$

$\Rightarrow Ether\ A=90^0\,(or)\,B=90^0\,(or)\,C=90^0$

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

RHS is min when $x=\sqrt{3}$

min $value=1$

$x=\sqrt{3},LHS\sqrt{3}\max imum$

and max value $=1$

$x=\sqrt{3}$ is only one solution

6. $0<x<1\Rightarrow 0<1-x<1$

$\Rightarrow\tan^{-1}\left(\dfrac{1}{1-x+x^2}\right)-\tan^{-1}\left(\dfrac{9}{7}\right)$

$\Rightarrow x=\dfrac{1}{3},\dfrac{2}{3}$

$\Rightarrow 9\left(\alpha^2+\beta^2\right)=9\left(\dfrac{1}{9}+\dfrac{4}{9}\right)=5$

7. $=\pi\left[\left(\sqrt{\sin A}-\dfrac{1}{\sqrt{\sin A}}\right)^2+3\right]>27$

8. $5\sin x+12\sin y=p------(i)$

$5\cos x+12\cos y=13------(ii)$

Squaring and adding (i) & (ii)

$\Rightarrow p^2=120\cos(x-y)$

$\Rightarrow p^2\leq 120$

$Max=1=\sqrt{120}$

9. $|z|=1,z\bar{z}=1$

$\dfrac{z}{1-z^2}=\dfrac{z}{2\bar{z}-z^2}=\dfrac{1}{\bar{z}-z}$

Is purely satisfactory

10. $f(x)=2x^3+3x+k$

$f^1(x)=6x^2+3>0\qquad\forall x\in R$

$\Rightarrow\ f(x)$ has only one real root

Two real roots for $f(x)=0$ does not exist in $[0,1]$

11. $\left|\left|x^2-x+4\right|-2\right|-3\Big|=x^2+x-12$

$\Rightarrow\left|\left|x^2-x+2\right|-3\right|=x^2+x-12$

$\Rightarrow\left|x^2-x+2\right|=x^2+x-12$

$\Rightarrow 2x=11\Rightarrow\dfrac{11}{2}$

12. ${}^6C_2-4$

13. Put $a=1,b=w,c=w^2$

14. Coefficient of t^4 in $\left(1-t^6\right)^3(1-t)^{-3}$

= The coefficient of t^4 in

$=\left(1-3t^6-3t^{12}-t^{18}\right)(1-t)^{-3}$

$=1\times{}^{3+4-1}C_4={}^6C_4=15$

15. B C K A R A R

No . of 4 letters words

$={}^5P_4+{}^2C_1.{}^4C_2\dfrac{4!}{2!}+\dfrac{4!}{2!2!}$

$=120+144+6$

$=270$

16. $f(x)+f(1-x)=1$

$f\left(\frac{1}{1996}\right)+f\left(\frac{1995}{1996}\right)+f\left(\frac{2}{1996}\right)+f\left(\frac{1994}{1996}\right)..$

$+f\left(\dfrac{997}{1996}\right)+f\left(\dfrac{997}{1996}\right)+f\left(\dfrac{998}{1996}\right)$

$=1+1+.....+1+\frac{1}{2}=997.5$

17. It is clear R_1 is an equivalence relation

18. $P^3-P^2Q=Q^3-Q^2P$
$\Rightarrow P^2(P-Q)+Q^2(P-Q)=0$
$(P^2+Q^2)(p-Q)=0$
$P-Q\neq 0\left|P^2+Q^2\right|=0$

19. $f(x+4)-f(x+2)+f(x)=0$
$f(x+6)-f(x+4)+f(x+2)=0$
$f(x+6)+f(x)=0$
$f(x+12)+f(x+6)=0$
$f(x+12)=f(x)$
$\Rightarrow$ f is periodic with period 12

20. $n(A\cup B)=n(A)+n(B)-n(A\cap B)$
$\Rightarrow n(A^1\cap B^1)=200+300-100=400$
$n(A^1\cap B^1)=n(A\cup B)=n(X)-n(A\cup B)$
$300=n(X)-400$
$\Rightarrow n(X)=700$

21. ${}^5C_2(2)+{}^3C_2(6)+{}^5C_1.{}^3C_1(6)=128$

22. $\begin{bmatrix}1&2&1&1\\1&3&4&k\\1&5&10&k^2\end{bmatrix}$
$R_2\to R_2-R_1$
$R_3\to R_3-R_1$
Given equations are consistent
$3k-k^2-2=0$
$\Rightarrow k=1,2, A+B=3$

23. $\frac{1(2^{2000}-1)}{2-1}=2^{2000}-1$
$=(5-1)^{1000}-1=(1-5)^{1000}-1$
$=1-{}^{1000}C_1.5+{}^{1000}C_2.5^2+..{}^{1000}C_{1000}.5^{1000}-1$
Which is divisible by 5

24. $z^2(z^2+z+1)+(z^2+z+1)=0$
$\Rightarrow(z^2+1)(z^2+z+1)=0$
$z^2+1=0; z^2+z+1=0$
$z=i,-i,w,w^2$
$|z|=1$

25. $\sec^2 x-\sec^{10} x=0$
$\sec^2 x(1-\sec^8 x)=0$
$1-\sec^8 x=0; \sec^2 x=1$
$\cos^8 x=1$
$\cos x=\pm 1$
$x=\{\pi,2\pi,3\pi\}$
No of sol = 3

PHYSICS

26. Initially at rest , V_0=0 m/s leaves the barrel with velocity V_f =500 m/s
Acceleration a = 70,000 m/s^2
The length of the barrel $x=\frac{V_f{}^2-V_0{}^2}{2a}$
=1.79 m

27. $V_i=18.5$ $\quad d=V_it+\frac{1}{2}at^2$
$V_f=46.1$ m/s $\quad$ =79.8 m
t=2.47s
$a=\frac{V_f-V_i}{t}$

28. $y=2t+t^2-2t^3$
Velocity
$\vartheta=\frac{dy}{dt}=\frac{d}{dt}(2t+t^2-2t^3)=2+2t-6t^2$
Acceleration
$a=\frac{d\vartheta}{dt}=\frac{d}{dt}(2+2t-6t^2)=2-12t$
Given acceleration = 0
$2-12t=0$
$t=\frac{1}{6}$
Then Velocity $\vartheta=2+2\left(\frac{1}{6}\right)-6\left(\frac{1}{6}\right)^2$
$=2+\frac{1}{3}-\frac{1}{6}=\frac{13}{6}$

29. $\bar{V}=k(y\hat{i}+x\hat{j})$
$\bar{V}=V_x\hat{i}+Vy\hat{j}$
$\bar{V}=\frac{dx}{dt}\hat{i}+\frac{dy}{dx}\hat{j}$ & $\bar{V}=\frac{dx}{dt}=ky, \frac{dy}{dt}=Kx$
$\frac{dx}{dy}=\frac{Ky}{Kx}=\frac{y}{x}\Rightarrow y^2=x^2$ + constant

30. $mass=\frac{force}{acceleration}$
$\frac{2\times thrust}{a}=\frac{2\times 1.4\times 10^5}{2.3}=1.22\times 10^5 kg$
Weight $W=mg$
$=1.22\times 10^5\times 9.8$

$\approx 1.1968\times10^6\,N$

$\approx 1.20\times10^6\,N$

31. Frictional force $\mu R=\mu\left(mg+Q\cos\theta\right)$

Horizontal push $=P-Q\sin\theta$

For equilibrium

$\mu\left(mg+Q\cos\theta\right)=P-Q\sin\theta$

$\mu=\dfrac{P-Q\sin\theta}{mg+Q\cos\theta}$

32. As the driving force is '0', friction will be '0'

33. $a_c=\dfrac{v^2}{r}=k^2rt^2$ (or) $v=krt$

$K.E=\dfrac{1}{2}mv^2=\dfrac{1}{2}mk^2r^2t^2$

From work-energy theorem

$W=\Delta K=\dfrac{1}{2}mk^2r^2t^2-0$

$P=\dfrac{dw}{dt}=mk^2r^2t$

34. K.E+P.E=E

KE=E-P.E

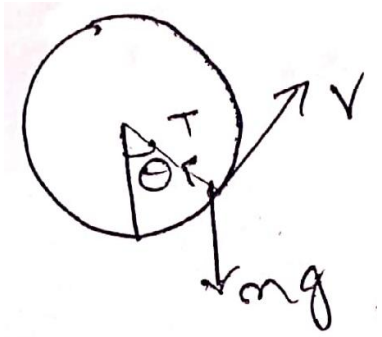
$=E-\dfrac{1}{2}kx^2$

K.E at $x=-\sqrt{\dfrac{2E}{k}}$

$=E-\dfrac{1}{2}k\left(\dfrac{2E}{k}\right)=0$

So speed of the particle is zero

35.



$\dfrac{mv^2}{R}=\dfrac{1\times4^2}{1}=16N$

$mg=1\times10=10N$

$T=mg\cos\theta+\dfrac{mv^2}{R}$

At top, $\theta=180°$

36. Conceptual

37. On earth's surface $g=\dfrac{GM}{R^2}$

If R increases, g increases

38. For simple pendulum, $T=2\pi\sqrt{\dfrac{l}{g}}$

$\dfrac{T_2}{T_1}=\sqrt{\dfrac{g_1}{g_2}}$

$g_1=\dfrac{GM}{R^2},g_2=\dfrac{GM}{\left(2R\right)^2}=\dfrac{GM}{4R^2}$

$\dfrac{T_2}{T_1}=\dfrac{2}{1}=2$

39. In case of a binary star system,

Angular velocity is same

So, $\omega_A=\omega_B$

$\dfrac{2\pi}{T_A}=\dfrac{2\pi}{T_B}$

i.e $T_A=T_B$

40. Centripetal force = Gravitational force

$mR\omega^2=\dfrac{GmM}{R^{\frac{5}{2}}}$ (or) $R^{\frac{7}{2}}\omega^2=GM$

$\omega^2R^{\frac{7}{2}}=\dfrac{GM}{\omega^2}=\dfrac{GM}{\left(2^{\frac{\pi}{T}}\right)^2}=\dfrac{T^2GM}{4\pi^2}$

$T^2\alpha R^{\frac{7}{2}}$

41. $F_1=m\omega_1^2y$ and $F_2=m\omega_2^2y$

Under the action of both the forces

$F=F_1+F_2$

$m\omega^2y=m\omega_1^2y+m\omega_2^2y$

$\omega^2=\omega_1^2+\omega_2^2$

$\left(\dfrac{2\pi}{T}\right)^2=\left(\dfrac{2\pi}{T_1}\right)^2+\left(\dfrac{2\pi}{T_2}\right)^2$

$T=\sqrt{\dfrac{T_1^2T_2^2}{T_1^2+T_2^2}}=0.48$

42. The standard differential equation

$\dfrac{d^2y}{dt^2}\alpha-\omega^2y$

43. $T=2\pi\sqrt{\dfrac{M}{K}}$

$\dfrac{5T}{3}=2\pi\sqrt{\dfrac{M+m}{K}}$

$\dfrac{\dfrac{5T}{3}}{T}=\dfrac{2\pi\sqrt{\dfrac{M+m}{K}}}{2\pi\sqrt{\dfrac{M}{K}}}$

Where m=16 g

M=9g

44. We have $x_1 + x_2 = A$

$\Rightarrow k_1 x_1 = k_2 x_2$

$x_1 = \dfrac{k_2 A}{k_1 + k_2}$

45. Conceptual

46. Acceleration of two blocks

$a = \dfrac{F}{m_1 + m_2}$

Contact force $= \dfrac{Fm_2}{m_1 + m_2}$

= 1N

47. First case|Second case

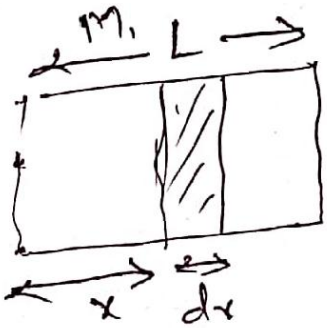
$\dfrac{1}{2}mv^2 = FS$ ---------(1)|

$\dfrac{1}{2}\left(m + \dfrac{m}{2}\right)v^2 = FS^1$ ---------- (2)

Dividing Eq (2) / Eq (1)

$\dfrac{S^1}{S} = \dfrac{3}{2} \Rightarrow S^1 = 1.5$

48.



Mass of liquid in unit length $= \dfrac{M}{L}$

Mass in element $d_x = \dfrac{M}{L}d_x$

Centripetal force $= \left(\dfrac{M}{L}d_x\right)x\omega^2$

(or) $d_F = \dfrac{M\omega^2}{L}xd_x$

$\therefore \int d_F = \int_0^L \dfrac{M\omega^2}{L}xd_x$

$F = kM\omega^2 L, \quad K = \dfrac{1}{2} = (0.5)$

49. According to Kepler's law, $T^2 \alpha R^3$

$\left(\dfrac{T_2}{T_1}\right)^2 = \left(\dfrac{R_2}{R_1}\right)^3 \quad \because T_1 = 365$ days

$\because T_2 = 129$ days

50. $K\alpha \dfrac{1}{\text{length of spring}}$

$\dfrac{k}{k_1} = \dfrac{l_1}{l} = \dfrac{\frac{2}{3}l}{l} \Rightarrow k_1 = \dfrac{3}{2}k$

CHEMISTRY

51. Consequence of lanthanide contraction

52. In SP^3d d-orbital is outer dZ^2

53. Hydroxides Solubilites Increases down the group

54. KO_2 is superoxide it contains 1 unpaired electron

55. $MgSO_4$ | $CaCO_3$

If n-factor is same [Mg^{+2}, n=2 Ca^{+2}, n=2] then

Numbers of moles are same

$MgSO_4$ | $CaCO_3$

No. of moles of $MgSO_4$ = No. of moles of $CaCO_3$

0.001 = No.of moles of $CaCO_3$

No.of moles of $CaCO_3 = \dfrac{Wt}{GM.W}$

$0.001 = \dfrac{Wt}{100} \quad \therefore wt = 0.1gr$

$\Rightarrow$1000 ml hard water contains -----0.1 gr. $CaCO_3$

10^6 ml hard water contains ---→ ?

$= \dfrac{0.1\times10^6}{10^3} = 0.1\times10^3 = 100\,ppm$

56. Conceptual

57. $4BCl_3 + 3LiAlH_4 \rightarrow 2B_2H_6 + 3LiCl + 3AlCl_3$

$2B_2H_6 + 6H_2O \rightarrow 2H_3BO_3 + 6H_2$

$2H_3BO_3 \xrightarrow{\text{Red heat}} B_2O_6 + 3H_2O$

58. Conceptual

59. Lower the TLV more is the toxicity.

60. Conceptual

61. Conceptual

62. Conceptual

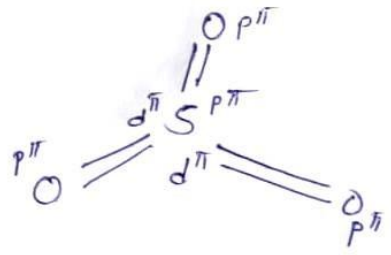
63. Azides of Na, Ba forms purest N_2

$Ba(N_3)_2 \xrightarrow{\Delta} Ba_3N_2 + N_2$

64. Pyrosulphuric acid : $H_2S_2O_7$

$HO - \overset{\overset{O}{\|}}{\underset{\underset{O}{\square}}{S}} - O - \overset{\overset{O}{\|}}{\underset{\underset{O}{\square}}{S}} - OH$

65.



66. In atomic state Fluorine shows "O"

67. $\underset{88}{\overset{226}{Ra}} \rightarrow \underset{86}{\overset{222}{Rn}} + \underset{2}{\overset{4}{He}}$

68. $\overset{+7}{HclO_4} > \overset{+5}{HcO_3} > \overset{+3}{HclO_2} > \overset{+1}{HOCl}$

Moro O.No. strong acid.

69. Conceptual

70. In neutral medium

71. $70mg = 70\times10^{-3}\,gr$

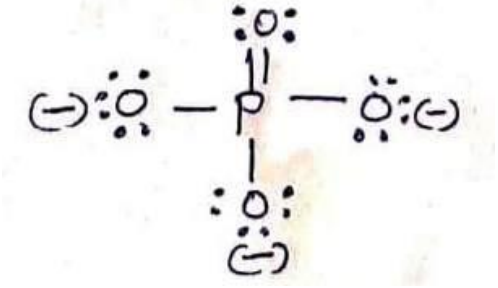
$No.ofmoles = \dfrac{70\times10^{-3}}{7} = 1\times10^{-2}\,moles$

1 mole -----500 KJ

$1\times10^{-2} \rightarrow ?$

$= 500\times10^{-2} = 5KJ$

72. The Lewis structure of $p_{O_4}^{-3}$ ion is



Formal Charge $= \left[N_A - N_{LP} - \dfrac{1}{2} N_B P \right]$

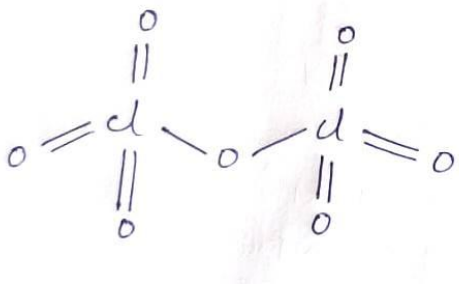
$= \left[6 - 6 - \dfrac{1}{2}\times 2 \right] = -1$

73. Pyro phosphoric acid $H_4P_2O_7$

$HO - \underset{\underset{OH}{|}}{\overset{\overset{O}{\|}}{P}} - O - \underset{\underset{OH}{|}}{\overset{\overset{O}{\|}}{P}} - OH$

$\therefore Basicity = 4$

74.



75. $\left[Fe(H_2O)_5\, NO \right]^{2+}$