STSE Question Paper with Solution (PCM)
PART-I
PHYSICS

1. $\frac{1}{273.16}$th part of thermodynamical temperature of triple point of water is called

(1) mole (2) second

(3) kelvin (4) Celsius

Ans. [3]
Sol. By definition Triple point of water is at 273.16 K.

2. Which of following is majority charge carrier particle in the N-type extrinsic semiconductor ?

(1) Electron (2) Proton

(3) Neutron (4) Hole

Ans. [1]
Sol. Majority charge carrier in N type is electrons.

3. Under which of following forces is mechanical energy not conserved ?

(1) Gravitational force (2) Friction force

(3) Restoring force (4) Electrostatic force

Ans. [2]
Sol. Friction force is a non conservative force.

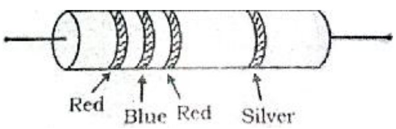
4. Curie temperature of iron is

(1) 1394 K (2) 631 K

(3) 893 K (4) 1043 K

Ans. [4]

5. Percentage error for colour coded resistor in the following figure is



(1) $\pm 20\%$ (2) $\pm 15\%$

(3) $\pm 10\%$ (4) $\pm 5\%$

Ans. [3]
Sol. Silver band represent a tolerance of 10%.

6. If the ratio of two specific heats $\left(¥ = \frac{C_p}{C_y}\right)$ of any gas is 1.4 then that gas will be

(1) monatomic (2) diatomic

(3) triatomic (4) none of these

Ans. **[2]**

Sol. $\gamma = 1 + \frac{2}{f}$

$1.4 = 1 + \frac{2}{f}$

$\Rightarrow\ f = 5\ \ \therefore$Diatomic

7. Communication frequency band range for FM broadcast is

(1) 540 – 1600 kHz (2) 88 – 108 MHz

(3) 54 – 72 MHz (4) 840 – 935 MHz

Ans. **[2]**

8. A radioactive isotope has a half-life of T years. How long will it take to reduce the activity to 3.125% of its original value ?

(1) 2 T years (2) 3 T years

(3) 4 T years (4) 5 T years

Ans. **[4]**

Sol. $A = A_0 2^{-t/T}$

$\frac{3.125}{100} A_0 = A_0 2^{-t/T}$

$\Rightarrow t = 5T$

9. Which of the following physical quantities remains conserved in the continuity equation for incompressed liquid flow ?

(1) Mass (2) Energy

(3) Moment (4) Charge

Ans. **[1]**

Sol. Continuity equation is based on the principle of conservation of mass.

10. The ground state energy of hydrogen atom is –13.6 eV. The kinetic energy of the electron in this state is

(1) –13.6 eV (2) +13.6 eV

(3) –27.2 eV (4) +27.2 eV

Ans. **[2]**

Sol. $|E_n| = K_n$ for any orbit.

11. If the magnification powers of two thin lenser are 4 and 2 respetively then the magnification power of the combined lens formed by these lenses is

(1) 2 (2) 4

(3) 8 (4) 12

Ans. **[1]**

Sol. Possible powers are (4+2) & (4 – 2)

6 is not present in options

$\therefore$ 2

12. Frequency of electric current of alternating current i = 100 sin ($120\pi t + \frac{\text{®}}{3}$) will be

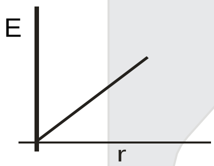
(1) 50 Hz (2) 60 Hz

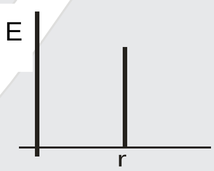
(3) 70 Hz (4) 80 Hz

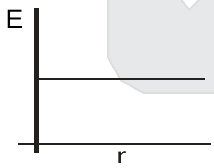
Ans. **[2]**

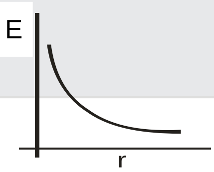
Sol. $f = \frac{\omega}{2\pi} = \frac{120\pi}{2\pi} = 60\,\text{Hz}$

13. The curve between distance r from sheet and electric field E due to a uniformly charged infinite plane sheet is

(1) 

(2) 

(3) 

(4) 

Ans. **[3]**

Sol. $E = \frac{\sigma}{2t_0} = \text{constant.}$

14. Among the following which electromagnetic wave have the wavelength range of 700 nm to 00 nm ?

(1) Light waves (2) Microwaves

(3) X-Rays (4) Radio waves

Ans. **[1]**

Sol. By memory.

15. A jet plane is travelling towards west at a speed of 400 m/s while the earth's magnetic field at the location has a magnitude of 5×10^{-4} T and the dip angle is 30°. The voltage difference developed between the ends of the wings of the plane having a span of 25 m long is

(1) 1.0 V (2) 1.5 V

(3) 2.0 V (4) 2.5 V

Ans. **[4]**

Sol. $e = VB\ell$

$= 400 \times 5 \times 10^{-4} \times \frac{1}{2} \times 25$

= 2.5 V

16. Which fundamental logic gate is equivalent to the following iruit ?

(1) NOT-gate (2) AND-gate

(3) OR-gate (4) none of these

Ans. **[3]**

Sol. $((A+B)')' = A+B$

$\therefore$ OR gate

17. The de-Broglie wavelength associated with an electron accelerated by 100 volt will be

(1) 0.123 nm (2) 0.312 nm

(3) 0.231 nm (4) 0.132 nm

Ans. **[1]**

Sol. $\lambda = \frac{h}{mv} = \frac{12.3}{\sqrt{V}} \text{Å} = 1.23\text{Å}$

= 0.123 nm.

18. The value of gravitational acceleration at the centre of earth is

(1) zero (2) 9.8 m/s^2

(3) 4.9 m/s^2 (4) 19.6 m/s^2

Ans. **[1]**

Sol. $g = \frac{GMx}{R^3}$; x = 0 therefore g = 0

19. Relation between power (P), force (F) and instantaneous velocity (v) is

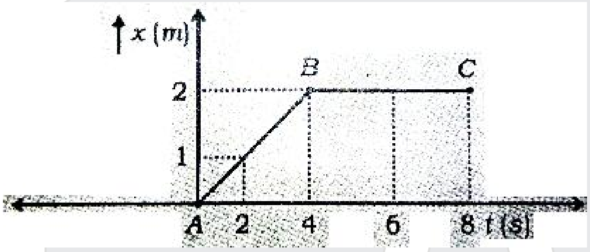
(1) $p = \frac{F}{v}$ (2) $F = \frac{P}{v}$

(3) $P = \frac{v}{F}$ (4) $v = \frac{F}{P}$

Ans. **[2]**

Sol. $P = \vec{F}.\vec{V} = FV$

20. The acceleration of the object in the given graph between the point A to point B is



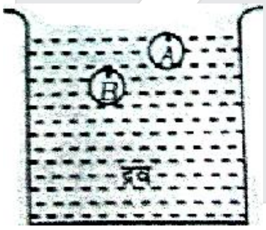
(1) 1 m/s^2 (2) 2 m/s^2

(3) 3 m/s^2 (4) zero

Ans. **[4]**

Sol. $a = \frac{d^2x}{dt^2} = 0$; second derivative for straight line is 0

21. If U_A and U_B are surface energies of the molecules A and B of the liquids respectively in given figure then relation between U_A and U_B is



(1) $U_A < U_B$ (2) $U_A = U_B$

(3) $U_A > U_B$ (4) None of these

Ans. **[3]**

Sol. A is on the surface. So it has more potential energy due to surface tension

22. The approximate nuclear energy released due to nuclear fission of one atom of ${}_{92}U^{235}$ is

(1) 500 MeV (2) 400 MeV

(3) 300 MeV (4) 200 MeV

Ans. **[4]**

Sol. By memory.

23. Energy of photons depends on

(1) frequency of photons

(2) intensity of photons

(3) both frequency and intensity of photons

(4) none of these

Ans. **[1]**
Sol. The energy of a photon is given by $E = h\nu$

24. The unit of electromotive force (emf) is

(1) newton (2) volt

(3) joule (4) coulomb

Ans. **[2]**
Sol. EMF is actually a kind of potential difference.

25. An object is moving in one direction with constant power under the influence of a source. At any time t, the displacement is proportional to

(1) $t^{\frac{1}{2}}$ (2) t^2

(3) t (4) $t^{\frac{3}{2}}$

Ans. **[4]**
Sol. P = FV

$= \frac{mvdv}{ds} xV$

Pds = mv^2dv.

$s = \frac{mv^3}{3P}$

$v \sim x^{\frac{1}{3}}$

$\frac{dx}{dt} \sim x^{\frac{1}{3}}$

$\frac{dx}{x^{\frac{1}{3}}} \sim dt$

$x^{\frac{2}{3}} \sim t$

26. A player can throw a ball up to a maximum horizontal distance of 80 m. The same player can throw the ball up to which maximum vertical height?

(1) 40 m (2) 80 m

(3) 120 m (4) 160 m

Ans. **[1]**

Sol. $R_{max} = \frac{v^2}{g}$ [when angle of projection = 45°]

$H_{max} = \frac{v^2}{2g}$ [when angle of projection = 90°]

$\therefore$ Hmax $= \frac{R_{max}}{2}$,

27. If the mass of 0.72 m long steel wire is 5.0×10^{-3} kg then the speed of produced transverse waves on the wire under 60 N tension in the wire is

(1) 63 m/s (2) 73 m/s

(3) 93 m/s (4) 39 m/s

Ans. **[3]**

Sol. $v = \sqrt{\frac{T}{\text{«}}} = \sqrt{\frac{60 \times 0.72}{5 \times 10^{-3}}} \simeq 93$ m/s

28. If the amplitude of S.H.M. is A and potential energy and kinetic energy are equal then displacement will be

(1) $\pm A$ (2) $\pm \frac{A}{2}$

(3) $\pm \frac{A}{\sqrt{2}}$ (4) $\pm\sqrt{2}A$

Ans. **[4]**

Sol. $\frac{1}{2}KA^2 = \frac{1}{2}m\omega^2 (A^2 - x^2)$

$x = A\sqrt{2}$

29. The focal length of a concave mirror in air is f. If it is immersed in water $\left(n = \frac{4}{3}\right)$ then the focal length will be

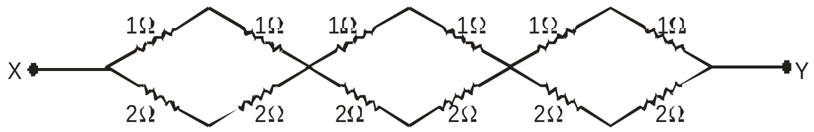
(1) 3f (2) f

(3) $\frac{3}{f}$ (4) 4f

Ans. **[4]**

Sol. $\frac{f'}{f} = \frac{1.5 - 1}{\left[\frac{1.5 \times 3}{4} - 1\right]} = 4$

30. The value of equivalent resistance between the points X and Y in the given circuit is

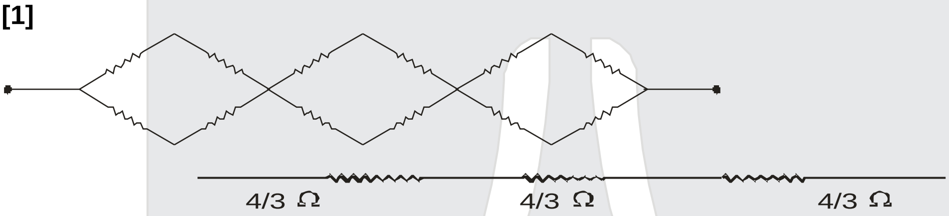


(1) $4\,\Omega$ (2) $3\,\Omega$

(3) $2\,\Omega$ (4) $1\,\Omega$

Ans. **[1]**

Sol.



PART-II
CHEMISTRY

31. Molecule having only sp3 hybrid carbon atoms is

(1) C_2H_2 (2) C_2H_4 (3) C_6H_6 (4) C_3H_8

Ans. **[4]**

Sol. C_3H_8 is an alkane

$CH_3 - CH_2 - CH_3$.

All 'C' atoms are sp^3 hybrid

32. Compound having highest oxidation state of halogen is

(1) Hypochlorous acid (2) Chlorous acid (3) Chloric acid (4) Perchloric acid

Ans. **[4]**

Sol. Oxidation number of chlorine

Perchloric acid	$HClO_4$	+7
Chloric acid	$HClO_3$	+5
Chlorous acid	$HClO_2$	+3
Hypochlorous acid	$HClO$	+1

33. Which compound shows stereoisomerism?

(1) $X_2C = CY_2$ (2) $X_2C = CXY$ (3) $YXC = CXY$ (4) $YXC = CY_2$

Ans. **[3]**

Sol. YXC = CXY will show Cis-trans isomerism.

34. Highest heat resistant compound is

(1) Na_2CO_3 (2) $CaCO_3$ (3) $Al_2(CO_3)_3$ (4) $MgCO_3$

Ans. **[1]**

Sol. Group 1 carbonates except Li_2CO_3 do not decompose on heating.

35. In the 13^{th} group from Al to Tl, the stability of +1 oxidation state increases due to

(1) Irregular increase in size (2) decrease in ionization enthalpy

(3) inert pair effect (4) decrease in ionic nature of compounds

Ans. **[3]**

Sol. Due to inert pair effect, in group 13, stability of (+1) oxidation store increases down the group.

36. In the refining of Nickel, technique used is

(1) Zone refining (2) Liquation refining

(3) Vapour phase refining (4) Chromatography

Ans. **[3]**

Sol. Vapour phase refining (Mond's process) is used for the purification of Ni.

37. Liquid in liquid colloid is

(1) Gel (2) Emulsion (3) sol (4) Foam

Ans. **[2]**

Sol. Liquid in liquid are called emulsions.

38. ns^2np^4 configuration represents the group

(1) 4 (2) 6 (3) 16 (4) 18

Ans. **[3]**

Sol. ns^2 np^4 represents the oxygen family hence group 16.

39. In the alkali metal group, the stability of peroxides and superoxides of metal ions increases

(1) due to same size
(2) due to increases in ionisation enthalpy
(3) due to increase in size
(4) due to decrease in size.

Ans. **[3]**

Sol. Stability of peroxides and super oxides of metal ions increases due to increase in size.

40. Which of the following pairs of elements forms covalent nitride by the direct combination with nitrogen?

(1) Li, Mg
(2) Na, Ca
(3) K, Sr
(4) Rb, Ba

Ans. **[1]**

Sol. Li and Mg both forms covalent nitride

$$6Li + 3N_2 \longrightarrow 2Li_3N$$

$$3Mg + N_2 \longrightarrow Mg_3N_2$$

41. Covalent solid is

(1) CO_2
(2) SiO_2
(3) CaF_2
(4) SO_2

Ans. **[2]**

Sol. SiO_2(silica) is a covalent solid

42. ……………. contains odd number of valence electrons.

(1) NO_2
(2) N_2O
(3) N_2O_3
(4) N_2O_5

Ans. **[1]**

Sol. NO_2 contains 17 valence electrons.

43. Nylon-6, 6 is

(1) Addition polymer
(2) Condensation polymer
(3) Thermoplastic polymer
(4) thermosetting polymer

Ans. **[2]**

Sol. Nylon–6,6 is a condensation polymer which is formed by condensation reaction of adipic acid & hexamethylene diamine.

$$n\,HO-\overset{\overset{O}{\|}}{C}-(CH_2)_4-\overset{\overset{O}{\|}}{C}-OH + nH_2N-(CH_2)_6-NH_2 \longrightarrow \left[-\overset{\overset{O}{\|}}{C}-(CH_2)_4-\overset{\overset{O}{\|}}{C}-NH-(CH_2)_6-NH-\right]_n$$

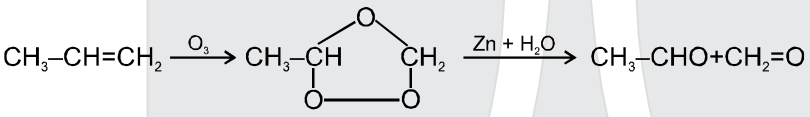
44. Propene react with ozone to give addition product. This on hydrolysis in the presence of Zn gives

(1) Formaldehyde (2) Acetaldehyde

(3) Acetone (4) Formaldehyde and Acetaldehyde

Ans. **[4]**

Sol.



Ozonide

45. Which of the following elements does not exhibit positive oxidation state?

(1) Br (2) Cl (3) F (4) I

Ans. **[3]**

Sol. 'F' atom shows only –1 oxidation Number where as other halogen can show both negative and positive oxidation number.

46. Zincite ore is

(1) oxide (2) chloride (3) sulphate (4) carbonate

Ans. **[4]**

Sol. Zincite is the ore of Zn formula of zincite is ($ZnCO_3$) which is a carbonate ore.

47. In first row transition series the metal which exhibits the maximum oxidation state is

(1) Cr (2) Co (3) Fe (4) Mn

Ans. **[4]**

Sol. In first row transition series, Mn shows maximum oxidation number.

48. By treating an aqueous solution of ammonium chloride with sodium nitrite, gaseous product obtained is

(1) NH_3 (2) Cl_2 (3) N_2 (4) NO_2

Ans. **[3]**

Sol. $NH_4Cl + NaNO_2 \longrightarrow N_2 + NaCl + 2H_2O$

49. Ranitidine drug is

(1) Tranquilizer (2) Antihistamine (3) Antacid (4) Antibiotic

Ans. **[3]**

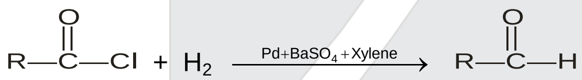
Sol. Ranitidine is an antacid.

50. In which reaction is aldehyde obtained from acyl chloride?

(1) Rosenmund reduction (2) Stephen reaction

(3) Clemmensen reduction (4) Finkelstein reaction

Ans. **[1]**

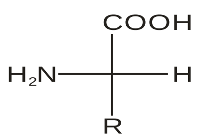
Sol. 

51. Amino acids obtained by the hydrolysis of proteins are

(1) α- amino acids (2) β-amino acids (3) γ -amino acids (4) all of these

Ans. **[1]**

Sol. Amino acids are α –amino arboxylic acids



52. Radioactive decay takes place by…….. kinetics.

(1) zero order (2) first order (3) second order (4) pseudo first order

Ans. **[2]**

Sol. Radioactive decay follow I order kinetics

53. Which of the following reagents on reaction with CH_3MgI gives primary alcohol?

(1) Formaldehyde (2) Acetaldehyde (3) Acetone (4) Water

Ans. **[1]**

Sol. (1) $CH_2{=}O + MeMgI \xrightarrow{(ii)\ H_3O^+} Me{-}CH_2{-}OH$ (1° Alcohol)

(2) $CH_3{-}CH{=}O \xrightarrow[(ii)\ H_3O^+]{(ii)\ MeMgI} CH_3{-}\underset{}{\overset{CH_3}{\overset{|}{C}}}H{-}OH$ (2° Alcohol)

(3) $Me_2C{=}O \xrightarrow[(ii)\ H_3O^+]{(i)\ MeMgI} Me_3C{-}OH$ (3° Alcohol)

(4) $Me{-}MgI + H_2O \longrightarrow CH_4$

54. Most successful and pollution free cell is

(1) Dry cell (2) Mercury cell (3) Fuel cell (4) Ni-Cd cell

Ans. **[3]**

Sol. Most successful and pollution free cell is fuel cell because it produces H_2O as product.

55. The concentratration of 0.1 M NaOH solution is

(1) 1 g/250 mL (2) 2 g/250 mL (3) 4 g/250 mL (4) 8 g/250 mL

Ans. **[1]**

Sol. 0.1 mole NaOH in 1000 ml

so $\frac{0.1}{4} \times 40$ = 1 gm in 250 ml

56. Which of the following salts does not hydrolise?

(1) CH_3COONa (2) NH_4Cl (3) CH_3COONH_4 (4) NaCl

Ans. **[4]**

Sol. NaCl will not hydrolised

57. Which of the following is Lewis acid?

(1) F^- (2) NH_3 (3) HO^- (4) BCl_3

Ans. **[4]**

Sol. BF_3 has incomplete octet and vacant p–orbital so it will accept lone pair. So it acts like lewis acid.

58. Paramagnetic behaviour is represented by

(1) S_8 monoclinic (2) S_2 (3) S_8 rhombic (4) S_6

Ans. **[2]**

Sol. According to M.O.T. it has unpaired e^- in π^*2Px and π^*2Py orbitals. so it is paramagnetic.

59. Nucleophilic addition reactions are shown by

(1) Carboxylic acids (2) Haloalkanes

(3) Carbonyl compounds (4) Amines

Ans. **[3]**

Sol. Nucleophilic addition reaction is characteristic reaction of carbonyl compounds.

60. In which of the following is the number of significant figures maximum?

(1) 0.0015 (2) 115000 (3) 5.0045 (4) 1002

Ans. **[3]**

PART-III
MATHEMATICS

61. If P (A) is power set of A, then which one of the following is true?

(1) $\{A\} \in P(A)$ (2) $A \subset P(A)$ (3) $\{A\} \subset P(A)$ (4) None of these

Ans. **[3]**

Sol. Obriously $\{A\} \subset P(A)$

62. If function $f(x) = |x-2| - 2|x-3|$ then for 2 < x < 3, f(x) is equal to

(1) x – 4 (2) 4 – x (3) 8 – 3x (4) 3x – 8

Ans. **[4]**

Sol. for $2 < x < 3$, $|x-2| = x-2$

& $2|x-3| = -2x+6$

so $f(x) = x - 2 + 2x - 6$

$= 3x - 8$

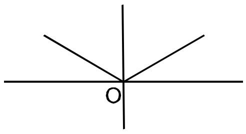
63. If $f : R \to R$ and f(x) = | x | then f(x) will be

(1) one-one onto (2) one-one into (3) many-one onto (4) many-one into

Ans. **[4]**

Sol. graph of f(x) = |x| is

so may one and into



64. Value of $\cot\left(\frac{23\pi}{12}\right)$ is

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

Ans. **[4]**

Sol. $\cot\left(\frac{23\pi}{12}\right)=\cot\left(2\pi-\frac{\pi}{12}\right)$

$= -\cot\frac{\pi}{12}$

$= -\tan 75°$

$= -(2+\sqrt{3})$

65. Number of solutions of $2\cos x+1=0$ in interval $[0, 3\pi]$ is

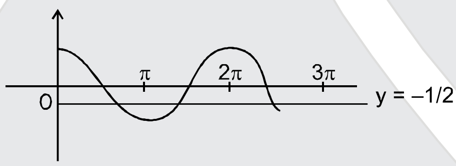
(1) 1 (2) 2 (3) 3 (4) infinite

Ans. **[3]**

Sol. $\cos x = \frac{-1}{2}$

Number of solutions

= 3



66. Amplitude (iz) is equal to

(1) $\frac{\pi}{2}+\text{amp}\,z$ (2) $-\frac{\pi}{2}+\text{amp}\,z$ (3) $\frac{\pi}{2}-\text{amp}\,z$ (4) $-\frac{\pi}{2}-\text{amp}\,z$

Ans. **[1]**

Sol. Amplitude (iz) = Ampi + Amp z =

= $\pi/2+$ Amp z $=$

67. How many even numbers of 5 digits can be made from digits 2, 4, 6, 8, 9 ?

(1) 120 (2) 24 (3) 12 (4) 96

Ans. **[4]**

Sol. 4 × 4! = 96

68. There are 20 persons in a party and every person shakes hand to each other. Then total number of handshakes will be

(1) 100 (2) 190 (3) 200 (4) 380

Ans. **[2]**

Sol. $^{20}C_2 = \frac{20 \times 19}{2} = 190$

69. If nth term of an A.P. in 3n + 5, then its common difference is

(1) 1 (2) 3 (3) 5 (4) 8

Ans. **[2]**

Sol. $d = T_n - T_{n-1} = (3n+5) - (3(n-1)+5) = 3$

70. Middle term of, in the expansion of $\left(3x^2 - \frac{1}{2x}\right)^{10}$ will be

(1) 6th (2) 5th (3) 10th (4) 11th

Ans. **[1]**

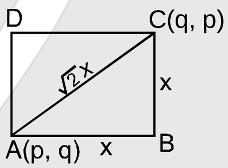
Sol. Middle Term = T_6

71. Area of the square whose vertices of diagonals are (p, q) and (q, p) will be

(1) $(p+q)^2$ (2) $p^2 + q^2$ (3) $p^2 - q^2$ (4) $(p-q)^2$

Ans. **[4]**

Sol. AC = $\sqrt{2}|p-q| = \sqrt{2}x$



x = $|p-q|$

Area of square = $(p – q)^2$

72. Eccentricity of the parabola is

(1) e = 0 (2) e = 1 (3) e < 1 (4) e > 1

Ans. **[2]**

Sol. e = 1

73. If $f(9) = 9, f'(9) = 4$, then the value of $\underset{x \to 9}{\text{lt}} \frac{\sqrt{f(x)} - 3}{\sqrt{x} - 3}$ is

(1) 1 (2) 2 (3) 3 (4) 4

Ans. **[4]**

Sol. $$\lim_{x \to 9} \frac{\frac{1}{2}\frac{f'(x)}{\sqrt{f(x)}}}{\frac{1}{2\sqrt{x}}}$$

$$= \frac{4 \times 3}{3} = 4$$

74. If $f(x) = \log_x (\log_e x)$ then at $x = e$, $f'(x) =$

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

Ans. **[3]**

Sol. $f(x) = \log_x(\log_e x) = \frac{\ln(\ln x)}{\ln x}$

$f'(x) = \frac{\ln x . \frac{1}{\ln x} . \frac{1}{x} - \frac{\ln \ln x}{x}}{(\ln x)^2}$

$f'(x) = \frac{1-\ln(\ln x)}{x(\ln x)^2} =$

$f'(e) = \frac{1}{e}$

75. If $f(x) = 2^x + 2^{x+1} + 2^{x+2} + ... + 2^{x+9}$ then the value of $f'(2)$ will be

(1) $2^x \log_e 2$ (2) $1023 \log_e 2$ (3) $1023 \log_e 16$ (4) $1023 \log_e 4$

Ans. **[3]**

Sol. $f(x) = 2^x\left(\frac{2^{10}-1}{2-1}\right) = 1023.2^x$

$f'(x) = 1023 \quad 2^x \ln 2$

$f'(2) = 1023 \times 4 \times \ln 2 = 1023 \ln 16$

76. If A is non-zero square matrix whose order is 3 × 3 then |adj A| is equal to

(1) |A| (2) $|A|^2$ (3) $|A|^3$ (4) 3|A|

Ans. **[2]**

Sol. $|\text{adj } A| = |A|^{n-1} = |A|^2$

77. Matrix A is or order 3 × 4 and B is such a type of matrix that A^TB and AB^T are both defined. The order of matrix B will be

(1) 4 × 3 (2) 3 × 3 (3) 3 × 4 (4) 4 × 4

Ans. **[3]**

Sol. area of B must be 3 × 4

$A^T . B = [A^TB]$ $\quad$ $A \quad B^T = [AB^T]_{3\times3}$

4×3 . 3×4 4×4 $\quad$ 3×4 4×3 3×3

78. The value of the following determinant $\begin{vmatrix} o & p & -q \\ -p & o & r \\ q & -r & o \end{vmatrix}$ will be

(1) pqr (2) –2pqr (3) $p^2+q^2+r^2$ (4) 0

Ans. [4]

Sol. Zero (skew symmetric matrix of odd order is always singular)

$$\Delta = \begin{vmatrix} o & p & -q \\ -p & o & r \\ q & -r & o \end{vmatrix} = (-1)^3 \begin{vmatrix} o & -p & +q \\ p & o & -r \\ -q & r & o \end{vmatrix}$$ (taking common –1 from R_1, R_2 & R_3)

$$\Delta = -\begin{vmatrix} o & -p & q \\ p & o & -r \\ -q & r & o \end{vmatrix} = -\begin{vmatrix} o & p & -q \\ -p & o & r \\ q & -r & o \end{vmatrix}$$ ($A^T = A$)

$$\Delta = -\Delta \Rightarrow \Delta = 0$$

79. If $\cos^{-1}\frac{3}{5} - \sin^{-1}\frac{4}{5} = \cos^{-1}x$ then value of x is

(1) 0 (2) 1 (3) 2 (4) 3

Ans. [2]

Sol. $\cos^{-1}\left(\frac{3}{5}\right) - \sin^{-1}\left(\frac{4}{5}\right) = \cos^{-1}x$

$$\cos^{-1}\left(\frac{3}{5}\right) - \cos^{-1}\frac{3}{5} = \cos^{-1}x \qquad \left(\because \quad \sin^{-1}\frac{4}{5} = \cos^{-1}\frac{3}{5}\right)$$

$$\Rightarrow \quad \cos^{-1}x = 0 \qquad x = 1$$

80. Increasing function for all real values of x is

(1) x^2 (2) $x^2 - 1$ (3) x^3 (4) x^4

Ans. [3]

Sol. $f(x) = x^3$ $f'(x) = 3x^2 \geq 0 \quad \forall\ x \in R$

81. The point where slope of curve y = $y = \sqrt{4x-3} - 1$ is $\frac{2}{3}$, is

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

Ans. [2]

Sol. $y = \sqrt{4x-3} - 1$

$\frac{dy}{dx} = \frac{4}{2\sqrt{4x-3}} = \frac{2}{3} \Rightarrow \sqrt{4x-3} = 3$

$4x - 3 = 9 \qquad x = 3$

$y = \sqrt{4x-3} - 1 = 2$

$x = 3$

82. If $\int \sqrt{2}\sqrt{1+\sin x}\, dx = -4\cos(ax+b) + c$, then the value of (a, b) is

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

Ans. **[2]**

Sol. $\int \sqrt{2}\sqrt{1+\sin x}\, dx$

$= \int \sqrt{2}(\cos\frac{x}{2} + \sin\frac{x}{2})dx$

$= 2\int \sin\left(\frac{\pi}{4} + \frac{x}{2}\right)dx$

$= -\frac{2\cos\left(\frac{x}{2} + \frac{\pi}{4}\right)}{\frac{1}{2}} + C$

$= -4\cos\left(\frac{x}{2} + \frac{\pi}{4}\right) + C$

So $\quad a = \frac{1}{2}, \quad b = \frac{\pi}{4}$

83. The value of $\int x^x(1+\log_e x)dx$ is

(1) x^x (2) x^{2x} (3) $x^x \log_e x$ (4) $\frac{1}{2}(1+\log_e x)^2$

Ans. **[1]**

Sol. $\int x^x(1+\log_e x)dx$

$x^x = t$

$x^x(1+\log_e x)dx = dt$

$= \int \frac{t\, dt}{t} = t + C = x^x + c$

84. The value of $\int_0^1 x(1-x)^n dx$ is

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

Ans. **[3]**

Sol. $I = \int_0^1 x(1-x)^n dx$

$I = \int_0^1 (1-x)x^n dx$ $\left[\because \int_0^a f(x)\,dx = \int_0^a f(a-x)dx\right.$

$= \left(\frac{x^{n+1}}{n+1} - \frac{x^{n+2}}{n+2}\right)_0^1$

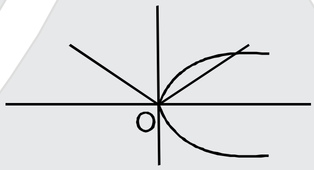
$= \frac{1}{n+1} - \frac{1}{n+2}$

85. Area enclosed between the curve $y^2 = x$ and $y = |x|$ is

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

Ans. **[3]**

Sol. Area = $\int_0^1 (\sqrt{x} - |x|)\,dx$



$= \left(\frac{2}{3}x^{3/2} - \frac{x^2}{2}\right)_0^1$

$= \frac{2}{3} - \frac{1}{2} = \frac{1}{6}$

86. If $|\vec{a}| = 3, |\vec{b}| = 4$ and $|\vec{a}+\vec{b}| = 5$ then $|\vec{a}-\vec{b}| =$

(1) 5 (2) 4 (3) 6 (4) 3

Ans. **[1]**

Sol. $|\vec{a}+\vec{b}|^2 = 5^2$

$a^2 + b^2 + 2\vec{a}.\vec{b} = 25$

$25 + 2\vec{a}.\vec{b} = 25$

$\vec{a}.\vec{b} = 0$

$|\vec{a}-\vec{b}| = \sqrt{a^2 + b^2 - 2\vec{a}.\vec{b}}$

$= \sqrt{25-0} = 5$

87. If line $\frac{x-x_1}{l}=\frac{y-y_1}{m}=\frac{z-z_1}{n}$ and the plane ax + by + cz + d = 0 is parallel then

(1) al + bm + cn = 0 (2) a + b + c = 0

(3) l + m + n = 1 (4) $\frac{a}{l}=\frac{b}{m}=\frac{c}{n}$

Ans. **[1]**

Sol. normal of plane is $\perp$r to line

$\therefore$ al + bm + cn = 0

88. The probability of getting 5 exactly twice in 6 throws of a dice is

(1) $\frac{1}{2}\left(\frac{5}{6}\right)^4$ (2) $\frac{1}{2}\left(\frac{5}{6}\right)^5$ (3) $\left(\frac{5}{6}\right)^5$ (4) $\left(\frac{1}{6}\right)^2\left(\frac{5}{6}\right)^4$

Ans. **[2]**

Sol. $P={}^6C_2\times\left(\frac{1}{6}\right)^2\left(\frac{5}{6}\right)^4$

$=\frac{15\times5^4}{6^6}=\frac{3\times5^5}{6\times6^5}=\frac{1}{2}\left(\frac{5}{6}\right)^5$

89. If the one end of diameter of the circle $x^2 + y^2 - 4x - 6y + 11 = 0$ is (3, 4) then other end will be

(1) (0, 0) (2) (1, 1) (3) (1, 2) (4) (2, 1)

Ans. **[3]**

Sol. centre (2, 3) let it is (α, β)

$\frac{\alpha+3}{2}=2,\quad \frac{\beta+4}{2}=3$

$\alpha=1,\quad \beta=2$

90. If $\sum x_i^2=100,\ n=5$ and $\sum x_i=20$ then variance =

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

Ans. **[2]**

Sol. $\sigma^2=\frac{\sum x_1^2}{n}-(\bar{x})^2$

$=\frac{100}{5}-\left(\frac{20}{5}\right)^2$

= 20 – 16 = 4