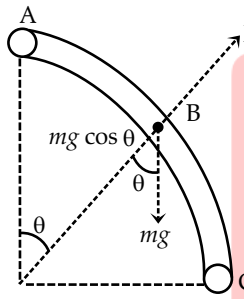
MOCK TEST PAPER 7

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

Physics

Section A

Q. 1. The tube AC forms a quarter circle in a vertical plane. The ball B has an area of cross-section slightly smaller than that of the tube, and can move without friction through it. B is placed at A and displaced slightly. It will :



(1) always be in contact with the inner wall of the tube

(2) always be in contact with the outer wall of the tube

(3) initially be in contact with the inner wall and later with the outer wall

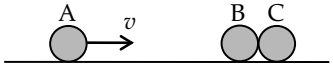
(4) initially be in contact with the outer wall and later with the inner wall

Q. 2. Energy required to accelerate a car from 10 to 20 ms^{-1} compared with that required to accelerate from 0 to 10 ms^{-1} in the same interval of time covering the same distance, is.

(1) twice **(2)** four times

(3) three times **(4)** same

Q. 3. As shown in figure A, B and C are identical balls B and C are at rest and, the ball A moving with velocity v collides elastically with ball B, then after collision :



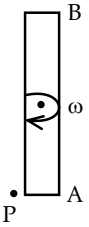
(1) All the three balls move with velocity $\frac{v}{2}$

(2) A comes to rest and (B + C) moves with velocity $\frac{v}{\sqrt{2}}$

(3) A moves with velocity v and (B + C) moves with velocity v

(4) A and B come to rest and C moves with velocity v

Q. 4. A rod of mass 'M' & length 'L' lying on a frictionless horizontal surface is initially given an angular velocity 'ω' about vertical axis with centre of mass at rest but circular motion is not fixed. Subsequently end A of rod collides with nail P, which is near to A such that end A becomes stationary immediately after impact. Velocity of end 'B' just after collision will be :



(1) ωL **(2)** $\frac{\omega L}{2}$ (3) $\frac{\omega L}{4}$ **(4)** $\frac{7\omega L}{3}$

Q. 5. If R is the radius of the earth and g the acceleration due to gravity on the earth's surface, the mean density of the earth is :

(1) $\frac{4\pi G}{3gR}$ **(2)** $\frac{3\pi R}{4gG}$

(3) $\frac{3g}{4\pi RG}$ **(4)** $\frac{\pi Rg}{12G}$

Q. 6. A particle is oscillating according to the equation $X = 7\cos 0.5\pi t$, where t is in second. The point moves from the position of equilibrium to maximum displacement in time :

(1) 4.0 seconds **(2)** 2 seconds

(3) 1.0 seconds **(4)** 0.5 seconds

Q. 7. A ball falling in a lake of 200 m shows a decrease of 0.1 % in its volume at the base of the lake. The bulk modulus of elasticity of the material of the ball is (take g = 10 m/s^2) :

(1) 10^9 N/m^2 **(2)** 2×10^9 N/m^2

(3) 3×10^9 N/m^2 **(4)** 4×10^9 N/m^2

Q. 8. In a capillary tube, water rises to a height of 4 cm. If the cross-sectional area of the tube were one-fourth, water would have risen to a height of :

(1) 2 cm **(2)** 4 cm (3) 8 cm **(4)** 16 cm

Q. 9. What is the velocity v of a metallic ball of radius r falling in a tank of liquid at the instant when its acceleration is one half that of a freely falling body? (The densities of metal and of liquid are ρ and σ respectively and the viscosity coefficient of the liquid is η)

(1) $\frac{r^2 g}{9\eta}(\rho - 2\sigma)$ **(2)** $\frac{r^2 g}{9\eta}(2\rho - \sigma)$

(3) $\frac{r^2 g}{9\eta}(\rho - \sigma)$ **(4)** $\frac{2r^2 g}{9\eta}(\rho - \sigma)$

Q. 10. A solid cone of height 25 cm and base diameter 25 cm floats in water with its vertex downwards such that 20 cm of its axis is immersed. The additional weight that must be placed at the centre of the base such that the cone now is completely immersed in water is :

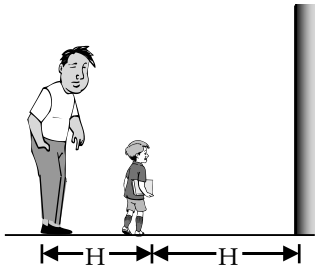
(1) 1 kg **(2)** 2 kg (3) 3 kg **(4)** 4 kg

Q. 11. The electric field in a certain region is given by $\vec{E} = (5\hat{i} - 3\hat{j})$ kV/m. The potential difference $V_B - V_A$ between points A and B, having coordinates (4, 0, 3)m and (10, 3, 0)m respectively, is equal to

(1) 21 kV **(2)** –21 kV

(3) 39 kV **(4)** –39 kV

Q. 12. A child is standing in front of a straight plane mirror. His father is standing behind him, as shown in the fig.



The height of the father is double the height of the child. What is the minimum length of the mirror required so that the child can completely see his own image and his father's image in the mirror? Given that the height of father is 2H.

(1) $\frac{H}{2}$ **(2)** $\frac{5H}{6}$

(3) $\frac{3H}{2}$ **(4)** None

Q. 13. If the refracting angle of a prism is 60° and minimum deviation is 30°, the angle of incidence is :

(1) 30° **(2)** 45° (3) 60° **(4)** 90°

Q. 14. The wave front of a light beam is given by the equation $x + 2y + 3z = C$, (where C is arbitrary constant) then the angle made by the direction of light with the y-axis is :

(1) $\cos^{-1}\frac{1}{\sqrt{14}}$ **(2)** $\sin^{-1}\frac{2}{\sqrt{14}}$

(3) $\cos^{-1}\frac{2}{\sqrt{14}}$ **(4)** $\sin^{-1}\frac{3}{\sqrt{14}}$

Q. 15. A film projector magnifies a 100 cm^2 film strip on a screen. In such a way that the distance between the screen and the projector is divided in the ratio of 2:1 by the lens. Then the area of magnified film on screen is :

(1) 1600 cm^2 **(2)** 400 cm^2

(3) 800 cm^2 **(4)** 200 cm^2

Q. 16. What are the number of wave lengths that can be emitted by hydrogen atoms when an electron falls from the fifth orbit to its ground state?

(1) 4 **(2)** 5 (3) 10 **(4)** 3

Q. 17. If the short series limit of the Balmer series for hydrogen is 3646 Å. Calculate the atomic no. of the element which gives X-ray wavelength down to 1.0 Å. Identify the element :

(1) $Z = 21$ **(2)** $Z = 31$

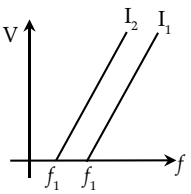
(3) $Z = 11$ **(4)** $Z = 5$

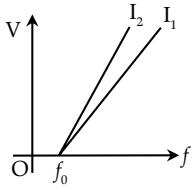
Q. 18. The wavelength of a neutron with energy 1 eV is closest to :

(1) 10^{-2} cm **(2)** 10^{-4} cm

(3) 10^{-6} cm **(4)** 10^{-8} cm

Q. 19. A photoelectric experiment is performed at two different light intensities I_1 and I_2 ($>I_1$). Choose the correct graph showing the variation of stopping potential versus frequency of light.

(1)


(2)


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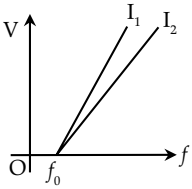


(4) None of these

Q. 20. If a semiconductor has an intrinsic carrier concentration of 1.41×10^{16} m^{-3}, when doped with 10^{21} m^{-3} phosphorus, then the concentration of holes at room temperature will be :

(1) 2×10^{21} **(2)** 2×10^{11}

(3) 1.41×10^{10} **(4)** 1.41×10^{16}

Section B

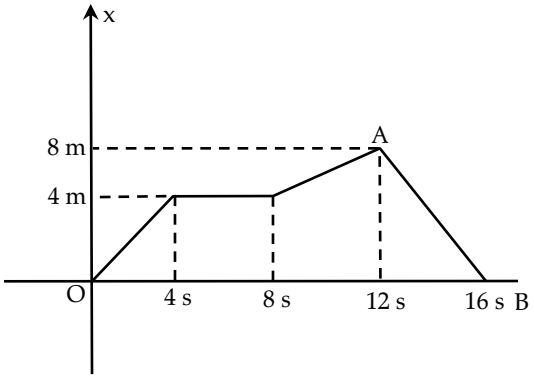
Q. 21. A ray of light passes through an equilateral prism ($\mu=1.5$) such that i=e and $e=\frac{8}{4}A$ the angle of deviation is:

(1) 35° **(2)** 30° (3) 60° **(4)** 45°

Q. 22. An Ideal Gas at 27°C is compressed adiabatically to $\frac{8}{27}$ of its original volume the rise in Temperature is (take $\gamma = 5/3$).

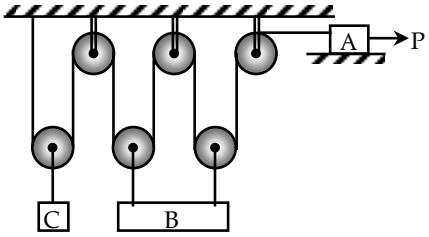
(1) 275K **(2)** 375K **(3)** 475K **(4)** 175K

Q. 23. Figure shows the graph of the x-co-ordinate of a particle going along the x-axis as function of time. Then, the instantaneous speed of particle at t = 12.5 s is ..... m/s.



Q. 24. A projectile is fixed at an angle 60° with horizontal. Ratio of initial K.E. to K.E when velocity vector of projectile makes an angle 15° with velocity of projection is ..... .

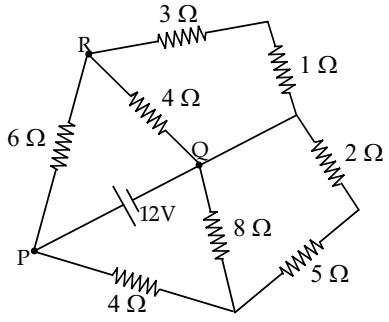
Q. 25. Three blocks A, B and C of mass m each are arranged in pulley mass system as shown. Coefficient of friction between block A and horizontal surface is equal to 0.5 and a force P acts on 'A' in the direction shown. The value of P/mg so that block 'C' doesn't move is.....



Q. 26. On an X temperature scale, water freezes at –125°X and boils at 375°X. On a Y temperature scale water freezes at –70°Y and boils at –30°Y. The value of temperature on X-scale equal to the temperature of 50°Y on Y-scale is .....°X.

Q. 27. A parallel plate capacitor is maintained at a certain potential difference. When a 3 mm thick slab is introduced between the plates, in order to maintain the same potential difference the distance between the plates is increased by 2.4 mm. The dielectric constant of slab is ..... .

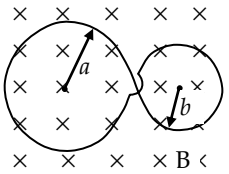
Q. 28. Power dissipated by the circuit is ..... W.



Q. 29. There is a constant homogeneous electric field of 100 Vm^{-1} within the region x = 0 and x = 0.167 m pointing in the positive x-direction. There is a constant homogeneous magnetic field B within the region x = 0.167 m and x = 0.334 m pointing in the z-direction. A proton at rest at the origin (x = 0, y = 0) is released in the positive x-direction. The minimum strength of the magnetic field B, so that the proton will come back

at $x = 0$, $y = 0.167$ m (mass of the proton $= 1.67 \times 10^{-27}$ kg) is.....mT.

Q. 30. A plane loop is shaped in the form as shown in figure with radii $a = 20$ cm and $b = 10$ cm and is placed in a uniform time varying magnetic field $B = B_0 \sin \omega t$, where $B_0 = 10$ mT and $\omega = 100$ rad/s. The amplitude of the current induced in the loop is ..... A, if its resistance per unit length is equal to 50×10^{-3} Ω/m. The inductance of the loop is negligible.



Chemistry

Section A

Q. 31. The name of $ClCH_2-\underset{\underset{Br}{|}}{C}=\underset{\underset{Br}{|}}{C}-CH_2Cl$ according to IUPAC nomenclature system is

(1) 2,3-dibromo-1,4-dichlorobut-2-ene
(2) 1,4-dichloro-2,3-dibromobut-2-ene
(3) dichlorobromobutene
(4) dichlorobromobutane

Q. 32. Only two isomeric monochloro derivatives are possible for (excluding stereo)

(1) n-butane
(2) 2,2-dimethylpentane
(3) benzene
(4) neopentane

Q. 33. A polysaccharide 'X' on boiling with dil. H_2SO_4 at 393 K and under 2-3 atm pressure yields 'Y'. 'Y' on treatment with bromine water gives gluconic acid. 'X' contains β-glycosidic linkages only. Compound 'X' is:

(1) Starch **(2)** Cellulose
(3) Amylose **(4)** Amylopectin

Q. 34. Given below are two statements: one is labelled as **Assertion A** and the other is labeled as **Reason R**.

Assertion A: A mixture contains benzoic acid and naphthalene. The pure benzoic acid can be separated out by the use of benzene.

Reason R: Benzoic acid is soluble in hot water.

In the light of the above statements, choose the most appropriate answer form 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.

Q. 35. Match List – I with List-II

List – I	List – II
(1) $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$	**(I)** Cu
(2) $CO(g) + 3H_2(g) \rightarrow CH_4(g) + H_2O(g)$	**(II)** $Cu/ZnO - Cr_2O_3$
(3) $CO(g) + H_2(g) \rightarrow HCHO(g)$	**(III)** $Fe_2O_3 + K_2O + Al_2O_3$
(4) $CO(g) + 2H_2(g) \rightarrow CH_3OH(g)$	**(IV)** Ni

Choose the correct answer from the options given below:

(1) (1)-(II), (2)-(IV), (3)-(I), (4)-(III)
(2) (1)-(II), (2)-(I), (3)-(IV), (4)-(III)
(3) (1)-(III), (2)-(IV), (3)-(I), (4)-(II)
(4) (1)-(III), (2)-(I), (3)-(IV), (4)-(II)

Q. 36. The pair, in which ions are isoelectronic with Al^{3+} is:

(1) Br^- and Be^{2+} **(2)** Cl^- and Li^+
(3) S^{2-} and K^+ **(4)** O^{2-} and Mg^{2+}

Q. 37. The heat of hydrogenation of benzene is 51 kcal/mol and its resonance energy is 36 kcal/mol. What will be the heat of hydrogenation of cyclohexene ?

(1) 18 kcal mol^{-1} **(2)** 29 kcal mol^{-1}
(3) 50 kcal mol^{-1} **(4)** 26 kcal mol^{-1}

Q. 38. $CH_3-\underset{\underset{Cl}{|}}{CH}-CH_3 \xrightarrow{Na/ether}$ A (major product).

A is :

(1) $CH_3 - CH_2 - CH_2 - CH_2 - CH_2 - CH_3$
(2) $CH_3-\underset{\underset{CH_3}{|}}{CH}-\underset{\underset{CH_3}{|}}{CH}-CH_3$
(3) No reaction
(4) $CH_3 - CH = CH_2$

Q. 39. $C_6H_6 \xrightarrow[AlCl_3]{CH_3COCl} A \xrightarrow[HCl]{Zn-Hg} B$

The end product in the above sequence is :

(1) Toluene

(2) Ethyl benzene

(3) Both of the above

(4) None of the above

Q. 40. $CH_3-\underset{\underset{O}{||}}{C}-CH_3 \xrightarrow[Na_2CO_3]{I_2} (A) \xrightarrow{Ag\ Powder}$

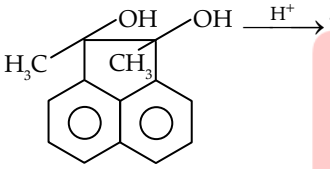
$(B) \xrightarrow[Hg^{++}]{H_2SO_4} (C)$. Product A, B and C are :

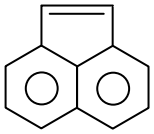
(1) Iodoform, Acetylene and Acetaldehyde

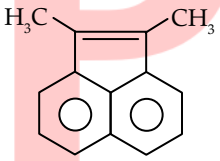
(2) Tri iodomethane, Ethyne and Acetone

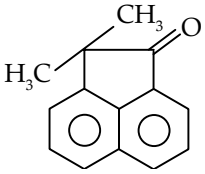
(3) Iodoform, Ethene and Ethylene glycol

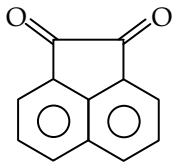
(4) Ethene, iodoform and Ethylhydrogen sulphate

Q. 41.  ? Product is :

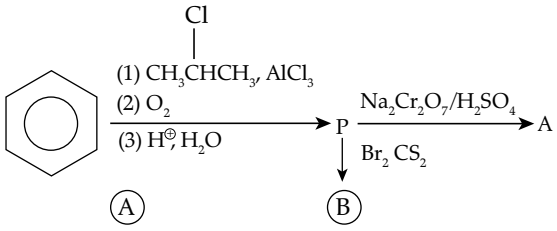
(1) 

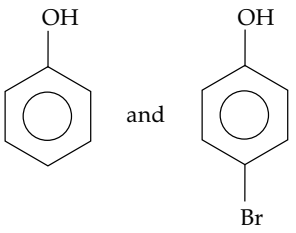
(2) 

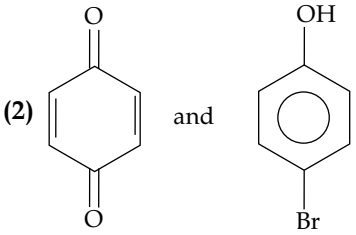
(3) 

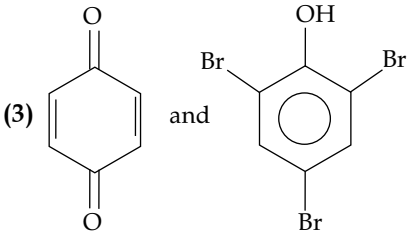
(4) 

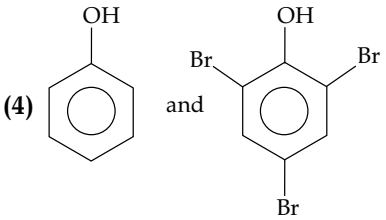
Q. 42. Identify the major products A and B for the below given reaction sequence.



(1) 

(2) 

(3) 

(4) 

Q. 43. In the reaction series –

$CH_3CHO \xrightarrow[dil.H_2SO_4]{KMnO_4} P \xrightarrow{SOCl_2} Q \xrightarrow[Heat]{CH_3COONa} R$. The product R is :

(1) $(CH_3CO)_2O$

(2) Cl. $CH_2COOCOCH_3$

(3) CH_3COCH_2COOH

(4) Cl_2 $CHCOOCOCH_3$

Q. 44. In the reaction sequence :

$CH_3CO\diagdown\diagup O \xrightarrow{X} CH_3CONH_2$

$\xrightarrow{Y} CH_3C \equiv N \xrightarrow{Z} CH_3COOC_2H_5$

(1) NaOH, PCl_5, Na + alcohol

(2) NH_3, P_2O_5, aqueous ethanol/H^+

(3) NH_3, NaOH, Zn + NaOH

(4) NH_3, Conc. H_2SO_4, aqueous methanol

Q. 45. Cyanides exists in :

(1) Tautomeric form **(2)** Geometrical form

(3) In both form **(4)** None of the above

Q. 46. Two hexoses were found to give the same osazone. Which one of the following statements is correct with respect to their structural relationship ?

(1) The carbon atoms 1 and 2 in both have the same configuration

(2) They are epimeric at C_3

(3) The carbon atoms 3, 4 and 5 in both have the same configuration

(4) Both must be aldoses

Q. 47. The simplest formula of a compound containing 50% of element X (at. wt. 10) and 50% of element Y (at. wt. 20) is :
(1) XY **(2)** XY_2 (3) X_2Y **(4)** X_2Y_3

Q. 48. Which of the following is the most likely structure of $CrCl_3.6H_2O$, if 1/3 of total chlorine of the compound is precipitated by adding $AgNO_3$ to its aqueous solution :
(1) $CrCl_3.6H_2O$
(2) $[Cr(H_2O)_3Cl_3](H_2O)_3$
(3) $[CrCl_2(H_2O)_4]Cl.2H_2O$
(4) $[CrCl.(H_2O)_5]Cl_2.H_2O$

Q. 49. Which of the following pair is not isoelectronic species?
(At. No. Sm: 62; Er: 68; Yb: 70; Lu: 71; Eu: 63; Tb: 65; Tm: 69)
(1) Sm^{2+} and Er^{3+} **(2)** Yb^{2+} and Lu^{3+}
(3) Eu^{2+} and Tb^{4+} **(4)** Tb and Tm^{4+}

Q. 50. Yellow ammonium sulphide solution is a suitable reagent used for the separation of :
(1) HgS and PbS **(2)** PbS and Bi_2S_3
(3) Bi_2S_3 and CuS **(4)** CdS and As_2S_3

Section B

Q. 51. 2L of 0.2 M H_2SO_4 is reacted with 2L of 0.1 M NaOH solution, the molarity of the resulting product Na_2SO_4 in the solution is_____ millimolar. (Nearest integer)

Q. 52. The number of non-ionisable protons present in the product B obtained from the following reaction is _____.
$C_2H_5OH + PCl_3 \rightarrow C_2H_5Cl + A$
$A + PCl_3 \rightarrow B$

Q. 53. The amount (in gm) of sample containing 80% NaOH, required to prepare 60 litre of 0.5 M solution is ..... gm.

Q. 54. If I.E. of F^- is 328 kJ/mol and E.A. of F^+ is 1681 kJ/mol, then E.N. of F at Pauling's scale is ..... .

Q. 55. In the presence of sunlight, benzene reacts with Cl_2 to give product X; The number of hydrogens in X is_____. (Nearest Integer)

Q. 56. The Arrhenius equations for the rate constant of decomposition of methyl nitrite and ethyl nitrite are.

$$k_1\,(s^{-1}) = 10^{13} \exp\left(\frac{-152300\ Jmol^{-1}}{RT}\right) \text{ and}$$

$$k_2\,(s^{-1}) = 10^{14} \exp\left(\frac{-157700\ Jmol^{-1}}{RT}\right)$$

respectively. The temperature at which the rate constants are equal is ..... K.

Q. 57. The conductivity of a saturated aqueous solution of $Ag_2C_2O_4$ is 3.8×10^{-5} $ohm^{-1}\ cm^{-1}$ at 25°C. The molar conductivity of oxalate ion is ..... $Ohm^{-1}cm^2mol^{-1}$. Given at 25°C, conductivity of water is 6.2×10^{-6} $ohm^{-1}\ cm^{-1}$ and molar conductivity of Ag^+ at infinite dilution is 62 $ohm^{-1}cm^2mol^{-1}$ and K_{sp} of $Ag_2C_2O_4$ is 5.3×10^{-12} ?

Q. 58. While estimating the nitrogen present in an organic compound by Kjeldahl's method, the ammonia evolved from 0.25g of the compound neutralized 2.5 mL of 2 M H_2SO_4. The percentage of nitrogen present in organic compound is _____.

Q. 59. A current of dry air was passed through a series of bulbs containing 1.25 g of a solute A_2B in 50 g of water and then through pure water. The loss in weight of the former series of bulbs was 0.98 g and in the later series 0.01 g. If the molecular weight of A_2B is 80. The degree of dissociation of A_2B is .....%.

Q. 60. A company dissolves 'x' amount of CO_2 at 298 K in 1 litre of water to prepare soda water. X = _____ $\times 10^{-3}$g. (nearest integer)
(Given: partial pressure of CO_2 at 298 K = 0.835 bar. Henry's law constant for CO_2 at 298 K = 1.67 kbar.
Atomic mass of H, C and O is 1, 12, and 16 g mol^{-1}, respectively)

Mathematics

Section A

Q. 61. $\int \frac{4+5\sin x}{\cos^2 x}\,dx$ equals :
(1) $4\tan x - \sec x + c$
(2) $4\tan x + 5\sec x + c$
(3) $9\tan x + c$
(4) $5\tan x - \sec x + c$

Q. 62. $\int_0^1 \frac{dx}{(x^2-2x+2)^3} =$
(1) $\frac{3\pi+8}{32}$ **(2)** $\frac{\pi+1}{4}$ **(3)** 0 **(4)** $\frac{2\pi}{3}$

Q. 63. The area between the parabola $x^2 = 4y$ and the line $x - 4y + 2 = 0$
(1) $\frac{9}{8}$ **(2)** 9 **(3)** $\frac{9}{2}$ **(4)** $\frac{9}{4}$

Q. 64. The degree of the differential equation $\left(\frac{d^3y}{dx^3}\right)^{2/3} + 4 - 3\frac{d^2y}{dx^2} + 5\frac{dy}{dx} = 0$ is :
(1) 1 **(2)** 2 **(3)** 3 **(4)** 2/3

Q. 65. $P \equiv (x_1, y_1, z_1)$ and $Q \equiv (x_2, y_2, z_2)$ are two points. If direction cosines of a line AB are ℓ, m, n, then projection of PQ on AB is :

(1) $\frac{1}{\ell}(x_2 - x_1) + \frac{1}{m}(y_2 - y_1) + \frac{1}{n}(z_2 - z_1)$

(2) $\ell(x_2 - x_1) + m(y_2 - y_1) + n(z_2 - z_1)$

(3) $\frac{1}{\ell mn}[\ell(x_2 - x_1) + m(y_2 - y_1) + n(z_2 - z_1)]$

(4) $\ell mn\,[\ell(x_2 - x_1) + m(y_2 - y_1) + n(z_2 - z_1)]$

Q. 66. If ABCDE is a pentagon, then the resultant of forces $\vec{AB}$, $\vec{AE}$, $\vec{BC}$, $\vec{DC}$, $\vec{ED}$ and $\vec{AC}$ in terms of $\vec{AC}$ is :

(1) $2\vec{AC}$ **(2)** $3\vec{AC}$ **(3)** $5\vec{AC}$ **(4)** $4\vec{AC}$

Q. 67. The root of the equation

$$[x\ 1\ 2]\begin{bmatrix}0 & 1 & 1\\ 1 & 0 & 1\\ 1 & 1 & 0\end{bmatrix}\begin{bmatrix}x\\ -1\\ 1\end{bmatrix} = 0 \text{ is .....}$$

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

Q. 68. If ΔABC is a scalene triangle, then the value of

$$\begin{vmatrix}\sin A & \sin B & \sin C\\ \cos A & \cos B & \cos C\\ 1 & 1 & 1\end{vmatrix} \text{ is ..... .}$$

(1) $= 0$ **(2)** $\neq 0$

(3) can not say **(4)** depends on area

Q. 69. From a pack of well shuffled cards, one card is drawn randomly. A gambler bets that it is either a diamond or a king. The odds in favour of his winning the bet will be :

(1) 9 : 4 **(2)** 4 : 9 **(3)** 5 : 7 **(4)** 9 : 7

Q. 70. Let $z_1 = 10 + 6i$, $z_2 = 4 + 6i$ and z is a complex number such that $\text{amp}\left(\frac{z - z_1}{z - z_2}\right) = \frac{\pi}{2}$, then maximum value of z–7–9i is.....

(1) 2 **(2)** 6 **(3)** 3 **(4)** 8

Q. 71. Find the values of x, if $\left(\frac{1}{2}\right)^{\log_2 \log_{\frac{1}{5}}\left(x^2 - \frac{4}{5}\right)} < 1$

(1) $-1 < x < -\frac{2}{\sqrt{5}}, \frac{2}{\sqrt{5}} < x < 1$

(2) $-1 < x < -0, \frac{2}{\sqrt{5}} < x < 1$

(3) $-1 < x < -\frac{2}{\sqrt{5}}, \frac{2}{\sqrt{5}} < x < 3$

(4) $-\frac{2}{\sqrt{5}} < x < 0,\ 0 < x < \frac{2}{\sqrt{5}}$

Q. 72. If α, β are roots of the equation $2x^2 - 35x + 2 = 0$, then the value of $(2\alpha - 35)^3 . (2\beta - 35)^3$ is equal to :

(1) 1 **(2)** 8 (3) 64 **(4)** $\frac{1}{8}$

Q. 73. If a, b, c are in AP, a, b, d are in GP then $a, a - b, d - c$ are in

(1) AP **(2)** GP

(3) HP **(4)** AP and GP both

Q.74 $\frac{1}{1!\cdot(n-1)!} + \frac{1}{3!\cdot(n-3)!} + \frac{1}{5!\cdot(n-5)!} + \ldots$ is equal to :

(1) $\frac{2^{n-1}}{n!}$ for even values of n only

(2) $\frac{2^{n-1}+1}{n!}$ –1 for odd values of n only

(3) $\frac{2^{n-1}}{n!}$ for all $n \in N$

(4) $\frac{2^n}{(n-1)!}$ for all $n \in N$

Q. 75. If vertices of a quadrilateral are A(0, 0), B(3, 4), C(7, 7) and D (4, 3), then quadrilateral ABCD is :

(1) parallelogram **(2)** rectangle

(3) square **(4)** rhombus

Q. 76. The equation of the circle which touches the axis of y at the origin and passes through (3, 4) is :

(1) $2(x^2 + y^2) - \frac{45}{3}x = 0$

(2) $3(x^2 + y^2) - 25x = 0$

(3) $4(x^2 + y^2) - 25x = 0$

(4) $4(x^2 + y^2) - 15x = 0$

Q. 77. The equation of the parabola whose focus is (1, 1) and tangent at the vertex is $x + y = 1$ is

(1) $x^2 + y^2 - 2xy - 4x - 4y + 4 = 0$

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

(3) $x^2 + y^2 - 2xy - 4x - 4y - 4 = 0$

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

Q. 78. If major and minor axis of an ellipse is 8 and 4, then distance between directrices of the ellipse is :

(1) $2\sqrt{3}$ **(2)** $\frac{16}{\sqrt{3}}$ (3) $16\sqrt{3}$ **(4)** $\frac{8}{\sqrt{3}}$

Q. 79. If the hyperbolas, $x^2 + 3xy + 2y^2 + 2x + 3y + 2 = 0$ and $x^2 + 3xy + 2y^2 + 2x + 3y + c = 0$ are conjugate of each other, then the value of 'c' is equal to :

(1) -2 **(2)** 4 **(3)** 0 **(4)** 1

Q. 80. Five numbers x_1, x_2, x_3, x_4, x_5 are randomly selected from the numbers 1, 2, 3,..., 18 and are arranged in the increasing order ($x_1 < x_2 < x_3 < x_4 < x_5$). The probability that $x_2 = 7$ and $x_4 = 11$ is:

(1) $\frac{1}{136}$ **(2)** $\frac{1}{72}$ **(3)** $\frac{1}{68}$ **(4)** $\frac{1}{34}$

Section B

Q. 81. If $A = \sum_{r=1}^{3} \log|\tan(60° - \alpha_r)|$,

$B = \sum_{r=1}^{3} \log|\tan(60° + \alpha_r)|$, where $\alpha_r = \frac{\theta}{3^r}$, then the value of A+B at $\theta = \frac{9\pi}{4}$ is ..... .

(where base of logarithm is $2+\sqrt{3}$)

Q. 82. If $\sin^2(10°)\sin(20°)\sin(40°)\sin(50°)\sin(70°) = \alpha - \frac{1}{16}\sin(10°)$, then $16 + \alpha^{-1}$ is equal to _____.

Q. 83. If $\frac{f(x)}{\sin^2 x} = -\cos^{-1}\left(\frac{2\sqrt{2}x}{\pi}\right) - |f(x)|$, then the value of $\frac{f(\pi/4)}{(-\pi/32)}$ is ..... .

Q. 84. Consider a triangle ABC and let a, b and c denote the lengths of the sides opposite to the vertices A, B and C respectively. If a, b, c are the roots of $t^3 - 12t^2 + 47t - 60 = 0$, then the value of $96\left(\frac{\cos A}{a} + \frac{\cos B}{b} + \frac{\cos C}{c}\right)$ is ..... .

Q. 85. The sum of all numbers greater than 10,000 by using the digits 0, 2, 4, 6, 8 no digit being repeated in any number, is.....

Q. 86. Suppose $p(x)$ is a polynomial with integer coefficients. The remainder when $p(x)$ is divided by $x - 1$ is 1 and the remainder when $p(x)$ is divided by $x - 4$ is 10. If $r(x)$ is the remainder when $p(x)$ is divided by $(x-1)(x-4)$, find the value of $r(2006)$ is ..... .

Q. 87. The value of $\lim_{x\to 2} \frac{2^x + 2^{3-x} - 6}{\sqrt{2^{-x}} - 2^{1-x}}$ is ..... .

Q. 88. The number of elements in the set

$\{z = a + ib \in C: a, b \in Z \text{ and } 1 < |z - 3 + 2i| < 4\}$ is _____.

Q. 89. The number of solutions to the equation $\ln x = -x^2$ is ..... .

Q. 90. If $\ln\left((e-1)e^{xy} + x^2\right) = x^2 + y^2$, then $\left(\frac{dy}{dx}\right)_{(1,0)}$ is equal to ..... .