Section-I (PHYSICS)

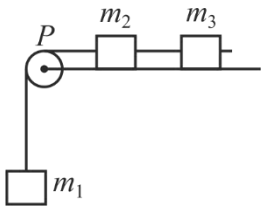
***Single Correct Type Question* (1 *to* 20)**

1. An open and a closed pipe have same length. The ratio of frequencies of their n^{th} overtone is:

(1) $\frac{n+1}{2n+1}$ (2) $\frac{2(n+1)}{2n+1}$

(3) $\frac{n}{2n+1}$ (4) $\frac{n+1}{2n}$

2. A system consists of three masses m_1, m_2 and m_3 connected by a string passing over a pulley P. The mass m_1 hangs freely and m_2 and m_3 are on a rough horizontal table (the coefficient of friction = μ). The pulley is frictionless and of negligible mass. The downward acceleration of mass m_1 is: (Assume $m_1 = m_2 = m_3 = m$)



(1) $\frac{g(1-g\mu)}{9}$ (2) $\frac{2g\mu}{3}$

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

3. The radius in kilometres to which the present radius of the earth (R = 6400 km) to be compressed so that the escape velocity is increased 10 times, is:

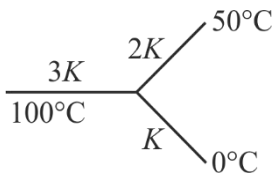
(1) 6.4

(2) 64

(3) 640

(4) 4800

4. Three rods of same dimensions have thermal conductivities 3 K, 2 K and K. They are arranged as shown, with their ends at 100°C, 50°C and 0°C. The temperature of their junction is



(1) 75°C (2) $\frac{200}{3}$ °C

(3) 40°C (4) $\frac{100}{3}$ °C

5. The period of oscillation of a mass M suspended from a spring of negligible mass is T. If along with it another mass M is also suspended, the period of oscillation will now

(1) T (2) $\frac{T}{\sqrt{2}}$

(3) $2T$ (4) $\sqrt{2}T$

6. A window whose area is 2 m^2 opens on a street where street noises result in an intensity level at the window of 60 dB. How much acoustic power enters the window via sound waves and if an acoustic absorber is fitted at the window, how much energy from street noise will it collect in five hours?

(1) 3 μW, 2×10^{-3} J

(2) 2 μW, 36×10^{-3} J

(3) 36 μW, 2×10^{-3} J

(4) 2 μW, 3.6×10^{-3} J

7. A sound wave with frequency 256 Hz falls normally on a perfectly reflecting wall. The shortest distance from the wall at which the air particles will have maximum amplitude of vibrations is nearly (velocity of sound in air is 336 m/s):

(1) 32.8 cm

(2) 50 cm

(3) 65.6 cm

(4) 25 cm

8. A physical quantity $y = \frac{a^4b^2}{(cd^4)^{\frac{1}{3}}}$ has four observables a, b, c and d. The percentage error in a, b, c and d are 2%, 3%, 4% and 5% respectively. The error in y will be:

(1) 6% (2) 11%

(3) 12% (4) 22%

9. A ball falls vertically onto a floor, with momentum p, and then bounces repeatedly. The coefficient of restitution is e. The total momentum imparted by the ball to the floor is

(1) $p(1 + e)$ (2) $\frac{p}{1-e}$

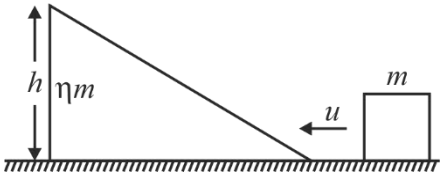
(3) $p\left(1+\frac{1}{e}\right)$ (4) $p\left(\frac{1+e}{1-e}\right)$

10. A car starts from rest and moves on a surface in which the coefficient of friction between the road and the tyres increases linearly with distance (x). The car moves with the maximum possible acceleration. The kinetic energy (E) of the car will depend on x as

(1) $E \propto \frac{1}{x^2}$ (2) $E \propto \frac{1}{x}$

(3) $E \propto x$ (4) $E \propto x^2$

11. A block of mass m is pushed towards a movable wedge of mass ηm and height h, with a velocity u. All surface are smooth. The minimum value of u for which the block will reach the top of the wedge is



(1) $\sqrt{2gh}$ (2) $\eta\sqrt{2gh}$

(3) $\sqrt{2gh\left(1+\frac{1}{\eta}\right)}$ (4) $\sqrt{2gh\left(1-\frac{1}{\eta}\right)}$

12. An insect of mass m is initially at one end of a stick of length L and mass M, which rests on a smooth floor. The coefficient of friction between the insect and the stick is k. The minimum time in which the insect can reach the other end of the stick is t. Then t^2 is equal to

(1) $\frac{2L}{kg}$ (2) $\frac{2Lm}{kg(M+m)}$

(3) $\frac{2LM}{kg(M+m)}$ (4) $\frac{2Lm}{kgM}$

13. A uniform rod of mass m and length l makes a constant angle θ with an axis of rotation which passes through one end of the rod. Its moment of inertia about this axis is

(1) $\frac{ml^2}{3}$ (2) $\frac{ml^2}{3}\sin\theta$

(3) $\frac{ml^2}{3}\sin^2\theta$ (4) $\frac{ml^2}{3}\cos^2\theta$

14. A wheel of radius r rolls without slipping with a speed v on a horizontal road. When it is at point A on the road, a small blob of mud separates from the wheel at its highest point and lands at point B on the road.

(1) $AB = v\sqrt{\frac{r}{g}}$

(2) $AB = 2v\sqrt{\frac{r}{g}}$

(3) $AB = 4v\sqrt{\frac{r}{g}}$

(4) If $v > \sqrt{4rg}$, the blob of mud will land on the wheel and not on the road.

15. A simple pendulum has time period T. A uniform rod, whose length is the same as that of the pendulum, undergoes small oscillations about its upper end. Its time period of oscillation will be

(1) $< T$

(2) T

(3) $> T$

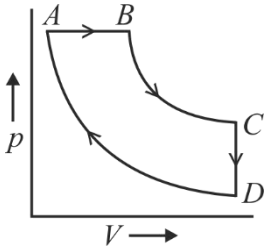
(4) may be (1), (2) or (3) depending on whether T is <, equal to or > 2 seconds.

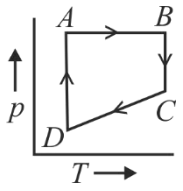
16. The escape velocity for a planet is V. A tunnel is dug along its diameter and a particle is dropped into the tunnel. At the centre of the planet, the speed of the particle will be

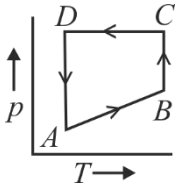
(1) V (2) $\frac{V}{2}$

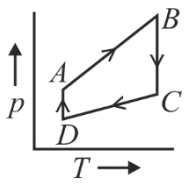
(3) $\frac{V}{\sqrt{2}}$ (4) $\frac{V}{2\sqrt{2}}$

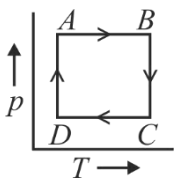
17. A cyclic process $ABCD$ is shown in the p-V diagram. Which of the following curves represents the same process?



(1) 

(2) 

(3) 

(4) 

18. Two identical containers A and B have frictionless pistons. They contain the same volume of an identical ideal gas at the same temperature. The mass of the gas in A is m_A and that in B is m_B. The gas in each cylinder is now allowed to expand isothermally to double the initial volume. The changes in the pressure in A and B are found to be Δp and $1.5\Delta p$ respectively. Then

(1) $4m_A = 9m_B$

(2) $2m_A = 3m_B$

(3) $3m_A = 2m_B$

(4) $9m_A = 4m_B$

19. A point source of heat of power P is placed at the centre of a spherical shell of mean radius R. The material of the shell has thermal conductivity k. If the temperature difference between the outer and inner surfaces of the shell is not to exceed T, the thickness of the shell should not be less than

(1) $\dfrac{4\pi kR^2T}{P}$

(2) $\dfrac{4\pi kR^2}{TP}$

(3) $\dfrac{4\pi R^2T}{kP}$

(4) $\dfrac{4\pi R^2P}{kT}$

20. Sounds from two identical sources S_1 and S_2 reach a point P. When the sounds reach directly, and in the same phase, the intensity at P is I_0. The power of S_1 is now reduced by 64%, and the phase difference between S_1 and S_2 is varied continuously. The maximum and minimum intensities recorded at P are now I_{max} and I_{min}.

(1) $I_{max} = 0.64\ I_0$

(2) $I_{min} = 0.36\ I_0$

(3) $I_{max}/I_{min} = 16$

(4) $I_{max}/I_{min} = 1.64/0.36$

***Integer Type Questions* (21 to 30)**

21. The average degree of freedom per molecule for a gas is 6. The gas performs 25 J of work when it expands at constant pressure. The heat absorbed by the gas (in J) is

22. In a 10-metre-deep lake, the bottom is at a constant temperature of 4°C. The air temperature is constant at –4°C. The thermal conductivity of ice is 3 times that of water. Neglecting the expansion of water on freezing, the maximum thickness of ice (in metre) will be

23. A 2 kg block drops vertically from a height of 40 cm on a spring whose force constant K is 1960 Newton per metre. Then, the maximum compression of the spring (in cm) is:

24. A wheel having a rotational inertia of 0.20 kg-m^2 rotates at 360 rpm about a vertical axis. What is the angular speed (in rad/sec) of the wheel when a torque of 1 N-m is applied about the same axis for 3.0 sec ?

25. Two wires A and B have the same length and area of cross-section. But Young's modulus of A is two times the Young's modulus of B. Then the ratio of force constant of A to that of B is:

26. A wire suspended vertically from one of its ends is stretched by attaching a weight of 200 N to the lower end. The weight stretches the wire by 1 mm. The elastic energy (in J) stored in the wire is:

27. A body floats in water with 40% of its volume outside water. When the same body floats in an oil, 60% of its volume remains outside oil. The relative density of oil is:

28. A layer of glycerine of thickness 1 mm is present between a large surface area and a surface area of 0.1 m^2. With what force (in N) the small surface is to be pulled, so that it can move with a velocity of 1 m/s? (Given that coefficient of viscosity = 0.07 kg m^{-1} s^{-1})

29. 80 gm of water at 30°C is poured on a large block of ice at 0°C. The mass of ice (in gm) that melts is:

30. The total KE of all the molecules of helium having a volume V exerting a pressure P is 1500 J. The total KE (in joules) of all the molecules of N_2 having the same volume V and exerting a pressure $2P$ is:

Section-II (CHEMISTRY)

***Single Correct Type Question* (31 *to* 50)**

31. 1.0 g of magnesium is burnt with 0.56 g O_2 in a closed vessel. Which reactant is left in excess and how much? (At. wt. of Mg = 24, O =16)

(1) Mg, 0.16 g (2) O_2, 0.16 g

(3) Mg, 0.44 g (4) O_2, 0.28 g

32. How fast is an electron moving if it has a wavelength equal to the distance it travels in one second?

(1) $\sqrt{\frac{m}{h}}$ (2) $\sqrt{\frac{h}{m}}$

(3) $\sqrt{\frac{h}{p}}$ (4) $\sqrt{\frac{h}{2(KE)}}$

33. The outer electronic configuration of Gd (Atomic No. 64) is

(1) $4f^3\,5d^5\,6s^2$

(2) $4f^8\,5d^0\,6s^2$

(3) $4f^4\,5d^4\,6s^2$

(4) $4f^7\,5d^1\,6s^2$

34. Arrange the following ions in the order of decreasing X–O bond length where X is the central atom

(1) $ClO_4^-, SO_4^{2-}, PO_4^{3-}, SiO_4^{4-}$

(2) $SiO_4^{4-}, PO_4^{3-}, SO_4^{2-}, ClO_4^-$

(3) $SiO_4^{4-}, PO_4^{3-}, ClO_4^-, SO_4^{2-}$

(4) $SiO_4^{4-}, SO_4^{2-}, PO_4^{3-}, ClO_4^-$

35. The species having bond order different from that in CO is

(1) NO^- (2) NO^+

(3) CN^- (4) N_2

36. What will happen to the volume of a bubble of air found under water in a lake where the temperature is 15°C and the pressure is 1.5 atm, if the bubble then rises to the surface where the temperature is 25°C and pressure is 1.0 atm?

(1) Its volume will become greater by a factor of 2.5

(2) Its volume will become greater by a factor of 1.6

(3) Its volume will become greater by a factor of 1.1

(4) Its volume will become smaller by a factor of 0.70

37. The incorrect expression among the following is:

(1) $K = e^{-\Delta G°/RT}$

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

(3) In isothermal process,

$$w_{reversible} = -nRT \ln \frac{V_f}{V_i}$$

(4) $\ln K = \frac{\Delta H° - T\Delta S°}{RT}$

38. The bond energy of an O – H bond is 109 kcal/mol. When a mole of water is formed, then

(1) 109 kcal is released

(2) 218 kcal is released

(3) 109 kcal is absorbed

(4) 218 kcal is absorbed

39. The values of K_{p1} and K_{p2} for the reactions

$$X \rightleftharpoons Y + Z \quad \ldots (1)$$

and $$A \rightleftharpoons 2B \quad \ldots (2)$$

are in the ratio of 9 : 1. If the degree of dissociation of X and A be equal, then total pressure at equilibrium (1) and (2) are in the ratio

(1) 3 : 1 (2) 1 : 9

(3) 36 : 1 (4) 1 : 1

40. Which of the following statements about HCO_3^- are correct?

1. It is a Bronsted acid
2. It can ionize in water to form CO_3^{2-} (aq)
3. It does not exist in aqueous solution
4. It is a Bronsted base.

Select the correct answer using the codes given below

(1) 1, 2 and 3 (2) 2, 3 and 4

(3) 1, 3 and 4 (4) 1, 2 and 4

41. In a saturated solution of the sparingly soluble strong electrolyte $AgIO_3$ (Molecular mass = 283), the equilibrium which sets in is

$$AgIO_3(s) \rightleftharpoons Ag^+(aq) + IO_3^-(aq)$$

If the solubility product constant K_{sp} of $AgIO_3$ at a given temperature is 1.0×10^{-8}, what is the mass of $AgIO_3$ contained in 100 ml of its saturated solution?

(1) 1.0×10^{-4} g (2) 28.3×10^{-2} g

(3) 2.83×10^{-3} g (4) 1.0×10^{-7} g

42. 3.92 g of ferrous ammonium sulphate are dissolved in 100 ml water. 20 ml of this solution requires 18 ml of potassium permanganate during titration for complete oxidation. The weight of $KMnO_4$ present in one litre of the solution is

(1) 34.76 g (2) 12.38 g
(3) 1.238 g (4) 3.476 g

43. Calcium is obtained by the

(1) Roasting of limestone
(2) Electrolysis of a solution of calcium chloride in H_2O
(3) Reduction of calcium chloride with carbon
(4) Electrolysis of molten anhydrous calcium chloride.

44. Which of the following substances on treatment with H_2O_2 gives MnO_2

(1) acidified $KMnO_4$
(2) alkaline $KMnO_4$
(3) alkaline $MnSO_4$
(4) Both (2) and (3)

45. The oxide which is the strongest acid is

(1) Tl_2O_3 (2) PbO_2
(3) CO_2 (4) SnO_2

46. The correct stability order of the following resonance structures is

(I) $H_2C=\overset{+}{N}=N^-$

(II) $H_2\overset{+}{C}-N=N^-$

(III) $H_2C^- - \overset{+}{N}\equiv N$

(IV) $H_2C^- - N=\overset{+}{N}$

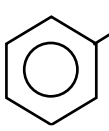
(1) I > II > IV > III (2) I > III > II > IV
(3) II > I > III > IV (4) III > I > IV > II

47. The Lassaigne's extract is boiled with conc. HNO_3 while testing for halogens. By doing so it

(1) decomposes Na_2S and NaCN, if formed
(2) helps in the precipitation of AgCl
(3) increases the solubility product of AgCl
(4) increases the concentration of NO_3^- ions

48. The process of 'eutrophication' is due to

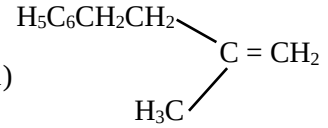
(1) increase in concentration of insecticide in water
(2) increase in concentration of fluoride ion in water
(3) the reduction in concentration of the dissolved oxygen in water due to phosphate pollution in water
(4) attack of younger leaves of a plant by peroxyacetyl nitrate

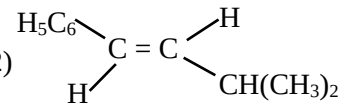
49. In a compound  electrophilic substitution has occurred. The substituent-E are methyl, $-CH_2Cl$, $-CCl_3$ and $-CHCl_2$. The correct increasing order towards electrophilic substitution is

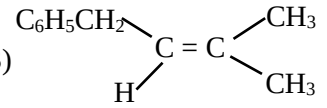
(1) $-CH_3 < -CH_2Cl < -CHCl_2 < -CCl_3$
(2) $-CH_3 < -CHCl_2 < -CH_2Cl < -CCl_3$
(3) $-CCl_3 < -CH_2Cl < -CHCl_2 < -CH_3$
(4) $-CCl_3 < -CHCl_2 < -CH_2Cl < -CH_3$

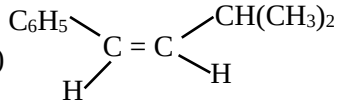
50. The main product of the following reaction is

$C_6H_5CH_2CH(OH)CH(CH_3)_2 \xrightarrow{\text{Conc. } H_2SO_4}$

(1) 

(2) 

(3) 

(4) 

Integer Type Questions **(51 to 60)**

51. The degree of dissociation of an acid HA_1 is 9 times the degree of dissociation of acid HA_2 of the same concentration, then the ratio of the strengths of acid HA_1 to HA_2 will be

52. How many silicon atoms are present in the anion of a pyrosilicates?

53. The value of n in the molecular formula Be_n $Al_2Si_6O_{18}$ is

54. The number of moles of an ideal gas that should be taken in a closed vessel of 30 L capacity at a temperature of 27°C so that the pressure exerted by the gas on the walls of the container is 4.1 atmosphere is

55. A student performs a titration with different burettes and finds titre values of 25.2 mL, 25.25 mL, and 25.0 mL. The number of significant figures in the average titre value is

56. In an atom, the total number of electrons having quantum numbers, n = 4, $|m_\ell| = 1$ and $m_s = -1/2$ is

57. To an evacuated vessel with movable piston under external pressure of 1 atm. 0.1 mol of He and 1.0 mol of an unknown compound (vapour pressure 0.68 atm at 0°C) are introduced. Considering the ideal gas behaviour, the total volume (in litre) of the gases at 0°C is close to

58. Total number of coordinate bonds present in a molecule of $CuSO_4.5\ H_2O$ is

59. Which of the following molecules have zero dipole moment?
cis-1, 2-dichloroethene, *trans*-1, 2-dichloro - ethene, 1, 1-dichloroethene, *trans*-2-pentene, *cis*-2-pentene, 1-butyne, 2-butyne, *trans*-2-butene, *cis*-2-butene.

60. CO is pollutant produced due to incomplete combustion of butane. One mole of butane requires 6.5 moles of O_2 for complete combustion. If 6 moles of oxygen are available, then number of moles of CO produced will be

Section-III (MATHEMATICS)

***Single Correct Type Question* (61 *to* 80)**

61. If the roots of the equation $ax^2 + bx + c = 0$ are in the ratio $m : n$, then
(1) $mnb^2 = ac(m + n)^2$
(2) $b^2(m + n) = mn$
(3) $m + n = b^2mn$
(4) $mnc^2 = ab(m + n)^2$

62. A pole 50 m high stands on a building 250 m high. To an observer at a height of 300 m, the building and the pole subtend equal angles. The horizontal distance of the observer from the pole is
(1) 25 m
(2) 50m
(3) $25\sqrt{6}$ m
(4) $25\sqrt{3}$ m

63. If a and b are two real numbers lying between 0 and 1, such that $Z_1 = a + i$, $Z_2 = 1 + bi$ and $Z_3 = 0$ form an equilateral triangle, then
(1) $a = 2 + \sqrt{3}$ (2) $b = 4 - \sqrt{3}$
(3) $a = b$ (4) $a = 2, b = \sqrt{3}$

64. The difference between the greatest and the least possible value of the expression $3 - \cos x + \sin^2 x$ is
(1) 13/4 (2) 17/4
(3) 9/4 (4) 1/4

65. The Negation of the statement "If Amit is eating then Bipin is sleeping" is:
(1) Amit is eating or Bipin is not sleeping
(2) If Amit is not sleeping then Bipin is not sleeping
(3) Amit is eating and Bipin is not sleeping
(4) Amit is not eating or Bipin is sleeping

66. If $S = 1 + 1\cdot1! + 2\cdot2! + 3\cdot3! + \ldots\ldots + n \cdot n!$. Then the value of S is equal to
(1) $(n + 1)! - 1$
(2) $(n + 2)!$
(3) $(n + 1)!$
(4) $(n + 2)! - 1$

67. In which ratio the line segment joining the points (3, 4, 10) and (–3, 2, 5) is divided by x-axis?
(1) 2 : 1 internally
(2) 2 : 1 externally
(3) 1 : 2 internally
(4) 1 : 2 externally

68. If $x, y, z \in R^+$ such that $x + y + z = 4$ then maximum possible value of xyz^2 is
(1) 3 (2) 4
(3) 5 (4) 6

69. If $\sigma_A, \sigma_B, \sigma_C$ are the variance of heights of students of three sections each containing 10 students as follows.

Section A	Section B	Section C
20	30	40
21	31	41
22	32	42
23	33	43
24	34	44
25	34	45
26	36	46
27	37	47
28	38	48
29	39	49

Then $\sigma_A : \sigma_B : \sigma_C$ is
(1) 1 : 2 : 3 (2) 2 : 3 : 4
(3) 1 : 1 : 1 (4) 1 : 2 : 4

70. Let a_1, a_2, a_3 …….. are in A.P. If $\frac{a_1+a_2+.....+a_p}{a_1+a_2+.....+a_q}=\frac{p^2+p}{q^2+q}$, $p \neq q$, then the value of $\frac{a_5}{a_{15}}$ is

(1) $\frac{3}{8}$ (2) $\frac{9}{31}$

(3) $\frac{1}{3}$ (4) $\frac{2}{7}$

71. The curve represented by $x = 3(\cos t + \sin t)$, $y = 4(\cos t - \sin t)$, (where t is parameter) is -

(1) ellipse (2) parabola

(3) hyperbola (4) circle

72. By using 2, 4, 5, 7, 8, 9 how many three digit numbers are formed in form xyz when $x < y$ and $z < y$ (repetition not allowed).

(1) 20 (2) 40

(3) 60 (4) 30

73. If a_n be the n^{th} term of an A.P. and if $a_7 = 15$, then the value of the common difference that would make $a_2\ a_7\ a_{12}$ greatest is:-

(1) 7 (2) 9/4

(3) 0 (4) 18

74. Sum of the roots of the equation $x^2 + |2x - 3| - 4 = 0$ is

(1) 2 (2) -2

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

75. The focus of the parabola $(y - 3)^2 = 8(x + 2)$ is

(1) (2, 0) (2) (0, 3)

(3) (0, 2) (4) (3, 0)

76. The centres of the circles $x^2 + y^2 = 1$, $x^2 + y^2 + 6x - 2y - 1 = 0$ and $x^2 + y^2 - 12x + 4y - 1 = 0$ are

(1) The vertices of an equilateral triangle

(2) The vertices of a right angled triangle

(3) The vertices of an isosceles triangle

(4) Collinear

77. If $1+\cos\alpha+\cos^2\alpha+\cos^3\alpha+...+\infty$ $= 2-\sqrt{2}$, $(\pi<\alpha<2\pi)$, then the value of α is

(1) $\frac{5\pi}{4}$ (2) $\frac{7\pi}{4}$

(3) $\frac{4\pi}{3}$ (4) $\frac{5\pi}{3}$

78. The equation of the curve whose parametric equation is $x = 2t - 3$ and $y = 4t^2 - 1$, is given by

(1) $y^2 + 6x - y + 8 = 0$

(2) $x^2 + 6x - y + 8 = 0$

(3) $x^2 + y^2 - 6x - y - 8 = 0$

(4) $x^2 + y^2 - 6x + y - 8 = 0$

79. The equation $\frac{x^2}{16-k}+\frac{y^2}{k-9}=1$ represents an ellipse if

(1) $k < 9$

(2) $k > 16$

(3) $k \in (9,16)-\left\{\frac{25}{2}\right\}$

(4) $k \in (-16,-9)-\left\{-\frac{25}{2}\right\}$

80. If $\frac{^{n+2}C_6}{^{n-2}P_2}=11$, then n satisfies the equation

(1) $n^2 + n - 110 = 0$

(2) $n^2 + 2n - 80 = 0$

(3) $n^2 + 3n - 108 = 0$

(4) $n^2 + 5n - 84 = 0$

***Integer Type Question* (81 *to* 90)**

81. If 5^{97} is divided by 52, then the remainder obtained is

82. If $\frac{1}{1!11!}+\frac{1}{3!9!}+\frac{1}{5!7!}=\frac{2^n}{m!}$, then the value of $m + n$ is

83. The exponent of 7 in $^{100}C_{50}$ is

84. If the maximum value of $y=\frac{7+6\tan x-\tan^2 x}{(1+\tan^2 x)}$ is λ then the value of $\log_{\sqrt{2}}(\lambda)$ is

85. If $y=\frac{x^{12}+x^6+1}{x^6+x^3+1}$ & $\frac{dy}{dx}=x^2(ax^3+b)$, then the value of $(a + b)$ is equal to

86. Number of principal solution(s) of the equation $4.16^{\sin^2 x} = 2^{6\sin x}$ is

87. If the product of the roots of the equation $x^2 - 3kx + 2e^{2\ln k} - 1 = 0$ is 7, then the roots of the equation are real for k equal to

88. Total number of ways of selecting 10 balls out of unlimited number of white, red, blue and green balls given that balls of each colour are identical, is $11P$ then value of P is

89. If the value of $\sum_{r=16}^{30}(r+2)(r-3)$ is equal to k, then find $k - 7700$.

90. The number of values of α in $[0,2\pi]$ for which $2\sin^3\alpha-7\sin^2\alpha+7\sin\alpha=2$, is: