JEE MAIN-2024-25 (Part Test-1)

(Physics, Chemistry and Mathematics)

SYLLABUS

Physics :- Physical world error & measurments, U&D, Kinematics, NLM
Chemistry :- Mole Concept, Redox Reactions
Mathematics :- Basic Maths, Set, Trigonometry

1
PART TEST

CLASS-XIth

Date :- ..... **Time :- 3:00 Hrs.** **Marks :- 300**

Important Instructions :

1. The test duration is of **3 hours**.
2. The Test Booklet consists of 90 questions. The maximum marks are 300.
3. There are **three** parts in the question paper consisting of **Physics, Chemistry** and **Mathematics** having 30 questions in each part of equal weightage. Each part (subject) has two sections.

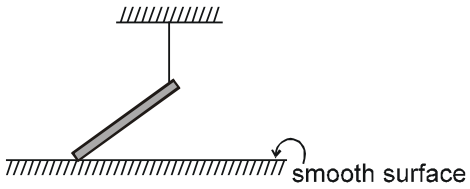
   (i) **Section-A:** This section contains 20 multiple choice questions which have only one correct answer. Each question carries **4 marks** for correct answer and **–1 mark** for wrong answer.
   (ii) **Section-B:** This section contains 10 questions. In Section-B, attempt any **five questions out of 10.** The answer to each of the questions is a numerical value. Each question carries **4 marks** for correct answer and **–1 mark** for wrong answer. For Section-B, the answer should be rounded off to the nearest integer.

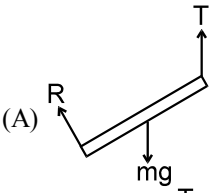
Student's Name :- .....
School Name :- .....

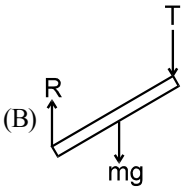
Student's Signature :- ..... **Invigilator's Signature :- .....**

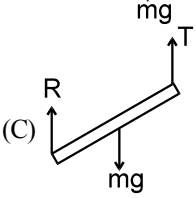
PE

1. Which figure represents the correct F.B.D. of rod of mass m as shown in figure :



(A) 

(B) 

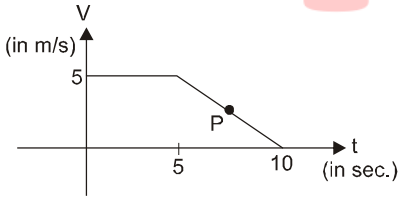
(C) 

(D) None of these

2. In a particular system, the unit of length, mass and time are chosen to be 10 cm, 10g and 0.1s respectively. The unit of force in this system will be equivalent to -

(A) 1/10 N (B) 1 N (C) 10 N (D) 100 N

3. V-t graph for the motion of a particle moving along a straight line is shown. Slope of the curve at point 'P' shown in the graph is correctly represented by :



(A) -1 m/s^2 (B) tan 45° (C) tan 15° (D) $\frac{3\pi}{4}$

4. A stone is dropped from a running bus. It will hit the ground in a-

(A) Straight path (B) Circular path

(C) Parabolic path (D) None of these

5. A block is given certain upward velocity along the incline of elevation α. The time of ascent to upper point was found to be half the time of descent to initial point . The co-efficient of friction between block and incline is :

(A) 0.5 tan α (B) 0.3 tan α

(C) 0.6 tan α (D) 0.2 tan α

6. A plank of mass 2kg and length 1 m is placed on a horizontal floor. A small block of mass 1 kg is placed on top of the plank, at its right extreme end. The coefficient of friction between plank and floor is 0.5 and that between plank and block is 0.2. If a horizontal force = 30 N starts acting on the plank to the right, the time after which the block will fall off the plank is (g = 10 m/s^2)

(A) (2/3) s

(B) 1.5 s

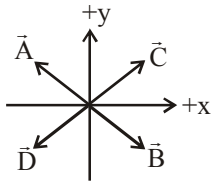
(C) block will never fall off the plank.

(D) (4/3) s

7. You have ring balanced at the center of the table by three forces $\vec{F}_1$, $\vec{F}_2$ and $\vec{F}_3$. The forces $\vec{F}_1$ and $\vec{F}_2$ have components.

$F_{1x} = 10$ N $F_{1y} = -50$ N

$F_{2x} = -40$ N $F_{2y} = 100$ N



The force $\vec{F}_3$ is required to make the ring stationary at the center of the table. Which one of the 4 vectors in the diagram could represent $\vec{F}_3$?

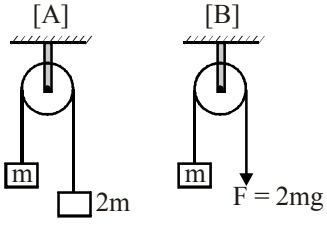
(A) $\vec{A}$ (B) $\vec{B}$ (C) $\vec{C}$ (D) $\vec{D}$

8. A particle starts from rest on a straight path. Its acceleration is linearly varying with time, such that velocity of the particle at t = 2 sec and t = 4 sec is 6 ms^{-1} and 20 ms^{-1} respectively. Find acceleration of the particle at t = 1 sec.

(A) 1.5 ms^{-2} (B) 2 ms^{-2}

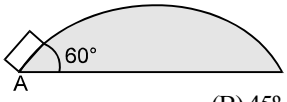
(C) 3 ms^{-2} (D) 2.5 ms^{-2}

9. Two pulley arrangements (A) and (B) are as shown in the figure. Neglect the masses of the ropes and pulleys and the friction at the axle of the pulleys. The ratio of the acceleration of mass m in arrangement (A) to that in arrangement (B) is :



(A) 1 : 3 (B) 2 : 3 (C) 1 : 4 (D) 5 : 9

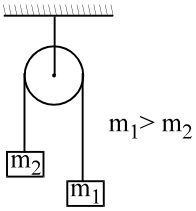
10. A particle when projected in vertical plane moves along the fixed smooth surface with initial velocity 20 m/s at an angle of 60º, so that its normal reaction on the surface remains zero throughout the motion. Then the slope of the tangent to the surface at height 5 m from the point of projection A will be:

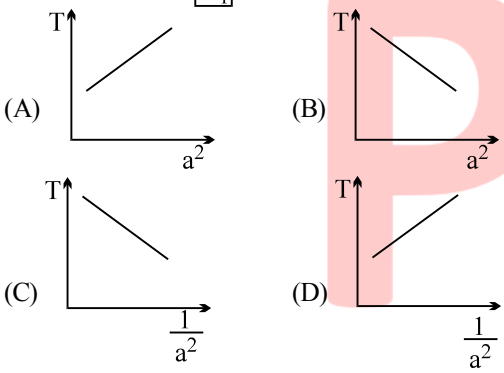


(A) 30º (B) 45º

(C) $\tan^{-1} 2$ (D) $\tan^{-1} \sqrt{2}$

11. For the arrangement shown in the figure let 'a' and T be the acceleration of the blocks and tension in the string respectively. The string and the pulley are frictionless and massless. Which of the graphs show the correct relationship between a and T for the system in which sum of the two masses m_1 and m_2 is constant.





12. **Statement 1 :** Two projectiles are projected with same initial velocity one after the other with some time interval between their projection. While both the projectiles are in air, their relative position vectors $\vec{r}_2 - \vec{r}_1$ changes with time.

Statement 2 : Difference in their instantaneous velocities $\vec{v}_2 - \vec{v}_1$ is constant.

(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
(C) Statement-1 is true, statement-2 is false.
(D) Statement-1 is false, statement-2 is true.

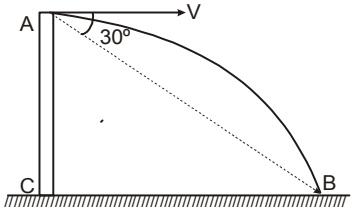
13. A body is projected at an angle 60° with the horizontal ground with kinetic energy k. When the velocity makes an angle 30° with the horizontal, the kinetic energy of the body will be

(A) k/2 (B) k/3 (C) 2k/3 (D) 3k/2

14. A body is projected at time (t = 0) from a certain point on a planet's surface with a certain velocity at a certain angle with the planet's surface (assumed horizontal). The horizontal and vertical displacements x & y (in meter) respectively vary with time t in second as, $x = 10\sqrt{3}\ t$ and $y = 10\ t - t^2$. Then the maximum height attained by the body is :

(A) 200 m (B) 100 m (C) 50 m (D) 25 m

15. An object is thrown from a point 'A' horizontally from a tower and hits the ground 3s later at B. The line from 'A' to 'B' makes an angle of 30º with the horizontal. The initial velocity of the object is: (take $g = 10\ m/s^2$)



(A) $15\sqrt{3}$ m/s (B) 15 m/s

(C) $10\sqrt{3}$ m/s (D) $25/\sqrt{3}$ m/s

16. During a trip Shyam walks a little faster than Ram, who started off earlier. Shyam observes that he reaches a certain tree time t_1 later than Ram. Then he catches up with Ram after another lapse of time t_2. The ratio of v_{Shyam} to v_{Ram} is

(A) $\frac{t_2}{t_1 + t_2}$ (B) $\frac{t_1 + t_2}{t_2}$ (C) $\frac{t_2}{t_1}$ (D) $\frac{t_1}{t_2}$

17. A stone is thrown vertically upward and reaches a maximum height Δy. After an elapsed time Δt, measured from the time the stone was thrown, the stone has fallen back down to the ground. The magnitude of the average speed of the stone during this time is

(A) $\frac{\Delta y}{\Delta t}$ (B) $\frac{1}{2}\frac{\Delta y}{\Delta t}$ (C) $2\frac{\Delta y}{\Delta t}$ (D) zero

18. Two bodies are moving so that their coordinates are changed according to the law: $x_1 = -3 + 2t + t^2$ and $x_2 = 7 - 8t + t^2$. Determine the relative speed V of bodies at the time of their meeting.

(A) 1 m/s (B) 10 m/s (C) 5 m/s (D) 6 m/s

19. A boat is heading 30° East of north having velocity 20 ms^{-1} with respect to the water which is flowing from West to East with 5 ms^{-1}. Eastern wind (East to West) is blowing with 15 ms^{-1}. The direction of flutter of the flag hoisted on the boat is

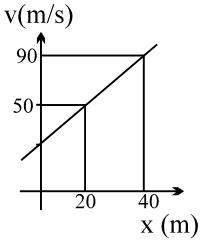
(A) 60° West of North (B) 60° North of West
(C) 30° West of South (D) 30° South of West

20. A street car start to move rectilinearly from station A to the next stop B with an acceleration varying according to the law $a = \alpha - \beta x$ where α and β are positive constant and x is its distance from station A. The distance AB is then equal to

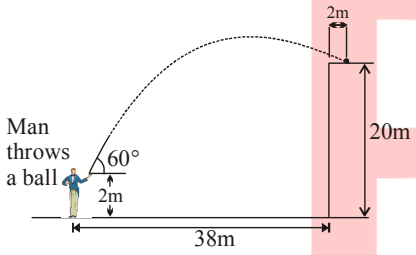
(A) $2\alpha/\beta$ (B) α/β (C) $\alpha/2\beta$ (D) 2α

SECTION-B

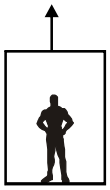
21. Acceleration of particle moving in straight line can be written as $a = \frac{dv}{dt} = v\frac{dv}{dx}$. From the given graph find acceleration at x = 20 m.



22. A soft ball is thrown at an angle of $\alpha = 60°$ above the horizontal. It lands a distance d = 2m from the edge of a flat roof, whose height is h = 20 m ; the edge of the roof is l = 38 m from the thrower (see fig.). At what speed (in m/s) was the softball thrown?

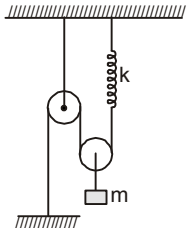


23. An elevator cabin has a mass of 900 kg (excluding man's mass) A man is standing in it. When the cabin is pulled upwards with a force of 7000 N, the man feels a normal force of 700 N on his feet. How much normal force (in N) will he feel if we pull the cabin upward with a force of 10,000 N.

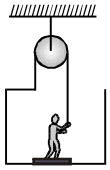


24. An empty box of mass 5kg is found to accelerate up at the rate of $\frac{g}{6}$ when a constant force $\vec{F}$ is applied on it. How much mass (in kg) of sand be filled in it so that the box may accelerate down at the same rate? (g being the acceleration due to gravity).

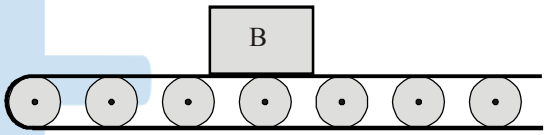
25. Mass m = 10 kg shown in figure is in equilibrium. If it is displaced further by x = 1 cm and released find its acceleration (in cm/s^2) just after it is released. Take pulleys to be light & smooth and strings light. (Take k = 10 N/m)



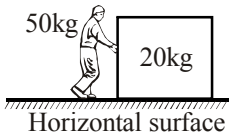
26. Figure shows a man of mass 48 kg standing on a light weighing machine kept in a box of mass 30 kg. The box is hanging from a pulley fixed to the ceiling through a light rope, the other end of which is held by the man himself. If the man manages to keep the box at rest, the weight shown by the machine is _____kg.



27. The conveyor belt is moving at speed 4 m/s. If the coefficient of static friction between the conveyor and the package B of mass 10 kg is 0.2, determine the shortest time (in sec) the belt can stop so that the package does not slide on the belt.



28. A boy of mass 50 kg produces an acceleration of 2 m/s^2 in a block of mass 20 kg by pushing it in horizontal direction. The boy moves with the block such that boy and block have same acceleration. There is no friction between the block and fixed horizontal surface but there is friction between foot of the boy and horizontal surface find friction force (in N) exerted by the horizontal surface on the boy. (Assume that frictional force acting on boy remains constant)



29. A scientist measure the initial velocity of an object to be 12.376 m/s, its acceleration (constant) to be 1.82 m/s^2. He is to find the velocity after 2.00 sec. How many significant digits are there in the answer?

30. In a given system of unit standard measurment of mass is 100 gm, standard measurement of length is 200 cm and standard measurement of time is 5 sec. 10 J energy in the given system of unit has value N,then value of N is.

31. One of the following combinations illustrate law of reciprocal proportions
(A) N_2O_3, N_2O_4, N_2O_5 (B) NaCl, NaBr, NaI
(C) CS_2, CO_2, SO_2 (D) PH_3, P_2O_3, P_2O_5

32. How many moles of electron weigh one kilogram :
(A) 6.023×10^{23} (B) $\frac{1}{9.108} \times 10^{31}$
(C) $\frac{6.023}{9.108} \times 10^{54}$ (D) $\frac{1}{9.108 \times 6.023} \times 10^{8}$

33. The NH_3 evolved from 2.8 gm sample of protein was absorbed in 45 ml of 0.2 M HNO_3. The excess acid required 20 ml of 0.05 M NaOH % of N in the sample will be :
(A) 16% (B) 4%
(C) $\frac{17 \times 4}{7}$ % (D) 8%

34. The vapour density of a gaseous mixture of non-reactive gases 'A' and 'B' is 40. If the molar mass of gas 'A' is 20 gm/mol and the mixture contains the gases in 2 : 3 volume ratio, then the molar mass of gas 'B' is :
(A) $\frac{160}{3}$ (B) 40
(C) 120 (D) 60

35. The mass of graphite which should be burnt completely with 9.6 gm oxygen to produce CO and CO_2 gases in 4 : 1 mole - ratio is :
(A) 12.0 gm (B) 7.2 gm
(C) 6.0 gm (D) 4.8 gm

36. The density of a pure liquid (molecular mass = 80) is 1.5 gm/ml. If 4 ml of liquid contains 60 drops, then the number of molecules per drop of liquid is give by : [**Given :** $N_A = 6 \times 10^{23}$]
(A) 7.5×10^{20} (B) 1.33×10^{21}
(C) 4×10^{23} (D) 2×10^{22}

37. The mass of 3.2×10^5 atoms of an element is 8.0×10^{-18} gm. The atomic mass of the element is about
(A) 2.5×10^{-22} (B) 15
(C) 8.0×10^{-18} (D) 30

38. A pre-weighed rigid vessel was filled with oxygen at NTP and weighed. It was then evacuated, filled with SO_2 at the same temperature and pressure, and again weighed. The weight of oxygen is
(A) the same as that of SO_2
(B) $\frac{1}{2}$ that of SO_2
(C) twice that of SO_2
(D) $\frac{1}{4}$ that of SO_2

39. When a mixture of a aluminum powder and iron (III) oxide is ignited, it produces molten iron and aluminum oxide. In an experiment, 5.4 gm of aluminum was mixed with 18.5 gm of iron (III) oxide. At the end of the reaction, the mixture contained 11.2 gm of iron, 10.2 gm of aluminum oxide, and an undetermined amount of unreacted iron (III) oxide. No aluminum was left. What is the mass of the iron (III) oxide left?
(A) 2.5 gm (B) 7.3 gm
(C) 8.3 gm (D) 2.9 gm

40. **Statement - 1 :** Molality of pure ethanol is lesser than water.
Statement - 2 : As density of ethanol is lesser than density of water.
(**Given :** $d_{ethanol} = 0.789$ gm/ml, $d_{water} = 1$ gm/ml)
(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(B) Statement-1 is true, statement-2 is true and statement-2 is **NOT** the correct explanation for statement-1.
(C) Statement-1 is true, statement-2 is false.
(D) Statement-1 is false, statement-2 is true.

41. 0.1 N $K_2C_2O_4 . 3H_2C_2O_4 . 4H_2O$ solution reacts completely with 20 ml 0.05 M of $KMnO_4$ solution in acidic medium. Another sample of same solution of $K_2C_2O_4 . 3H_2C_2O_4 . 4H_2O$, having same volume is titrated with $\frac{1}{8}$ M NaOH solution, then volume of NaOH solution is
(A) 20 ml (B) 30 ml
(C) 50 ml (D) None of these

42. $(NH_4)_3PO_4$ get converted into NO_3^- and PH_3 on reacting with $KMnO_4$ in acidic medium. If 50 ml of 0.2 M $(NH_4)_3PO_4$ solution reacts with 16 ml of $KMnO_4$ solution, then normality of $KMnO_4$ solution is
(A) 5 (B) 8 (C) 10 (D) 20

43. In the redox reaction :
$x\ MnO + y\ PbO_2 + z\ HNO_3 \longrightarrow a\ HMnO_4 + b\ Pb(NO_3)_2 + c\ H_2O$
(A) x = 2, y = 5, z = 10 (B) x = 2, y = 7, z = 8
(C) x = 2, y = 5, z = 8 (D) x = 2, y = 5, z = 5

44. Number of moles of electrons produced per mole of $FeCr_2O_4$ in the following redox reaction.
$FeCr_2O_4 + KOH + O_2 \longrightarrow K_2CrO_4 + Fe_2O_3$
(A) 6 (B) 1 (C) 7 (D) 3

45. $O_2 + FeS_2 \longrightarrow FeO + SO_2$

The number of moles of FeS_2 required to produce 20 mol electrons to reduce O_2 in the above reaction is

(A) 2 (B) 10

(C) $\frac{10}{3}$ (D) $\frac{5}{3}$

$O_2 + FeS_2 \longrightarrow FeO + SO_2$

46. Ratio of stoichiometric coefficients of $CrCl_3$ to MnO_4^- in balanced chemical reaction in acidic medium is

$MnO_4^- + CrCl_3 \longrightarrow MnCl_2 + Cr_2O_7^{2-} + Cl^-$

(A) $\frac{5}{3}$ (B) $\frac{2}{5}$

(C) $\frac{3}{5}$ (D) 1

47. $K_2Cr_2O_7 + H_2SO_4 + 4H_2O_2^{\vee} \underset{\text{Sulphur compound}}{X} +$

$\underset{\text{Chromium compound}}{Y} + 5H_2O$

In above reaction identify the oxidation state of chromium in compound 'Y'.

(A) + 10 (B) + 8

(C) + 6 (D) + 7

48. A sample of hydrazine sulphate ($N_2H_6SO_4$) was dissolved in 100 ml water 10 ml of this solution was reacted with excess of $FeCl_3$ solution and warmed to complete the reaction. Ferrous ions formed required 20 ml of $\frac{M}{50}$ $KMnO_4$ solution.

Given : $4Fe^{+3} + N_2H_4 \rightarrow N_2 + 4Fe^{+2} + 4H^+$

$MnO_4^- + 5Fe^{+2} + 8H^+ \rightarrow Mn^{2+} + 5Fe^{+3} + 4H_2O$

The amount in gm of hydrazine sulphate in one litre is :

(A) 1.30 gm (B) 6.5 gm

(C) 3.25 gm (D) 8.66 gm

49. **Statement - 1 :** In a reaction $Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$, Zn is a reductant but itself get oxidized.

Statement - 2 : In a redox reaction, oxidant is reduced by accepting electrons and reductant is oxidized by losing electrons.

Reduction gain of $2e$

Oxidation loss of $2e$

(A) If both Statement - 1 : and Statement - 2 : are true and the Statement - 2 : is the correct explanation of the Statement - 1 : .

(B) If both Statement - 1 : and Statement - 2 : are true but Statement - 2 : is not the correct explanation of the Statement - 1 : .

(C) If Statement - 1 : is true but Statement - 2 : is false.

(D) If Statement - 1 : is false but Statement - 2 : is true.

50. **Statement - 1 :** Oxidation number of carbon in CH_2O is zero.

Statement - 2 : CH_2O formaldehyde, is a covalent compound.

(A) If both Statement - 1 : and Statement - 2 : are true and the Statement - 2 : is the correct explanation of the Statement - 1 : .

(B) If both Statement - 1 : and Statement - 2 : are true but Statement - 2 : is not the correct explanation of the Statement - 1 : .

(C) If Statement - 1 : is true but Statement - 2 : is false.

(D) If Statement - 1 : is false but Statement - 2 : is true.

SECTION-B

51. If ratio of molality and molarity of aqueous solution of glucose is 5 and density of solution is 2g/ml. Then molarity of solution will be :

[Report your answer by dividing it by 2]

52. A sample of iron weighing 20 g was heated with $KClO_3(s)$ in an evacuated container. The oxygen generated from decomposition of $KClO_3$ converted some of Fe to Fe_2O_3. If the combined mass of Fe and Fe_2O_3 was 21.5 g. Calculated mass of Fe_2O_3 **(in g)** formed.

53. A mixture of $CH_4(g)$ and $C_2H_6(g)$ has a total pressure of 0.5 atm. Just enough $O_2(g)$ is added to the mixture to bring about its complete combustion to $CO_2(g)$ and $H_2O(g)$. The total pressure of two product gases is 2.1 atm. Then mole fraction of $C_2H_6(g)$ will be.

[**Assume** volume and temperature to be constant]

[Report your answer by multiplying it by 100]

54. In 10 g of sample containing Tl_2SO_4 all thallium (Tl) is precipitated as TlI (Thallium iodide). Calculate mass percentage of Tl_2SO_4 in the sample if 6.64 g of TlI was recovered.

[Atomic mass of Tl = 205]

[Report your answer by multiplying it by 10]

55. PCl_5 reacts with water to give H_3PO_4 and HCl according to following reaction:

$PCl_5(g) + H_2O(l) \longrightarrow H_3PO_4(aq) + HCl(aq)$

If 2 mol of PCl_5 and 4 mol of H_2O are taken and yield of reaction is 30%. Then find mass **(in g)** of HCl formed.

[Multiply your answer by 100]

56. Calculate the sum of stoichiometric coefficients of products in minimum integral balanced following chemical reaction.

$a\ CrCl_3 + b\ H_2O_2 + c\ NaOH \longrightarrow x\ Na_2CrO_4 + y\ NaCl + z\ H_2O$

57. Given balanced chemical equation for oxidation of phosphorus (III) sulfide by nitric acid. The products include NO and SO_2. Find the value of a,b,c,d,e in the following equation.

$a\ P_4S_6 + 44H^+ + b\ NO_3^- \rightarrow cNO + dH_3PO_4 + e\ SO_2 + 4H_2O$

Write your answer as (a + b + c + d + e)

58. An equimolar mixture of CuO & Cu_2O is titrated with 100 ml 0.1 M $KMnO_4$ solution in acidic medium. Calculate millimoles of Cu^{2+} in final solution.

59. 1 litre solution containing 0.1 M $Na_2S_2O_3$ & 0.2 M IO_4^- is titrated with I_2 according to following reaction.

$Na_2S_2O_3 + I_2 \longrightarrow Na_2S_4O_6 + I^-$

$IO_4^- + I_2 \longrightarrow IO_3^-$

Calculate millimoles of I_2 consumed ?

60. 20 ml of $KMnO_4$ solution completely reacts with 10 ml solution of 1M FeS_2 and 2M CuS to produce Cu^{+2}, Fe^{+3}, SO_2. Calculate Normality of $KMnO_4$ solution?

[Fill you answer by multiplying with 100]

61. The expression, $\frac{\tan\left(\frac{3\pi}{2}-\alpha\right)\cos\left(\frac{3\pi}{2}-\alpha\right)}{\cos(2\pi-\alpha)} + \cos\left(\alpha-\frac{\pi}{2}\right)\sin(\pi-\alpha) + \cos(\pi+\alpha)\sin\left(\alpha-\frac{\pi}{2}\right)$ when simplified reduces to :

(A) zero (B) 1
(C) -1 (D) none

62. If $\theta = 3\alpha$ and $\sin\theta = \frac{a}{\sqrt{a^2+b^2}}$. The value of the expression, $a\,\text{cosec}\,\alpha - b\sec\alpha$ is

(A) $\frac{1}{\sqrt{a^2+b^2}}$ (B) $2\sqrt{a^2+b^2}$
(C) $a+b$ (D) none

63. If $\log_2(a^3b) = x$ and $\log_2\left(\frac{3a}{b}\right) = y$, then the value of $\log_2 a$ is equal to

(A) $\frac{x+y}{4} - \log_2\sqrt[4]{3}$ (B) $\frac{x+y}{4}$
(C) $\frac{x-y}{4}$ (D) $\frac{x-y}{4} - \log_2\sqrt[4]{3}$

64. In ΔABC, $AB = AC$ and in ΔDEF, $DE = DF$. If AB is twice DE and $\angle D$ is twice $\angle A$, then the ratio of the area of ΔABC to the area of ΔDEF is

(A) tan A (B) 2 sec A
(C) csc 2A (D) sec A · tan A

65. Number of solution of the equation $\frac{3\sin\theta-\sin3\theta}{1+\cos\theta} + \frac{3\cos\theta+\cos3\theta}{1-\sin\theta} = 4\sqrt{2}\cos\left(\theta+\frac{\pi}{4}\right)$ in the interval $(-10\pi, 8\pi]$ is equal to

(A) 8 (B) 9
(C) 16 (D) 18

66. Let a, b, c, d > 0 and not equal to one such that $\log_a b = c$, $\log_b c = 2d$, $\log_c d = 3a$ and $\log_d a = 4b$, then product (a b c d) equals

(A) $\frac{1}{2}$ (B) $\frac{1}{6}$
(C) $\frac{1}{12}$ (D) $\frac{1}{24}$

67. If $0 \le x < 2\pi$, then the number of real values of x, which satisfy the equation $\cos x + \cos 2x + \cos 3x + \cos 4x = 0$, is

(A) 5 (B) 7
(C) 9 (D) 3

68. The expression $\frac{\tan A}{1-\cot A} + \frac{\cot A}{1-\tan A}$ can be written as :

(A) sinA cosA + 1 (B) secA cosecA + 1
(C) tanA + cotA (D) secA + cosecA

69. In a class 140 students numbered 1 to 140, all even numbered students opted Mathematics course, those whose number is divisible by 3 opted Physics course and those whose number is divisible 5 opted Chemistry course. Then the number of student who did not opt for any of the three courses is :

(A) 38 (B) 42
(C) 102 (D) 1

70. The value of $\log_{\sqrt{2}}\left(\text{antilog}_{128}\left(\frac{3}{7}\right)\right)$ equals

(A) 16 (B) 8
(C) 6 (D) 4

71. In a Δ ABC with usual notations, If $\angle A = 55°$, $\angle B = 15°$, $\angle C = 110°$ then the value of $(c^2 - a^2)$ equals

(A) 2ab (B) $\frac{ab}{2}$
(C) ab (D) $\frac{ab}{4}$

72. General solution of the trigonometric equation, $\left(2\sin^4\frac{x}{2} - 1\right)\frac{1}{\cos^4\frac{x}{2}} = 2$, is

(A) $n\pi + \frac{2\pi}{3}$ (B) $n\pi \pm \frac{\pi}{3}$
(C) $2n\pi + \frac{2\pi}{3}$ (D) $2n\pi \pm \frac{2\pi}{3}$

where $n \in I$

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

(A) X (B) Y
(C) N (D) $Y - X$

74. In ΔABC, if $\frac{\sin A}{c \sin B} + \frac{\sin B}{c} + \frac{\sin C}{b} = \frac{c}{ab} + \frac{b}{ac} + \frac{a}{bc}$, then the value of angle A, is

(All symbols used have their usual meaning in a triangle.)

(A) 120° (B) 90°
(C) 60° (D) 30°

75. If $7 \log_p\left(\frac{16}{15}\right) + 5\log_p\left(\frac{25}{24}\right) + 3\log_p\left(\frac{81}{80}\right) = 8$, then p^{16} equals

(A) 16 (B) 1
(C) 2 (D) 4

76. Let $X = \{1, 2, 3, 4, 5\}$. The number of different ordered pairs (Y, Z) that can formed such that $Y \subseteq X$, $Z \subseteq X$ and $Y \cap Z$ is empty, is :

(A) 5^2 (B) 3^5
(C) 2^5 (D) 5^3

77. Number of positive integers which have characteristic 2 when base is 5, is equal to

(A) 25 (B) 32
(C) 100 (D) 101

78. The value of x satisfying the equation $4^{\log_9 3} + 9^{\log_2 4} = 10^{\log_x 83}$ is equal to

(A) 9 (B) 4
(C) 10 (D) 100

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

(A) $A = C$ (B) $B = C$
(C) $A \cap B = \phi$ (D) $A = B$

80. In an examination of a certain class, at least 70% of the students failed in Physics, at least 72% failed in Chemistry, at least 80% failed in Mathematics and at least 85% failed in English. How many at least must have failed in all the four subjects?

(A) 5%
(B) 7%
(C) 15%
(D) Cannot be determined due to insufficient data

SECTION-B

81. Find the number of solutions of the trigonometric equation $4\cos^2 x + \tan^2 x + \cot^2 x + \sec^2 x = 6$ in $[0, 2\pi]$.

82. Find the number of integers which do not satisfy the inequality $\log_{1/2}(x+5)^2 > \log_{1/2}(3x-1)^2$.

83. If $\frac{\sqrt{2}\sin\alpha}{\sqrt{1+\cos 2\alpha}} = \frac{1}{7}$ and $\sqrt{\frac{1-\cos 2\beta}{2}} = \frac{1}{\sqrt{10}}$, $\beta \in \left(0, \frac{\pi}{2}\right)$, then $\tan(\alpha + 2\beta)$ is _____

84. If $\cos 63° \cos 57° \sin 87°$ is equal to $\frac{\cos k°}{m}$, where k and m are natural numbers and $k \in (0, 180)$ then find $(k - m)$.

85. In a triangle ABC, D is the mid-point of side BC, AB = 7, AC = 3 and BC = 6. The length AD is $p\sqrt{q}$ where p and q are both prime, then find the value of $(p + q)$.

86. Find the number of solution of the equation $\sin 7\theta = \sin 3\theta + \sqrt{1 - \cos^2\theta}$ in $\left(0, \frac{\pi}{2}\right)$.

87. Let $A = \{(x, y) : x \in R, y \in R, x^3 + y^3 = 1\}$, $B = \{(x, y) : x \in R, y \in R, x - y = 1\}$ and $C = \{(x, y) : x \in R, y \in R, x + y = 1\}$. If $A \cap B$ contains 'p' elements and $A \cap C$ contains 'q' elements then find $(q - p)$.

88. The number of integers satisfying the inequality $\sqrt{\log^2_{1/2} x + 4\log_2 \sqrt{x}} < \sqrt{2}\,(4 - \log 16x^4)$ are

89. Let p and q $(p < q)$ be two prime numbers such that their difference is odd and $9^{-\log_{\sqrt{p+q}}\left(\tan\frac{\pi}{8}\right)} = 3 + \sqrt{8}$. Find the value of $(p^2 + q^2)$.

90. Let $p = 4\sec^2\theta + \cos^2\theta$ and $q = \operatorname{cosec}^2\phi + 4\sin^2\phi$, then find the minimum value of $(p + q)$.