MOCK TEST PAPER 10

General Instructions: *Same as Mock Test Paper 1.*

Physics

Section A

Q. 1. If energy E, velocity (V) and time (T) are chosen as the fundamental quantities, then the dimensions of surface tension will be :

(1) $[EV^{-2}T^{-1}]$ **(2)** $[EV^{-1}T^{-2}]$

(3) $[EV^{-2}T^{-2}]$ **(4)** $[E^{-2}V^{-1}T^{-3}]$

Q. 2. A vector $\vec{P}_1$ is along the positive x-axis. If its vector product with another vector $\vec{P}_2$ is zero, then $\vec{P}_2$ could be :

(1) $4\hat{j}$ **(2)** $-4\hat{i}$

(3) $(\hat{j}+\hat{k})$ **(4)** $-(\hat{i}+\hat{j})$

Q. 3. The trajectory of a projectile in a vertical plane is $y = ax - bx^2$, where a and b are constants and x and y are respectively horizontal and vertical distances of the projectile from the point of projection. The maximum height attained by the particle and the angle of projection from the horizontal are:

(1) $\frac{b^2}{2a}, \tan^{-1}(b)$ **(2)** $\frac{a^2}{b}, \tan^{-1}(2a)$

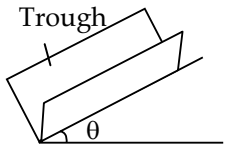
(3) $\frac{a^2}{4b}, \tan^{-1}(a)$ **(4)** $\frac{2a^2}{b}, \tan^{-1}(a)$

Q. 4. A block of mass M is pulled along a horizontal frictionless surface by a rope of mass m. If a force P is applied at the free end of the rope, the force exerted by the rope on the block is :

(1) $\frac{Pm}{M+m}$ **(2)** $\frac{Pm}{M-m}$

(3) P **(4)** $\frac{PM}{M+m}$

Q. 5. A block of mass m slides down an inclined right angled trough as shown in the figure. If the coefficients of kinetic friction between block and material composing the trough is μ_k, find the acceleration of the block :



(1) $g(\sin\theta - \sqrt{2}\mu_k \cos\theta)$

(2) $g(\sin\theta - \mu_k \cos\theta)$

(3) $g(\sin\theta - 2\mu_k \cos\theta)$

(4) $g(\sin\theta - \sqrt{\mu_k} \cos\theta)$

Q. 6. An insulating solid sphere of radius 'R' is charged in a non-uniform manner such that volume charge density $\rho = \frac{A}{r}$, where A is a positive constant and r is the distance from centre. Electric field strength at any inside point at distance r_1 is :

(1) $\frac{1}{4\pi\varepsilon_0}\frac{4\pi A}{r_1}$ **(2)** $\frac{1}{4\pi\varepsilon_0}\frac{A}{r_1}$

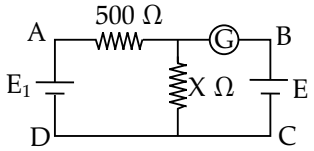
(3) $\frac{A}{\pi\varepsilon_0}$ **(4)** $\frac{A}{2\varepsilon_0}$

Q. 7. Two metallic charged spheres whose radii are 20 cm and 10 cm, respectively, each having 150 μC positive charge. The common potential after they are connected by a conducting wire is :

(1) 9×10^6 V **(2)** 4.5×10^6 V

(3) 1.8×10^7 V **(4)** 13.6×10^6 V

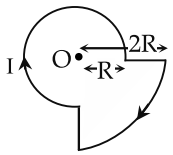
Q. 8. In an experiment according to set up, E_1 = 12 volt having zero internal resistance and E = 2 volt. The galvanometer reads zero, then X (in ohm) would be :



(1) 200 **(2)** 500

(3) 100 **(4)** 10

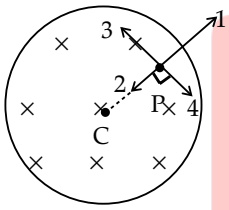
Q. 9. A current I flowing through the loop as shown in the adjoining figure. The magnetic field at centre O is :



(1) $\frac{7\mu_0 I}{16 R}\otimes$ **(2)** $\frac{7\mu_0 I}{16 R}\odot$

(3) $\frac{5\mu_0 I}{16 R}\otimes$ **(4)** $\frac{5\mu_0 I}{16 R}\odot$

Q. 10. A uniform but time varying magnetic field exists in cylindrical region and directed into the paper. If field decrease with time and a positive charge placed at any point inside the region. Then it moves :



(1) along 1 **(2)** along 2

(3) along 3 **(4)** along 4

Q. 11. A copper disc of radius 0.1 m is rotated about its centre with 20 revolution per second in a uniform magnetic field of 0.1 T with its plane perpendicular to the field. The emf induced across the radius of the disc is :

(1) $\frac{\pi}{20}$ volt **(2)** $\frac{\pi}{10}$ volt

(3) 20 π milli volt **(4)** 100 π milli volt

Q. 12. A bulb is rated at 100 V, 100 W, it can be treated as a resistor. Find out the inductance of an inductor (called choke coil) that should be connected in series with the bulb to operate the bulb at its rated power with the help of an ac source of 200 V and 50 Hz.

(1) $\frac{\pi}{\sqrt{3}}$ H **(2)** 100 H

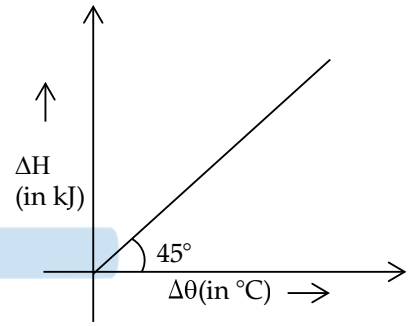
(3) $\frac{\sqrt{2}}{\pi}$ H **(4)** $\frac{\sqrt{3}}{\pi}$ H

Q. 13. Consider a solid cube of uniform charge density of insulating material. What is the ratio of the electrostatic potential at a corner to that at the centre: (Take the potential to be zero at infinity, as usual)

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

(3) $\frac{1}{4}$ **(4)** $\frac{1}{9}$

Q. 14. A solid of mass 2 kg is heated and ΔH (Heat given) vs Δθ (change in temperature) is plotted. Specific heat of solid is :



(1) 1 J/kg/°C **(2)** 0.5 J/kg/°C

(3) 2 kJ/kg/°C **(4)** 0.5 kJ/kg/°C

Q. 15. A parallel plate capacitor of plate area A and separation d is provided with thin insulating spacers to keep its plates aligned in an environment of fluctuating temperature. If the coefficient of thermal expansion of material of plate is α then the coefficient of thermal expansion (α_S) of the spacers in order that the capacitance does not vary with temperature (ignore effect of spacers on capacitance)

(1) $\alpha_S = \frac{\alpha}{2}$ **(2)** $\alpha_S = 3\alpha$

(3) $\alpha_S = 2\alpha$ **(4)** $\alpha_S = \alpha$

Q. 16. A wire is 4 m long and has a mass 0.2 kg. The wire is kept horizontally. A transverse pulse is generated by plucking one end of the taut (tight) wire. The pulse makes four trips back and forth along the cord in 0.8 sec. The tension is the cord will be : (Assume uniform tension throughout the wire)

(1) 80 N **(2)** 160 N

(3) 240 N **(4)** 320 N

Q. 17. Consider a plane standing sound wave of frequency 10^3 Hz in air at 300 K. Suppose the amplitude of pressure variation associated with this wave is 1 dyne/cm^2. The equilibrium pressure is 10^6 dyne/cm^2. The amplitude of displacement of air molecules associated with this wave is :

(Given speed of sound : 340 m/s

Molar mass of air : 29×10^{-3} kg/mol)

(1) 4×10^{-6} m **(2)** 40×10^{-6} m

(3) 400×10^{-6} m **(4)** 40000×10^{-6} m

Q. 18. A body is floating partially immersed in a liquid. If the body and the liquid are taken to the moon, the body will :

(1) Continue to float exactly as in the Earth.

(2) Float with larger part immersed in the liquid.

(3) Float with a smaller part immersed in the liquid.

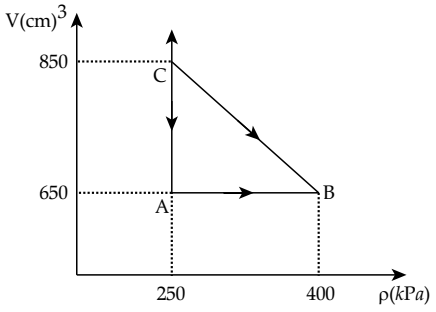
(4) Sink

Q. 19. A body is heated to temperature 40° and kept in a chamber maintained at 20°. If temperature decreases to 36° in 2 minutes. Time after it will further decrease by 4° is :

(1) 2 min **(2)** 2 min 33 s

(3) 2 min 55 s **(4)** 3 min

Q. 20. A gas is taken through a cyclic process ABCA as shown in figure. If 3.6 calories of heat is given in the process, one calorie is equivalent to :



(1) 4.20 J **(2)** 4.19 J

(3) 4.18 J **(4)** 4.17 J

Section B

Q. 21. A block of mass $m = 1$ kg moving on horizontal surface with speed $u = 2$ m/s enters a rough horizontal patch ranging from $x = 0.10$ m to $x = 2.00$ m. If the retarding force f_r on the block in this range is inversely proportional to x over this range i.e.

$$f_r = \frac{-k}{x}, \ 0.10 < x < 2.00$$

$= 0$ for $x < 0.10$ and $x > 2.00$

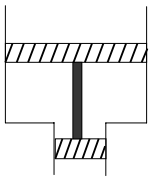
If $k = 0.5$ J then the speed of this block as it crosses the patch is ..... m/s. (use ln 20 = 3)

Q. 22. A sphere of mass $m = 0.5$ kg carrying positive charge $q = 110$ μC is connected with a light, flexible and inextensible spring of length $r = 60$ cm and whirled in a vertical circle. If a vertically upwards electric field of strength E = 10^5 N/C exists in the space then the minimum velocity of sphere ..... m/s required at highest point so that it may just complete the circle is (g = 10 m/s^2)

Q. 23. The electric potential difference between two points is 50kV. If a charge of 20C, having a mass of 200 kg, is placed at the high-potential end, then find the final speed of the charge as it reaches the low- potential end in m s^{-1} is.....

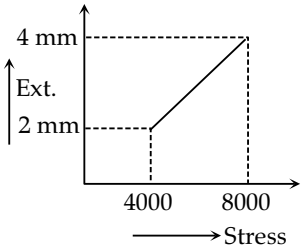
Q. 24. A uniform ball of radius R = 10 cm rolls without slipping between two rails such that the horizontal distance is d = 16 cm between two contact points of the rail to the ball. If the angular velocity is 5 rad/s, then the velocity of centre of mass of the ball is ..... cm/s.

Q. 25. A smooth vertical conducting tube have two different section is open from both ends and equipped with two piston of different areas. Each piston slides in respective tube section. 1 liter of ideal gas at pressure 1.5×10^5 Pa is enclosed between the piston connected with a light rod. The cross section area of upper piston is 10π cm^2 greater than lower one. Combined mass of two piston is 1.5 kg. If the piston is displaced slightly. Time period of oscillation will be ..... $\times 10^{-1}$ s.



Q. 26. In determination of young modulus of elasticity of wire, a force is applied and extension is recorded. Initial length of wire is '1 m'. The curve between extension and

stress is depicted then young modulus of wire will be K × 10^9 N/m^2, where K is ..... × 10^9 N/m^2.

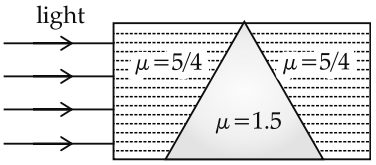


Q. 27. The focal length of a biconvex lens made with glass (m = 1.5) having equal radii of curvature is 20 cm. Find the radii of curvature of lense.

(1) 22 cm **(2)** 20 cm

(3) 18 cm **(4)** 40 cm

Q. 28. A thin isosceles prism with angle 4° and refractive index 1.5 is placed inside a transparent tube with water (refractive index = $\frac{5}{4}$) as shown. The deviation of light whether upward or downward due to prism will be in degree is .....



Q. 29. As Ideal Gas at 27° C is compressed adiabatically to $\frac{8}{27}$ of its original volume. If g = $\frac{5}{3}$, then the rise in temperature is

(1) 450 K **(2)** 375K

(3) 225 K **(4)** 405K

Q. 30. When the voltage applied to an X-ray tube is increased from 10 kV to 20 kV, the wavelength interval between the k_α line the short wave cut off the continuous X-Ray spectrum increases by a factor of 3. The atomic number of element for which the tube anticathode is made, is ..... (Rydberg's constant 10^7 m^{-1}).

Chemistry

Section A

Q. 31. Polarisation may be called as the distortion of the shape of an anion by an adjacently placed cation. Which of the following statements is/are correct ?

(1) Lesser polarization is brought about by a cation of low radius

(2) A large cation is likely to bring about a large degree of polarisation

(3) Larger polarisation is brought about by a cation of high charge

(4) A small anion is likely to undergo a large degree of polarisation

Q. 32. Lanthanide contraction is related with :

(1) Sharp decrease in atomic size in lanthanide series

(2) Slow or gradual decrease in atomic size in lanthanide series

(3) Constancy in atomic size

(4) All of the above

Q. 33. The compound which has one isopropyl group is :

(1) 2, 2, 3, 3-tetramethyl pentane

(2) 2, 2-dimethyl pentane

(3) 2, 2, 3-trimethyl pentane

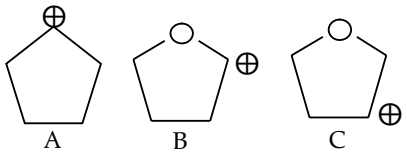
(4) 2-methyl pentane

Q. 34. CH_3–CH_2–CH_2–CH_3. There is free rotation about (C_2 σ C_3) bond. The same most stable form is repeated after rotation of :

(1) 60° **(2)** 120°

(3) 240° **(4)** 360°

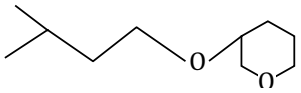
Q. 35. Arrange the following carbocations in decreasing order of stability.

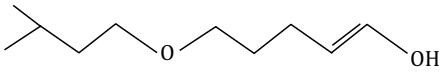


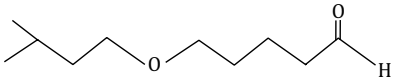
(1) B>A>C **(3)** A>B>C

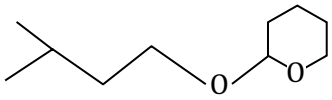
(3) C>B>A **(4)** C>A>B

Q. 36. The major product formed in the following reaction, is

(1) 

(2) 

(3) 

(4) 

Q. 37. Among the following, which is the strongest oxidizing agent?

(1) Mn^{3+} **(2)** Fe^{3+}

(3) Ti^{3+} **(4)** Cr^{3+}

Q. 38. SO_2Cl_2 on reaction with excess of water results into acidic mixture

$SO_2Cl_2 + 2H_2O \rightarrow H_2SO_4 + 2HCl$

16 moles of NaOH is required for the complete neutralization of the resultant acidic mixture. The number of moles of SO_2Cl_2 used is:

(1) 16 **(2)** 8

(3) 4 **(4)** 2

Q. 39. HCHO with conc. alkali forms two compounds. The change in oxidation number of carbon would be :

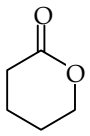
(1) (0 to –2) in both the compounds

(2) (0 to +2) in both the compounds

(3) (0 to +2) in one compound and (0 to –2) in the second compound

(4) All of the above

Q. 40. $OHC–CH_2–CH_2–CH_2–CH_2–OH$

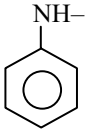
is converted into  by :

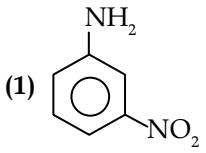
(1) (i) $KMnO_4$ (ii) H^+, ΔH

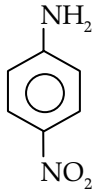
(2) (i) $Na_2Cr_2O_7$ (ii) H^+, Δ

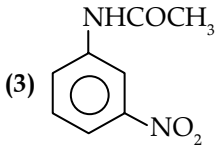
(3) (i) Ag_2O (ii) H^+, Δ

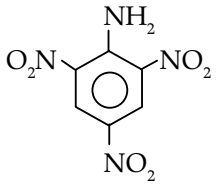
(4) All of the above

Q. 41.  $\xrightarrow{HNO_3/H_2SO_4}$ X $\xrightarrow[\text{heat}]{H_2O/H^+}$ Z, Z is :

(1) 

(2) 

(3) 

(4) 

Q. 42. Glycoside linkage is :

(1) an amide linkage **(2)** an ether linkage

(3) an ester linkage **(4)** none of the above

Q. 43. Dumas method involves the determination of nitrogen content in the organic compound in form of

(1) NH_3 **(2)** N_2

(3) NaCN **(4)** $(NH_4)_2SO_4$

Q. 44. In which of the following molecules, the substituent does not exhibit resonance effect?

(1) $C_6H_5NH_2$ **(2)** $C_6H_5\overset{\oplus}{N}H_3$

(3) C_6H_5OH **(4)** C_6H_5Cl

Q. 45. The reduction of oct-4-yne with H_2 in the presence of $Pd/CaCO_3$ gives (major product)

(1) *trans*-oct-4-ene

(2) *cis*-oct-4-ene

(3) a mixture of cis and trans-oct-4-ene

(4) a completely reduced product C_8H_{18}

Q. 46. The species responsible for nitration and sulphonation by nitric acid conc. H_2SO_4 and fuming H_2SO_4 respectively are :

(1) NO_2 and SO_3 **(2)** $\overset{\oplus}{N}O_2$ and SO_3

(3) $\overset{\oplus}{N}O$ and SO_2 **(4)** NO_2 and SO_2

Q. 47. Ester A $(C_4H_8O_2)$ + CH_3MgBr $\xrightarrow{H_3O^+}$ $C_4H_{10}O$

(2 parts) (alcohol)

(B)

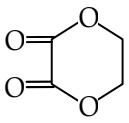
Here A and B are

(1) $CH_3–\overset{\overset{O}{\|}}{C}–O–C_2H_5$, $(CH_3)_3COH$

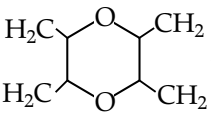
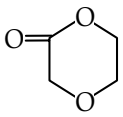
(2) $H–\overset{\overset{O}{\|}}{C}–O–C_3H_7$, $(CH_3)_2CHOH$

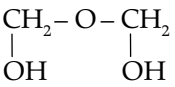
(3) $CH_3-\overset{\overset{O}{\|}}{C}-O-C_2H_5$, $(CH_3)_2CHOH$

(4) $H-\overset{\overset{O}{\|}}{C}-O-C_3H_7$, $(CH_3)_3COH$

Q. 48. Oxalic acid + A → 

hence A $\xrightarrow{\text{conc. } H_2SO_4}$ B, B is :

(1)  **(2)** 

(3)  **(4)** None of these

Q. 49. pH of 10^{-7} M HCl solution is :

(1) 7 – log2 **(2)** 7 – log 1.618

(3) 7 **(4)** 6.95

Q. 50. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (R) : Experimental reaction of CH_3Cl with aniline and anhydrous $AlCl_3$ does not give o and p–methylaniline.

Reason (R) : The $-NH_2$ group of aniline becomes deactivating because of salt formation with anhydrous $AlCl_3$ and hence yields *m*–methyl aniline as the product.

In the light of the above statements, choose the most appropriate answer from the options given below :

(1) Both (A) and (R) are true and (R) is the correct explanation of (A).

(2) Both (A) and (R) are true but (R) is not the correct explanation of (A).

(3) (A) is true, but (R) is false.

(4) (A) is false, but (R) is true.

Section B

Q. 51. In an ore the only oxidisable material is Sn^{2+}. This ore is titrated with a dichromate solution containing 2.5 g of $K_2Cr_2O_7$ in 0.50 litre. A 0.40 g sample of the ore required 10.0 cm^3 of titrant to reach equivalence point. The percentage of tin in ore is ..... .

(K = 39.1, Cr = 52, Sn = 118.7)

Q. 52. 28.0 g of N_2 gas at 350 K and 25 atm was allowed to expand isothermally against a constant external pressure of 1 atm. The value of '*q*' for the gas is ..... J.

Q. 53. In the preparation of quick lime from lime stone, the reaction is:

$CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$

Experiments carried out between 850°C and 950°C led to set of K_p values fitting an empirical equation

$$\log K_p = 7.282 - \frac{8500}{T}$$

where T is absolute temp. If the reaction is carried out in quite air, the temperature predicted from this equation for complete decomposition of the lime stone would be ..... K.

Q. 54. The cell potential for $Zn|Zn^{2+}(aq)||Sn^{x+}|Sn$ is 0.801 V at 298K. The reaction quotient for the above reaction is 10^{-2}. The number of electrons involved in the given electrochemical cell reaction is _____.

(Given: $E^o_{Zn^{2+}|Zn} = 0.763V$,

$E^o_{Sn^{x+}|Sn} = +0.008V$ **and** $\frac{2.303RT}{F} = 0.06V$

Q. 55. At room temperature (20°C) orange juice gets spoilt in about 64 hours. In a refrigerator at 3°C juice can be stored three times as long before it gets spoling. The time taken by juice to get spoilt at 40°C is ..... hours.

Q. 56. The voltage of the cell :

$Pb|PbSO_4|Na_2SO_4.10H_2O(salt)|Hg_2SO_4|Hg$

is + 0.9647 at 25°C. The temperature coefficient is 1.74×10^{-4} V. K^{-1}.

The values of ΔS is ..... cal K^{-1} mol^{-1}.

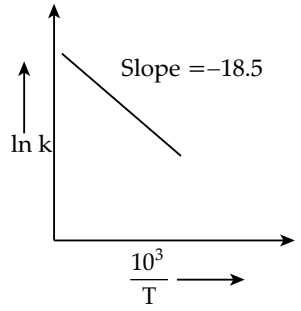
Q. 57. Number of grams of bromine that will completely react with 5.0 g of pent-1-ene is _____ $\times 10^{-2}$ g.

(Atomic mass of Br = 80 g/mol) [Nearest Integer]

Q. 58. 1.5 g of a monobasic acid when dissolved in 150 g of water lowers the freezing point by 0.165°C. 0.5 g of the same acid when titrated, after dissolution in water, requires 37.5 ml of N/10 alkali. The degree of dissociation of the acid is ..... %. (K_f for water = 1.86°C mol^{-1}).

Q. 59. The rate constants for decompostion of acetaldehyde have been measured over the

temperature range 700–1000 K. The data has been analysed by plotting ln k vs $\frac{10^3}{T}$ graph. The value of activation energy for the reaction is_____ kJ mol^{-1}. (Nearest integer)
(Given: R = 8.31 J K^{-1} mol^{-1})



Q. 60. The standard molar enthalpies of formation of IF_3 (g) and IF_5 (g) are –470 kJ and –847 kJ, respectively. Valence shell electron pair repulsion theory predicts that IF_5 (g) is square pyramidal in shape in which all I–F bonds are equivalent while IF_3 (g) is T-shaped (based on trigonal bipyramidal geometry) in which I–F bonds are of different lengths. It is observed that the axial I–F bonds in IF_3 are equivalent to the I–F bonds in IF_5. The equatorial I–F bond strength in IF_3 is ..... kJ/mol. Some other informations given are :

I_2 (s) $\rightarrow$ I_2 (g) ; ΔH = 62 kJ
F_2 (g) $\rightarrow$ 2F (g); ΔH = 155 kJ
I_2 (g) $\rightarrow$ 2 I (g) ; ΔH = 149 kJ

Mathematics

Section A

Q. 61. Let $z \in C$ be such that $|z| < 1$. If $\omega = \frac{5+3z}{5(1-z)}$, then

(1) 5 Re (ω) > 4 **(2)** 4 Im (ω) > 5
(3) 5 Re (ω) > 1 **(4)** 5 Im (ω) < 1

Q. 62. Let $f : R \rightarrow R$ be a continuous function such that $f(3x) - f(x) = x$. If $f(8) = 7$, then $f(14)$ is equal to

(1) 4 **(2)** 10 **(3)** 11 **(4)** 16

Q. 63. Let O be the origin and A be the point $z_1 = 1 + 2i$. If B is the point z_2, $\text{Re}(z_2) < 0$, such that OAB is a right angled isosceles triangle with OB as hypotenuse, then which of the following is NOT true ?

(1) $\arg z_2 = \pi - \tan^{-1}3$
(2) $\arg(z_1 - 2z_2) = -\tan^{-1}\frac{4}{3}$
(3) $|z_2| = \sqrt{10}$
(4) $|2z_1 - z_2| = 5$

Q. 64. Let A be a 2 × 2 matrix with det $(A) = -1$ and det $((A + I)\,(\text{Adj}\,(A) + I)) = 4$. Then the sum of the diagonal elements of A can be

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

Q. 65. Consider two G.Ps. 2, 2^2, 2^3,.... and 4, 4^2, 4^3,... of 60 and n terms respectively. If the geometric mean of all the 60 + n terms is $(2)^{\frac{225}{8}}$, then $\sum_{k=1}^{n} k(n-k)$ is equal to

(1) 560 **(2)** 1540
(3) 1330 **(4)** 2600

Q. 66. Let P and Q be any points on the curves $(x-1)^2 + (y+1)^2 = 1$ and $y = x^2$, respectively. The distance between P and Q is minimum for some value of the abscissa of P in the interval

(1) $\left(0, \frac{1}{4}\right)$ **(2)** $\left(\frac{1}{2}, \frac{3}{4}\right)$
(3) $\left(\frac{1}{4}, \frac{1}{2}\right)$ **(4)** $\left(\frac{3}{4}, 1\right)$

Q. 67. How many numbers of four digits greater than 2300 can be formed with the digits 0, 1, 2, 3, 4, 5 and 6; no digit being repeated in any number ?

(1) 560 **(2)** 590
(3) 90 **(4)** 360

Q. 68. The area of the pentagon whose vertices are (4, 1), (3, 6), (–5, 1), (–3, –3) and (–3, 0) is

(1) 30 unit^2 **(2)** 60 unit^2
(3) 120 unit^2 **(4)** 150 unit^2

Q. 69. The equation of the circle which passes through the points (1, –2) and (4, –3) and which has its centre on the straight line $3x + 4y = 7$ is

(1) $15x^2 + 15y^2 + 94x + 18y + 55 = 0$
(2) $15x^2 + 15y^2 - 94x - 18y + 55 = 0$

(3) $15x^2 + 15y^2 - 94x + 18y + 55 = 0$
(4) $15x^2 + 15y^2 + 94x - 18y - 55 = 0$

Q. 70. A point P moves so that the sum of squares of its distances from the points (1, 2) and (– 2, 1) is 14. Let $f(x, y) = 0$ be the locus of P, which intersects the x-axis at the points A, B and the y-axis at the points C, D. Then the area of the quadrilateral ACBD is equal to

(1) $\frac{9}{2}$ **(2)** $\frac{3\sqrt{17}}{2}$
(3) $\frac{3\sqrt{17}}{4}$ **(4)** 9

Q. 71. If $\frac{dy}{dx} + 2y \tan x = \sin x$, $0 < x < \frac{\pi}{2}$ and $y\left(\frac{\pi}{3}\right) = 0$, then the maximum value of $y(x)$ is

(1) $\frac{1}{8}$ **(2)** $\frac{3}{4}$
(3) $\frac{1}{4}$ **(4)** $\frac{3}{8}$

Q. 72. The equation of the hyperbola whose conjugate axis is 5 and the distance between the foci is 13 is

(1) $9x^2 - 144y^2 = 900$
(2) $25x^2 - 144y^2 = 900$
(3) $25x^2 - 144y^2 = 200$
(4) $25x^2 - 36y^2 = 900$

Q. 73. Which of the following function from $A = \{x : -1 \le x \le 1\}$ to itself is bijection :

(1) $f(x) = \frac{x}{2}$ **(2)** $g(x) = \sin\left(\frac{\pi x}{2}\right)$
(3) $h(x) = |x|$ **(4)** $k(x) = x^2$

Q. 74. Let $f(x) = \begin{cases} x^3 - x^2 + 10x - 7, & x < 1 \\ -2x + \log_2(b^2 - 4), & x > 1 \end{cases}$

Then the set of all values of b, for which $f(x)$ has maximum value at $x = 1$, is

(1) $(-6, -2)$
(2) $(2, 6)$
(3) $[-6, -2) \cap (2, 6]$
(4) $[-\sqrt{6}, -2) \cup (2, \sqrt{6}]$

Q. 75. If $f(x) = \begin{cases} 1 & \text{if } x \text{ is rational} \\ -1 & \text{if } x \text{ is irrational} \end{cases}$ is continuous

(1) $\forall x \in R$
(2) for no real values of x
(3) $\forall x \in (-1, 1)$
(4) $\forall x \in (-1, 0, 1)$

Q. 76. Differentiation of $\log_e x$ w. r. t. $\log_{1/5} x$ is

(1) $\log_e \frac{1}{5}$ **(2)** $-\log_e \frac{1}{5}$
(3) $\log_{1/5} e$ **(4)** $\log 5^e$

Q. 77. If $f(x) = \begin{cases} x + a, & x < 0 \\ |x - 4|, & x > 0 \end{cases}$ and $g(x) = \begin{cases} x + 1, & x < 0 \\ (x-4)^2 + b, & x > 0 \end{cases}$ are continuous on R, then $(gof)(2) + (fog)(-2)$ is equal to

(1) – 10 **(2)** 10
(3) 8 **(4)** – 8

Q. 78. In a submarine telegraph cable the speed of signaling varies as $x^2 \log_e\left(\frac{1}{x}\right)$, where x is the ratio of the radius of the cable to that of covering. Then the greatest speed is attained when this ratio is

(1) $1 : \sqrt{e}$ **(2)** $\sqrt{e} : 1$
(3) $e : 1$ **(4)** $1 : e$

Q. 79. Let the abscissae of the two points P and Q on a circle be the roots of $x^2 - 4x - 6 = 0$ and the ordinates of P and Q be the roots of $y^2 + 2y - 7 = 0$. If PQ is a diameter of the circle $x^2 + y^2 + 2ax + 2by + c = 0$, then the value of $(a + b - c)$ is

(1) 12 **(2)** 13
(3) 14 **(4)** 16

Q. 80. The projections of a line segment on x, y and z axes are respectively 3, 4 and 5, then the length and direction cosines of the line segment are respectively equal to

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

Section B

Q. 81. If the value of expression $\sin 5°.\sin 55°\sin 115°$ can be expressed as $\frac{\sqrt{a}-b}{\sqrt{c}}$, then $\frac{c+4b}{11a}$ is equal to ..... (where a, b, c are mutually coprime)

Q. 82. If the solution set of inequality $\left(\cos x+\frac{\sqrt{3}}{2}\right)\left(\cos x-\frac{1}{2}\right)\le 0$ in $[0, 2\pi]$ is, $\left[\frac{\alpha\pi}{6},\frac{\beta\pi}{6}\right]\cup\left[\frac{\gamma\pi}{6},\frac{\delta\pi}{6}\right]$ **where** $\alpha, \beta, \gamma, \delta \in I^+$, then the value of $|\beta-\alpha+\delta-\gamma|$ is ..... .

Q. 83. If x and y are positive integers satisfying, $\tan^{-1}\left(\frac{1}{x}\right)+\tan^{-1}\left(\frac{1}{y}\right)=\tan^{-1}\left(\frac{1}{7}\right)$ then the number of ordered pairs of (x, y) is :

Q. 84. In a tournament, four players are participating. Each player plays with every other player. Each player has 50% chance of winning any game and there are no ties. If the probability that at the end of tournament there is neither a winless nor an undefeated player is there is $\frac{a}{b}$, where a and b are relatively prime integers, then $|2a-b|$ is equal to ..... .

Q. 85. If for some $p, q, r \in R$, not all have same sign, one of the roots of the equation $(p^2+q^2)x^2 - 2q(p+r)x + q^2+r^2 = 0$ is also a root of the equation $x^2+2x-8=0$, then $\frac{q^2+r^2}{p^2}$ is equal to _____.

Q. 86. Let $A=\begin{bmatrix}6 & 4\\ -9 & -6\end{bmatrix}$, $B=\begin{bmatrix}2 & 3\\ 3 & 4\end{bmatrix}$ and $C = A + A^2B + A^3B^2+..... A^{100}B^{99}$. If sum of elements of matrix CB is λ, then $36+\lambda$ is ..... .

Q. 87. If the coefficients of x and x^2 in the expansion of $(1+x)^p(1-x)^q$, $p, q \le 15$, are -3 and -5 respectively, then the coefficient of x^3 is equal to _____.

Q. 88. $\int_{-4}^{0}(|x+1|+[x+3])dx$ (where [.] denotes greatest integer function) is equal to

Q. 89. The shortest distance between the curve $y = x^4 + 3x^2 + 2x$ and the straight line $y = 2x - 1$ is expressed as $\frac{1}{\sqrt{p}}$, then p is

Q. 90. Curve satisfying differential equation $x(y^2+x)dx + x^2ydy = 0$ passes through $\left(\sqrt[3]{3}, 0\right)$, then value of $\left[y^2(-2)\right]$ is ..... , where [.] denotes greatest integer function.