



JEE Mains (11th)

Sample Paper - I

DURATION : 180 Minutes

M. MARKS : 300

General Instructions:

1. Immediately fill in the particulars on this page of the test booklet.
2. The test is of **3 hours** duration.
3. The test booklet consists of **90** questions (**75 to attempt**). The maximum marks are **300**.
4. There are three subjects in the question paper, Subject I, II and III consisting of Section-I (**Physics**), Section-II (**Chemistry**), Section-III (**Mathematics**), and having **30 questions** in each part.
5. There will be a total of **20 MCQs** and **10 Numerical** Value Based Questions (**attempt any 5**).
6. Each correct answer will give 4 marks while 1 Marks will be deducted for a wrong response.
7. No student is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device, etc. inside the examination room/hall.
8. On completion of the test, the candidate must hand over the Answer Sheet to the Invigilator on duty in the Room/Hall. However, the candidates are allowed to take away this Test Booklet with them.
9. **Do not fold or make any stray mark on the Answer Sheet (OMR).**

Name of the Student (In CAPITALS): _____

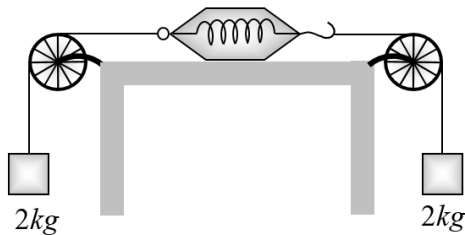
Roll Number: _____

Candidate's Signature: _____

Section-I (PHYSICS)

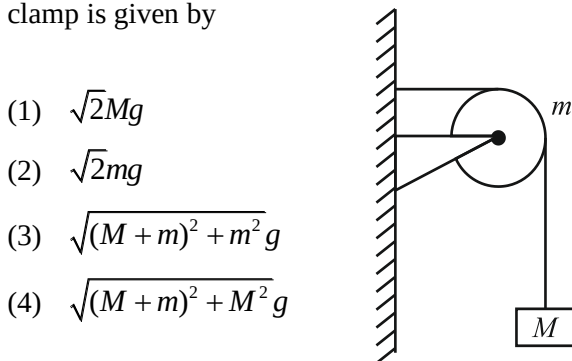
Single Correct Type Question (1 to 20)

1. As shown in the figure, two equal masses each of 2 kg are suspended from a spring balance. The reading of the spring balance will be



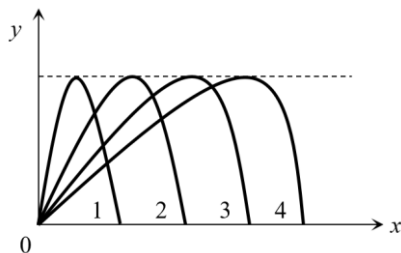
- (1) Zero (2) 2 kg
(3) 4 kg (4) Between zero and 2 kg

2. A string of negligible mass going over a clamped pulley of mass m supports a block of mass M as shown in the figure. The force on the pulley by the clamp is given by



- (1) $\sqrt{2}Mg$
(2) $\sqrt{2}mg$
(3) $\sqrt{(M+m)^2 + m^2}g$
(4) $\sqrt{(M+m)^2 + M^2}g$

3. Figure shows four paths for a kicked football. Ignoring the effects of air on the flight, rank the paths according to initial horizontal velocity component, highest first

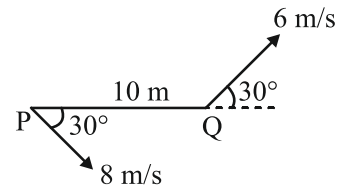


- (1) 1, 2, 3, 4
(2) 2, 3, 4, 1
(3) 3, 4, 1, 2
(4) 4, 3, 2, 1

4. Two bodies are thrown up at angles of 45° and 60° respectively, with the horizontal. If both bodies attain same vertical height, then the ratio of velocities with which these are thrown is

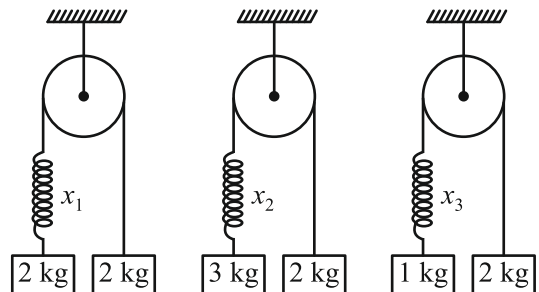
- (1) $\sqrt{\frac{2}{3}}$ (2) $\frac{2}{\sqrt{3}}$
(3) $\sqrt{\frac{3}{2}}$ (4) $\frac{\sqrt{3}}{2}$

5. Two moving particle P and Q are 10 m apart at a certain instant. The velocity of P is 8 m/s making an angle 30° with the line joining P and Q and that of Q is 6 m/s making an angle 30° with PQ as shown in the figure. Then angular velocity of P with respect to Q is



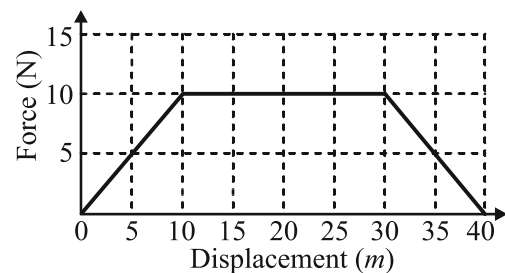
- (1) Zero (2) 0.1 rad/sec
(3) 0.4 rad/sec (4) 0.7 rad/sec

6. Same spring is attached with 2 kg, 3 kg and 1 kg blocks in three different cases as shown in figure. If x_1 , x_2 and x_3 be the extensions in the spring in these three cases then



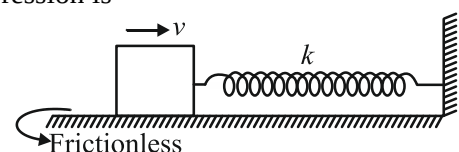
- (1) $x_1 = 0$, $x_3 > x_2$ (2) $x_2 > x_1 > x_3$
(3) $x_3 > x_1 > x_2$ (4) $x_1 > x_2 > x_3$

7. Adjacent figure shows the force-displacement graph of a moving body. The work done in displacing body from $x = 0$ to $x = 35$ m is equal to



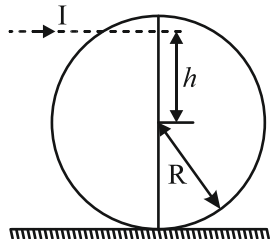
- (1) 50 J (2) 25 J
(3) 287.5 J (4) 200 J

8. A block of mass m is given a speed v when spring of constant k is in its natural length as shown in figure. Remaining kinetic energy of the block when spring is compressed by half of maximum compression is

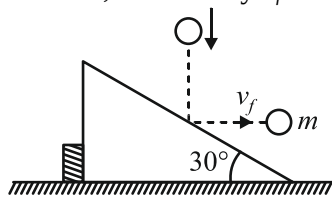


- (1) 25%
(2) 50%
(3) 75%
(4) Any value less than 50%

9. A solid sphere rests on a horizontal surface. A horizontal impulse is applied at height h from centre. The sphere starts rolling just after the application of impulse. The ratio h/r will be



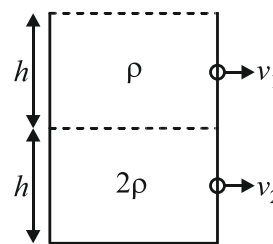
- (1) $\frac{1}{2}$ (2) $\frac{2}{5}$
 (3) $\frac{1}{5}$ (4) $\frac{2}{3}$
10. A spring, which is initially in its unstretched condition, is first stretched by a length x and then again by a further length x . The work done in the first case is W_1 and in the second case is W_2 . Then,
- (1) $W_2 = W_1$ (2) $W_2 = 2W_1$
 (3) $W_2 = 3W_1$ (4) $W_2 = 4W_1$
11. As shown in the figure, a body of mass m moving vertically with speed 3 m/s hits a smooth fixed inclined plane and rebounds with a velocity v_f in the horizontal direction. If angle of plane with horizontal is 30° , the velocity v_f will be



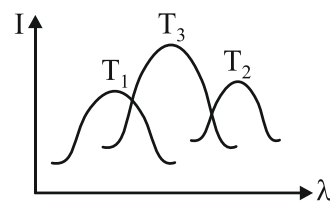
- (1) 3 m/s (2) $\sqrt{3} \text{ m/s}$
 (2) $\frac{1}{\sqrt{3}} \text{ m/s}$ (4) 2 m/s
12. A piece of cork starts from rest at the bottom of a lake and floats up. Its velocity v is plotted against time t . Which of the following best represents the resulting curve?
- (1) (2)
 (3) (4)
13. Two soap bubbles with radii r_1 and r_2 ($r_1 > r_2$) come in contact. Their common surface has a radius of curvature r .

- (1) $r = \frac{r_1 + r_2}{2}$ (2) $r = \frac{r_1 r_2}{r_2 - r_1}$
 (3) $r = \frac{r_1 r_2}{r_1 + r_2}$ (4) $r = \sqrt{r_1 r_2}$

14. Equal volume of two immiscible liquids of densities ρ and 2ρ are filled in a vessel as shown in figure. Two small holes are punched at depth $\frac{h}{2}$ and $\frac{3h}{2}$ from the surface of lighter liquid. If v_1 and v_2 are the velocities of efflux at these two holes, then $\frac{v_1}{v_2}$ is

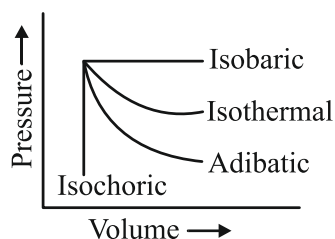


- (1) $\frac{1}{4}$ (2) $\frac{1}{2}$
 (3) $\frac{1}{\sqrt{2}}$ (4) $\frac{1}{2\sqrt{2}}$
15. Assuming the sun to be a spherical body of radius R at a temperature of $T \text{ K}$, evaluate the total radiant power, incident on the Earth, at a distance r from the Sun
- (1) $\frac{R^2 \sigma T^4}{r^2}$ (2) $\frac{4\pi r_0^2 R^2 \sigma T^4}{r^2}$
 (3) $\frac{\pi r_0^2 R^2 \sigma T^4}{r^2}$ (4) $\frac{r_0^2 R^2 \sigma T^4}{4\pi r^2}$
- (Where r_0 is the radius of the Earth and σ is Stefan's constant.)
16. The plots of intensity radiation versus wavelength of three black bodies at temperatures T_1 , T_2 and T_3 are shown. Then:

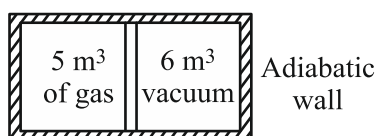


- (1) $T_3 > T_2 > T_1$
 (2) $T_1 > T_2 > T_3$
 (3) $T_2 > T_3 > T_1$
 (4) $T_1 > T_3 > T_2$
17. The coefficient of linear expansion of crystal in one direction is α_1 and that in every direction perpendicular to it α_2 . The coefficient of cubical expansion is:
- (1) $\alpha_1 + \alpha_2$ (2) $2\alpha_1 + \alpha_2$
 (3) $\alpha_1 + 2\alpha_2$ (4) none of these

18. The amount of work done (in P-V diagram) by the gas during expansion is greatest for



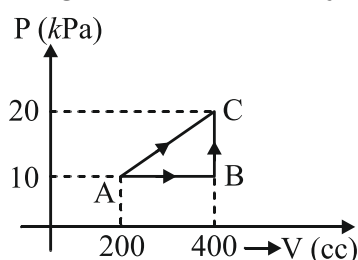
- (1) Isobaric process
(2) Isothermal process
(3) Adiabatic process
(4) Same in each process
19. A movable piston separates a sample of gas from vacuum. In this state, pressure of gas is P , then find pressure after piston is released



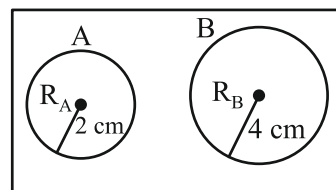
- (1) P
(2) $6P$
(3) $\frac{5P}{11}$
(4) Pressure is not defined because it is a free expansion
20. A sound wave of frequency 245 Hz travels with the speed of 300 ms^{-1} along the positive x-axis. Each point of the wave moves to and fro through a total distance of 6 cm. What will be the mathematical expression of this travelling wave?
- (1) $Y(x, t) = 0.06 [\sin 0.8x - (0.5 \times 10^3)t]$
(2) $Y(x, t) = 0.03 [\sin 5.1x - (1.5 \times 10^3)t]$
(3) $Y(x, t) = 0.03 [\sin 5.1x - (0.2 \times 10^3)t]$
(4) $Y(x, t) = 0.06 [\sin 5.1x - (1.5 \times 10^3)t]$

Integer Type Question (21 to 30)

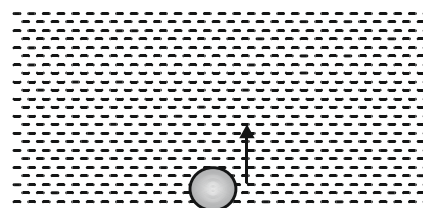
21. If a gas is taken from A to C through B then heat absorbed by the gas is 8 J. Heat (in J) absorbed by the gas in taking it from A to C directly is



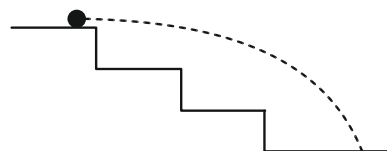
22. Two soap bubbles A and B are kept in a closed chamber where the air is maintained at pressure 8 N/m^2 . The radii of bubbles A and B are 2 cm and 4 cm, respectively. Surface tension of the soap water used to make bubbles is 0.04 N/m . Find the ratio n_B/n_A , where n_A and n_B are the number of moles of air in bubbles A and B, respectively. (Neglect the effect of gravity.)



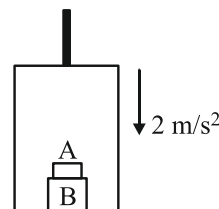
23. An air bubble doubles its radius on raising from the bottom of water reservoir to be the surface of water in it. If the atmospheric pressure is equal to 10 m of water, the height (in metre) of water in the reservoir is



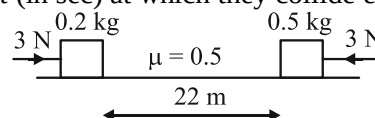
24. A physical quantity P is given by the relation. $P = P_0 e^{(-\alpha t^2)}$. If t denotes the time, the dimensions of constant α are $[T^{-x}]$ then find value of x .
25. A staircase contains three steps each 10 cm high and 20 cm wide (figure). What should be the minimum horizontal velocity of a ball rolling off the uppermost plane so as to hit directly the lowest plane?



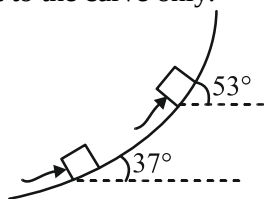
26. The elevator shown in figure is descending with an acceleration of 2 m/s^2 . The mass of the block A is 0.5 kg. What force is exerted by the block A on the block B?



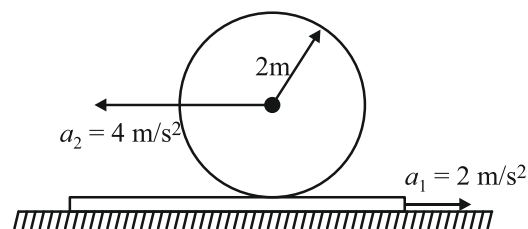
27. Two blocks of mass 0.2 kg and 0.5 kg, which are placed 22 m apart on a rough horizontal surface ($\mu = 0.5$), are acted upon by two forces of magnitude 3 N each as shown in figure at time $t = 0$. Then, find the time t (in sec) at which they collide each other.



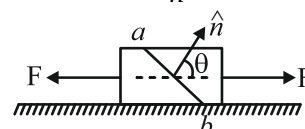
28. A man can just push a box on 37° concrete slope. When he keeps it at the point where the angle increases to 53° , he can just hold it from sliding back. If the coefficient of friction between the box and the concrete slope is μ , find $\frac{1}{\mu}$. Assume that the man is applying same magnitude of force along the tangent to the curve only.



29. In Fig., a sphere of radius 2 m rolls on a plank. The accelerations of the sphere and the plank are indicated. The value of α (in rad/s^2) is



30. A rod of area of cross-section A is being acted upon by two forces $F - F$ as shown in figure. Consider a section ab of rod whose normal makes angle θ with horizontal. The shear stress upon this section is maximum when $\theta = \frac{180^\circ}{n}$. Find n .



Section-II (CHEMISTRY)

Single Correct Type Question (31 to 50)

31. The molarity of aqueous NaCl solution which contains 5.85 g NaCl in 500 ml solution is:

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

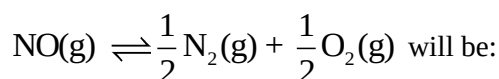
32. Square planar molecule among the following is:

- (1) CH_4 (2) SF_4
(3) XeF_4 (4) ClF_3

33. Maximum critical temperature is of:

- (1) CO_2 (2) N_2
(3) H_2 (4) NH_3

34. If K_c for the reaction $\text{N}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{NO}(\text{g})$ is x , then K_c for the reaction



- (1) x^2 (2) $\frac{1}{x}$
(3) $\frac{1}{x^2}$ (4) $\frac{1}{\sqrt{x}}$

35. Which of the following is not a permanent effect?

- (1) Inductive effect
(2) Electromeric effect
(3) Resonance effect
(4) No bond resonance

36. Match the following and choose the correct option:

Metals	Flame colour
(1) Calcium	(p) Brick red
(2) Strontium	(q) Crimson
(3) Barium	(r) Apple green
(4) Magnesium	(s) No colour
(1) 1(s) 2(p) 3(r) 4(q)	
(2) 1(r) 2(s) 3(p) 4(q)	
(3) 1(s) 2(r) 3(q) 4(p)	
(4) 1(p) 2(q) 3(r) 4(s)	

37. Which of the following cannot be prepared by Wurtz reaction?

- (1) CH_4 (2) C_6H_6
(3) $\text{CH} \equiv \text{CH}$ (4) All of these

38. Maximum prescribed limit of Cd in drinking water is:

- (1) 0.2 mg/dm^3 (2) 5.0 mg/dm^3
(3) 0.005 mg/dm^3 (4) 0.05 mg/dm^3

39. Maximum electronegativity among the following is of:

- (1) B (2) Al
(3) Ga (4) In

40. Most basic among the following in aqueous medium is:

- (1) NH_3
(2) $(\text{CH}_3)_2\text{NH}$
(3) $(\text{CH}_3)_3\text{N}$
(4) CH_3NH_2

41. **Statement I:** The relation between pH and pOH is given by the following expression:

$$\text{pH} - \text{pOH} = \text{p}K_w$$

Statement II: For neutral water at 25°C $[\text{H}_3\text{O}^+] = [\text{OH}^-] = 10^{-7} \text{ M}$

- (1) Statement I and II both are correct and statement II is the correct explanation of statement I
- (2) Statement I is correct but statement II is incorrect
- (3) Statement I is incorrect but statement II is correct
- (4) Statement I and II both are correct but statement II is not the correct explanation of statement I

42. The wave number of radiation having wavelength $5000 \text{ \AA}$ is:

- (1) $2 \times 10^{-7} \text{ cm}^{-1}$
- (2) $2 \times 10^{-6} \text{ cm}^{-1}$
- (3) $2 \times 10^4 \text{ cm}^{-1}$
- (4) $2 \times 10^6 \text{ cm}^{-1}$

43. The correct order of ionization enthalpy is:

- (1) $\text{Li} > \text{Be} > \text{B}$
- (2) $\text{Be} > \text{B} > \text{Li}$
- (3) $\text{Be} > \text{Li} > \text{B}$
- (4) $\text{B} > \text{Be} > \text{Li}$

44. Lowest energy among the following for a multielectron atom is:

- (1) 5d subshell
- (2) 4f subshell
- (3) 6p subshell
- (4) 7s subshell

45. Select incorrect statement from the following:

- (1) Dipole moment of NH_3 is greater than NF_3
- (2) BF_3 is a non-polar molecule
- (3) $1\text{D} = 3.33564 \times 10^{30} \text{ C m}$
- (4) CO_2 molecule contains polar bonds

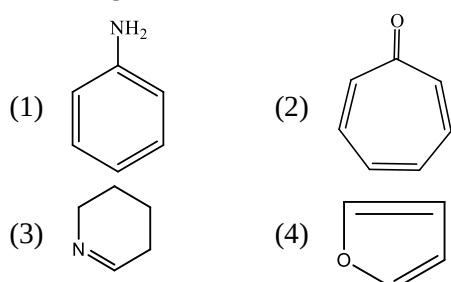
46. Which of the following is a path function?

- (1) w
- (2) U
- (3) H
- (4) G

47. Which of the following can form stable superoxide?

- (1) Ba
- (2) Ca
- (3) Na
- (4) Rb

48. Heterocyclic aromatic compound among the following is:



49. If enthalpy of combustion of butane is $-2658 \text{ kJ mol}^{-1}$ then how much heat energy will be released by the combustion of 5.8 g of butane?

- (1) 332.25 kJ
- (2) 132.9 kJ
- (3) 265.8 kJ
- (4) 664.5 kJ

50. Which of the following set of quantum numbers is possible?

- (1) $n = 4$ $l = 4$ $m = -3$ $s = +\frac{1}{2}$
- (2) $n = 4$ $l = 3$ $m = -2$ $s = -\frac{1}{2}$
- (3) $n = 2$ $l = 3$ $m = +3$ $s = +\frac{1}{2}$
- (4) $n = 4$ $l = 4$ $m = +4$ $s = -\frac{1}{2}$

Integer Type Question (51 to 60)

51. Strength of 30 V H_2O_2 is _____ g/L.

(Roundoff your answer to a whole number)

52. How many functional groups are present in Lactic acid?

53. Total number of electrons present in antibonding molecular orbitals of O_2 are _____.

54. In Carius method of estimation of halogens, 0.20 g of an organic compound gave 0.188 g of AgBr . The percentage of bromine in the compound is _____ %

55. How many geminal dibromides are possible for molecular formula $\text{C}_3\text{H}_6\text{Br}_2$?

56. The total number of moles of O_3 are required during the reductive ozonolysis of 1 mole of benzene is _____.

57. The sum of atomic numbers of most electronegative element and most negative electron gain enthalpy element is _____.

58. The number of protons present in the nucleus of the element which shows highest oxidation state in 4th period of modern periodic table is _____.

59. The total number of planar atoms present in diborane molecule is _____.

60. The total number of degenerate orbitals present in 3rd shell of He^+ ion is _____.

Section-III (MATHEMATICS)

Single Correct Type Question (61 to 80)

61. If $y = \log_{10} x + \log_x 10 + \log_x x + \log_{10} 10$, then $\frac{dy}{dx}$ is equal to

- (1) $\frac{1}{x \log_e 10} - \frac{\log_e 10}{x(\log_e x)^2}$
 (2) $\frac{1}{x \log_e 10} - \frac{1}{x \log_{10} e}$
 (3) $\frac{1}{x \log_e 10} - \frac{\log_e 10}{x(\log_e x)}$
 (4) $\frac{1}{x}$

62. In a certain town 25% families own a cell phone, 15% families own a scooter and 65% families own neither a cell phone nor a scooter. If 1500 families own both a cell phone and a scooter, then the total number of families in the town is

- (1) 10,000 (2) 20,000
 (3) 30,000 (4) 40,000

63. The number of ways of arranging 8 men and 4 women around a circular table such that no two women sit together is

- (1) 8! (2) 4!
 (3) 8!4! (4) 7!⁸P₄

64. A ray of light coming from the point (1, 2) is reflected at a point A on the x-axis and then passes through the point (5, 3). The coordinates of the point A are :-

- (1) $\left(\frac{13}{5}, 0\right)$ (2) $\left(\frac{5}{13}, 0\right)$
 (3) (-7, 0) (4) (7, 0)

65. If $|z - 4| < |z - 2|$, then

- (1) $\operatorname{Re}(z) > 0$ (2) $\operatorname{Re}(z) < 0$
 (3) $\operatorname{Re}(z) > 3$ (4) $\operatorname{Re}(z) > 2$

66. Distance between the lines represented by the equation $x^2 + 2\sqrt{3}xy + 3y^2 - 3x - 3\sqrt{3}y - 4 = 0$, is

- (1) $\frac{5}{2}$ (2) $\frac{5}{4}$
 (3) 5 (4) 0

67. If $f(x) = \prod_{k=1}^{999} (x^2 - 47x + k)$, then product of all real roots of $f(x) = 0$

- (1) 550! (2) 551!
 (3) 552! (4) 999!

68. If $\frac{2-|x|}{3-|x|} \geq 1$, then

- (1) $x \in (-\infty, 2) \cup (3, \infty)$
 (2) $x \in (-3, 3)$
 (3) $x \in (-\infty, -3) \cup (3, \infty)$
 (4) $x \in \emptyset$

69. Two cards are drawn from a well shuffled pack of 52 cards. The probability that atmost one of them is a card of ace is equal to (Assume cards are drawn without replacement)

- (1) $\frac{32}{221}$ (2) $\frac{220}{221}$
 (3) $\frac{16}{221}$ (4) $\frac{33}{221}$

70. If z satisfies $iz^2 = \bar{z}^2 + z$, then $\arg z$ is equal to (z is non-zero complex number) -

- (1) $\frac{\pi}{4}$ (2) $-\frac{\pi}{4}$
 (3) $\frac{3\pi}{2}$ (4) $-\frac{3\pi}{4}$

71. The general solution of the equation

$$\frac{1 - \sin x + \sin^2 x - \dots \text{ upto } \infty \text{ terms}}{1 + \sin x + \sin^2 x + \dots \text{ upto } \infty \text{ terms}} = \frac{1 - \cos 2x}{1 + \cos 2x} \text{ is :-}$$

- (1) $n\pi + (-1)^n \pi / 6, 2n\pi - \pi / 2$
 (2) $n\pi - (-1)^n \pi / 6, 2n\pi + \pi / 2$
 (3) $n\pi + (-1)^n \pi / 6$
 (4) $2n\pi - \pi / 2$

72. The co-ordinates of a point on the parabola $y^2 = 8x$ whose focal distance is 4 is:

- (1) (2, ± 4) (2) (± 2 , 4)
 (3) (-2, ± 4) (4) (± 2 , -4)

73. If $S_n = \frac{n(n+1)(n+2)}{6}$ then $\sum_{n=1}^{\infty} \frac{1}{t_n} =$

- (1) 1 (2) 6
 (3) 2 (4) 1/6

74. If $\sum_{i=1}^9 (x_i - 5) = 9$ and $\sum_{i=1}^9 (x_i - 5)^2 = 45$ then the standard deviation of the nine items $x_1, x_2, \dots, x_9$ is

- (1) 2 (2) 3
 (3) 4 (4) 9

75. If A and B are the vertices of the triangle ABC and are given by (2, 5) and (4, -11) respectively, and C moves along the line $L \equiv -9x + 7y + 4 = 0$, then the locus of the centroid of the triangle ABC is

- (1) $9x + 7y - 8 = 0$
 (2) $27x + 21y - 8 = 0$
 (3) $7x - 9y - 8 = 0$
 (4) $27x - 21y = 100$

76. Let a and b respectively be the semi-transverse and semi-conjugate axes of a hyperbola whose eccentricity satisfies the equation $9e^2 - 18e + 5 = 0$. If $S(5, 0)$ is a focus and $5x = 9$ is corresponding directrix of this hyperbola, then $a^2 - b^2$ is equal to:

- (1) -7 (2) -5
(3) 5 (4) 7

77. The sum of the series

$${}^{2020}C_0 - {}^{2020}C_1 + {}^{2020}C_2 - {}^{2020}C_3 + \dots + {}^{2020}C_{1010} \text{ is}$$

- (1) $\frac{1}{2} {}^{2020}C_{1010}$ (2) ${}^{2020}C_{1010}$
(3) 0 (4) $-\frac{1}{2} {}^{2020}C_{1010}$

78. The domain of the function

$$f(x) = \sqrt{\log_{10}\left(\frac{3-x}{x}\right)} \text{ is } x \in$$

- (1) $\left(0, \frac{3}{2}\right)$ (2) $(0, 3)$
(3) $\left(-\infty, \frac{3}{2}\right)$ (4) $\left(0, \frac{3}{2}\right]$

79. For two sets A & B , such that

$$A = \{x : x^2 - 4x + 3 \leq 0\}$$

$$B = \{x : x^2 - x + 2 > 0\}, \text{ the interval } A \cap B \text{ is}$$

- (1) $[1, 3]$ (2) $(-\infty, \infty)$
(3) $(1, 3)$ (4) $(-\infty, 1) \cup (3, \infty)$

80. If $\tan \alpha = (1 + 2^{-x})^{-1}$, $\tan \beta = (1 + 2^{x+1})^{-1}$, then $\alpha + \beta$ equals

- (1) $\frac{\pi}{6}$ (2) $\frac{\pi}{4}$
(3) $\frac{\pi}{3}$ (4) $\frac{\pi}{2}$

Integer Type Question (81 to 90)

81. The vertices of the triangle ABC are $A(0, 0)$, $B(3, 0)$ and $C(3, 4)$, where A and C are foci of an ellipse and B lies on the ellipse. If the length of the latus rectum of the ellipse is $24/p$ units, then the value of p is

82. Find the largest value of n among all possible natural numbers n , such that the coefficient of x in the expansion of $\left(x^3 + \frac{1}{x^4}\right)^n$, is ${}^nC_{11}$.

83. The number of four-digit numbers formed by using the digits 0, 2, 4, 5 and which are not divisible by 5, is

84. If α, β and γ are roots of equation $5x^3 - 2x - 1 = 0$ the value of $\frac{\alpha^2 - 3}{\beta\gamma} + \frac{\beta^2 - 3}{\alpha\gamma} + \frac{\gamma^2 - 3}{\alpha\beta}$ is

85. If $p = \cos 55^\circ$, $q = \cos 65^\circ$, $r = \cos 175^\circ$ then the value of $\frac{1}{p} + \frac{1}{q} + \frac{r}{pq}$ is equal to

86. If the circles

$$x^2 + y^2 + (3 + \sin \beta)x + (2 \cos \alpha)y = 0 \text{ and}$$

$$x^2 + y^2 + (2 \cos \alpha)x + 2cy = 0 \text{ touch each other, then the maximum value of } c \text{ is } \underline{\hspace{2cm}}.$$

87. There is a complex number z with imaginary part 164 and a positive integer n such that $\frac{z}{z+n} = 4i$.

Find $\frac{n}{17}$

88. If n is the number of solutions of equation

$$|\cot x| = \cot x + \frac{1}{\sin x}; (0 < x < 2\pi), \text{ then } n \text{ equals}$$

89. Variance of the following data 6, 8, 10, 16, 14, 12, 18, 24, 22, 20 is equal to

90. Three numbers a, b, c between 2 and 18 such that

$$(i) \quad a + b + c = 25$$

$$(ii) \quad 2, a, b \text{ are consecutive terms of an AP}$$

$$(iii) \quad b, c, 18 \text{ are consecutive terms of a GP}$$

If $G = \text{Max}\{a, b, c\}$ and $L = \text{Min}\{a, b, c\}$ then the value of $G + L$ is :

