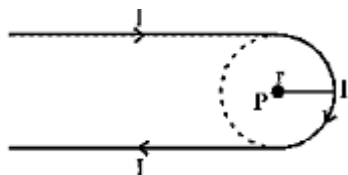


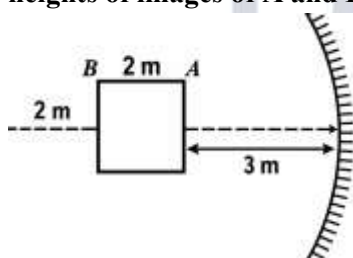
PART - I (PHYSICS)

1. When the force retards the motion of body, the work done is
 - (a) zero
 - (b) negative
 - (c) positive
 - (d) Positive or negative depending upon the magnitude of force and displacement
2. A steel rod has a radius of 20 mm and a length of 2.0 m. A force of 62.8 kN stretches it along its length. Young's modulus of steel is $2.0 \times 10^{11} \text{ N/m}^2$. The longitudinal strain produced in the wire is
 - (a) 25×10^{-5}
 - (b) 50×10^{-5}
 - (c) 75×10^{-5}
 - (d) 100×10^{-5}
3. Which of the following processes is irreversible?
 - (a) Transfer of heat by radiation
 - (b) Adiabatic changes performed slowly
 - (c) Extremely slow extension of a spring
 - (d) Isothermal changes performed slowly
4. When the wavelength of radiation falling on a metal is changed from 500 nm to 200 nm, the maximum kinetic energy of the photoelectrons becomes three times larger. The work function of the metal is close to :
 - (a) 0.81 eV
 - (b) 1.02 eV
 - (c) 0.52 eV
 - (d) 0.61 eV
5. The magnitude of electric field intensity E is such that, an electron placed in it would experience an electrical force equal to its weight is given by
 - (a) mge
 - (b) $\frac{mg}{e}$
 - (c) $\frac{e}{mg}$
 - (d) $\frac{e^2}{m^2} g$
6. A balloon filled with helium (32°C and 1.7 atm .) bursts. Immediately afterwards the expansion of helium can be considered as :
 - (a) irreversible isothermal
 - (b) irreversible adiabatic
 - (c) reversible adiabatic
 - (d) reversible isothermal
7. From a point charge, there is a fixed point A at same distance. At A, there is an electric field of 500 V/m and potential difference of 3000 V. Distance between point charge and A will be
 - (a) 6 m
 - (b) 12 m
 - (c) 16 m
 - (d) 24 m
8. In Bernoulli's theorem which of the following is conserved?
 - (a) Mass
 - (b) Linear momentum
 - (c) Energy
 - (d) Angular momentum
9. A tightly wound long solenoid carries a current 5 A . An electron shot perpendicular to the solenoid axis inside it revolves at a frequency 10^8 rev/s . The number of turns per meter length of the solenoid is
 - (a) 57
 - (b) 176
 - (c) 569
 - (d) 352
10. Two deuterons undergo nuclear fusion to form a Helium nucleus. Energy released in this process is : (given binding energy per nucleon for deuteron = 1.1MeV and for helium = 7.0MeV)
 - (a) 30.2 MeV
 - (b) 32.4 MeV
 - (c) 23.6 MeV
 - (d) 25.8 MeV
11. The magnetic energy stored in an inductor of inductance $4 \mu\text{H}$ carrying a current of 2 A is
 - (a) $4 \mu\text{J}$
 - (b) 4 mJ
 - (c) 8 mJ
 - (d) $8 \mu\text{J}$

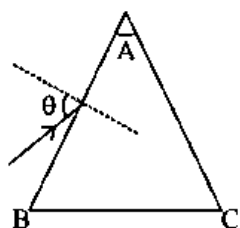
12. A hairpin like shape as shown in figure is made by bending a long current carrying wire. What is the magnitude of a magnetic field at point P which lies on the centre of the semicircle?



- (a) $\frac{\mu_0 I}{4\pi r} (2 + \pi)$ (b) $\frac{\mu_0 I}{4\pi r} (2 - \pi)$
(c) $\frac{\mu_0 I}{2\pi r} (2 - \pi)$ (d) $\frac{\mu_0 I}{2\pi r} (2 + \pi)$
13. Two bodies of equal masses moving with equal speeds make a perfectly inelastic collision. If the speed after the collision is reduced to half, the angle between their velocities of approach is.
- (a) 30° (b) 60°
(c) 90° (d) 120°
14. An electromagnetic wave propagating through vacuum is give by $E = E_0 \sin(\omega t - kx)$. Choose correct option
- (a) The average value of $E = \frac{E_0}{2}$
(b) The average value of produced magnetic field is zero
(c) The average value of electric energy density is equal to the average value of magnetic energy density
(d) Both (b) and (c)
15. A cube of side 2 m is placed in front of a concave mirror of focal length 1 m with its face A at a distance of 3 m and face B at a distance of 5 m form the mirror. The distance between the images of faces A and B and heights of images of A and B are respectively,



- (a) 1 m, 0.5 m, 0.25 m
(b) 0.5 m, 1 m, 0.25 m
(c) 0.5 m, 0.25 m, 1 m
(d) 0.25 m, 1 m, 0.5 m
16. Unpolarised light is incident on a dielectric of refractive index $\sqrt{3}$. What is the angle of incidence if the reflected beam is completely polarised?
- (a) 30° (b) 45°
(c) 60° (d) 75°
17. Monochromatic light is incident on a glass prism of angle A. If the refractive index of the material of the prism is μ , a ray, incident at an angle θ , on the face AB would get transmitted through the face AC of the prism provided :



- (a) $\theta > \cos^{-1} \left[\mu \sin \left(A + \sin^{-1} \left(\frac{1}{\mu} \right) \right) \right]$
 (b) $\theta < \cos^{-1} \left[\mu \sin \left(A + \sin^{-1} \left(\frac{1}{\mu} \right) \right) \right]$
 (c) $\theta > \sin^{-1} \left[\mu \sin \left(A - \sin^{-1} \left(\frac{1}{\mu} \right) \right) \right]$
 (d) $\theta < \sin^{-1} \left[\mu \sin \left(A - \sin^{-1} \left(\frac{1}{\mu} \right) \right) \right]$

18. Assume that protons and neutrons have equal masses. Mass of a nucleon is 1.6×10^{-27} kg and radius of nucleus is $1.5 \times 10^{-15} A^{1/3}$ m. The approximate ratio of the nuclear density and water density is $n \times 10^{13}$. The value of n is

- (a) 11.31 (b) 21
 (c) 66 (d) 78

19. Two liquid drops of equal radii are falling through air with the terminal velocity v . If these two drops coalesce to form a single drop, its terminal velocity will be :

- (a) $\sqrt{2}v$ (b) $2v$
 (c) $(4)^{1/3}v$ (d) $\sqrt[3]{2}v$

20. A 40μ F capacitor is connected to a 200 V, 50 Hz ac supply. The rms value of the current in the circuit is, nearly :

- (a) 2.05 A (b) 2.5 A
 (c) 25.1 A (d) 1.7 A

21. A plane electromagnetic wave of frequency 25 GHz is propagating in vacuum along the z-direction. At a particular point in space and time, the magnetic field is given by $\vec{B} = 5 \times 10^{-8} \hat{j}T$. The corresponding electric field $\vec{E}$ is (speed of light $c = 3 \times 10^8$ ms⁻¹)

- (a) $1.66 \times 10^{-16} \hat{i}$ V/m
 (b) $-1.66 \times 10^{-16} \hat{i}$ V/m
 (c) $-15 \hat{i}$ V/m
 (d) $15 \hat{i}$ V/m

22. The effective resistance of a parallel connection that consists of four wires of equal length, equal area of crosssection and same material is 0.25Ω . What will be the effective resistance if they are connected in series?

- (a) 4Ω (b) 0.25Ω
 (c) 0.5Ω (d) 1Ω

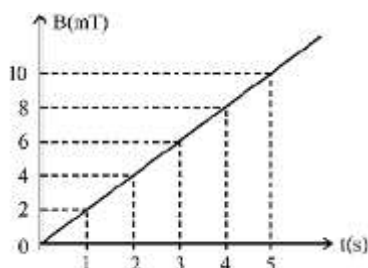
23. The coefficient of static friction between two surfaces depends upon

- (a) the normal reaction
 (b) the shape of the surface in contact
 (c) the magnitude of applied force
 (d) None of these

24. In an explosion, a body breaks up into two pieces of unequal masses. In this

- (a) both parts will have numerically equal momentum
 (b) lighter part will have more momentum
 (c) heavier part will have more momentum
 (d) both parts will have equal velocity

25. The magnetic field B crossing normally a square metallic plate of area 4 m^2 is changing with time as shown in figure. The magnitude of induced emf in the plate during $t = 2 \text{ s}$ to $t = 4 \text{ s}$, is



- (a) 4 Mv (b) 8 mV
(c) 12 mV (d) 16 mV

26. A particle of mass m has momentum p . Its kinetic energy will be

- (a) mp (b) p^2m
(c) $\frac{p^2}{m}$ (d) $\frac{p^2}{2m}$

27. The potential energy of a system increases if work is done

- (a) upon the system by a non conservative force
(b) by the system against a conservative force
(c) by the system against a non conservative force
(d) upon the system by a conservative force

28. A particle moves under the effect of a force $F = cx$ from $x = 0$ to $x = x_1$, the work done in the process is

- (a) cx_1^2 (b) $\frac{1}{2}cx_1^2$
(c) $2cx_1^2$ (d) zero

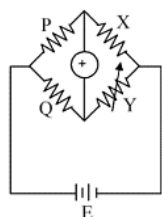
29. The Bulk modulus of a liquid is $3 \times 10^{10} \text{ Nm}^{-2}$. The pressure required to reduce the volume of liquid by 2% is :

- (a) $3 \times 10^8 \text{ Nm}^{-2}$ (b) $9 \times 10^8 \text{ Nm}^{-2}$
(c) $6 \times 10^8 \text{ Nm}^{-2}$ (d) $12 \times 10^8 \text{ Nm}^{-2}$

30. An insect is at the bottom of a hemispherical ditch of radius 1 m. It crawls up the ditch but starts slipping after it is at height h from the bottom. If the coefficient of friction between the ground and the insect is 0.75, then h is : ($g = 10 \text{ ms}^{-2}$)

- (a) 0.20 m (b) 0.45 m
(c) 0.60 m (d) 0.80 m

31. A wheat stone bridge is used to determine the value of unknown resistance X by adjusting the variable resistance Y as shown in the figure. For the most precise measurement of X , the resistances P and Q :



- (a) should be approximately equal and are small
(b) should be very large and unequal
(c) do not play any significant role
(d) should be approximately equal to $2X$

32. Two metallic plates form a parallel plate capacitor. The distance between the plates is ' d '. A metal sheet of thickness $\frac{d}{2}$ and of area equal to area of each plate is introduced between the plates. What will be the ratio of the new capacitance to the original capacitance of the capacitor ?

- (a) 2:1 (b) 1:2
(c) 1:4 (d) 4:1

33. The velocity of water in a river is 18 km/hr near the surface. If the river is 5 m deep, find the shearing stress between the horizontal layers of water. The co-efficient of viscosity of water = 10^{-2} poise.

- (a) 10^{-1} N/m^2 (b) 10^{-2} N/m^2
(c) 10^{-3} N/m^2 (d) 10^{-4} N/m^2

34. After terminal velocity is reached, the acceleration of a body falling through a fluid is

- (a) equal to g (b) zero
(c) less than g (d) greater than g

35. A liquid is filled upto a height of 20 cm in a cylindrical vessel. The speed of liquid coming out of a small hole at the bottom of the vessel is ($g = 10 \text{ ms}^{-2}$)

- (a) 1.2 ms^{-1} (b) 1 ms^{-1}
(c) 2 ms^{-1} (d) 3.2 ms^{-1}

PART - II (CHEMISTRY)

36. In a collection of H -atoms, all the electrons jump from $n = 5$ to ground level finally (directly or indirectly), without emitting any line in Balmer series. The number of possible different radiations is :

- (a) 10 (b) 8
(c) 7 (d) 6

37. According to molecular orbital theory, the species among the following that does not exist is

- (a) He_2^- (b) Be_2
(c) He_2^+ (d) O_2^{2-}

38. Which of the following statements/relationships is not correct in thermodynamic changes?

- (a) $\Delta U = 0$ (isothermal reversible expansion of a gas)
(b) $w = -nRT \ln \frac{V_2}{V_1}$ (isothermal reversible expansion of an ideal gas)
(c) $w = nRT \ln \frac{V_2}{V_1}$ (isothermal reversible expansion of an ideal gas)
(d) For a system of constant volume heat involved directly changes to internal energy.

39. If the reaction between CO_2 and H_2O is $\text{CO}_2 + \text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{CO}_3 \rightleftharpoons \text{H}^+ + \text{HCO}_3^-$

If CO_2 escapes from the system

- (a) pH will decrease
(b) H^+ concentration will decrease
(c) H_2CO_3 concentration will be altered
(d) The forward reaction is promoted

40. For the reaction :



$\Delta H = +ve$. In equilibrium condition, pressure of O_2 is dependent on

- (a) mass of BaO_2
(b) mass of BaO
(c) temperature of equilibrium
(d) mass of BaO_2 and BaO both

41. The vapour pressure of a solution of the liquids A ($P^\circ = 80 \text{ mm Hg}$ and $x_A = 0.4$) and B ($P^\circ = 120 \text{ mmHg}$ and $x_B = 0.6$) is found to be 100 mm Hg . It shows that the solution exhibits

- (a) positive deviation from ideal behaviour
(b) negative deviation from ideal behaviour
(c) ideal behaviour
(d) positive deviation for lower conc. and negative for higher conc.

42. Freezing point of an aqueous solution is $(-0.186)^\circ\text{C}$. Elevation of boiling point of the same solution is $K_b = 0.512^\circ\text{C}$, $K_f = 1.86^\circ\text{C}$, find the increase in boiling point.

- (a) 0.186°C (b) 0.0512°C
(c) 0.092°C (d) 0.2372°C

43. The EMF of the cell $\text{Ti}/\text{Ti}^+(0.001\text{M})\parallel\text{Cu}^{2+}(0.01\text{M})/\text{Cu}$ is 0.83 . The cell EMF can be increased by

- (a) Increasing the concentration of Ti^+ ions.
(b) Increasing the concentration of Cu^{2+} ions.

- (c) Increasing the concentration of Ti^+ and Cu^{2+} ions.
(d) None of these

44. Activation energy of a chemical reaction can be determined by

- (a) evaluating rate constant at standard temperature
(b) evaluating velocities of reaction at two different temperatures
(c) evaluating rate constants at two different temperatures
(d) changing concentration of reactants

45. Identify the correct statement regarding enzymes ____ .

- (a) Enzymes are specific biological catalysts that cannot be poisoned
(b) Enzymes are normally heterogeneous catalysts that are very specific in their action
(c) Enzymes are specific biological catalysts that can normally function at very high temperatures ($T \approx 1000 \text{ K}$)
(d) Enzymes are specific biological catalysts that possess well-defined active sites

46. The number of P – OH bonds and the oxidation state of phosphorus atom in pyrophosphoric acid ($\text{H}_4\text{P}_2\text{O}_7$) respectively are :

- (a) four and four (b) five and four
(c) five and five (d) four and five

47. On the basis of data given below,

$$E_{\text{Sc}^{3+}/\text{Sc}^{2+}}^\circ = -0.37, E_{\text{Mn}^{3+}/\text{Mn}^{2+}}^\circ = +1.57$$

$$E_{\text{Cr}^{2+}/\text{Cr}}^\circ = -0.90, E_{\text{Cr}^{2+}/\text{Cu}}^\circ = 0.34$$

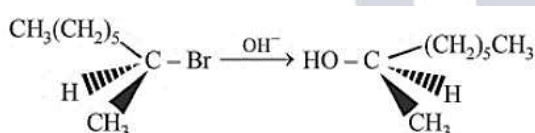
Which of the following statements is incorrect?

- (a) Sc^{3+} has good stability due of $[\text{Ar}]3d^04s^0$ configuration.
(b) Mn^{3+} is more stable than Mn^{2+} .
(c) Cr^{2+} is reducing in nature.
(d) Copper does not give H_2 on reaction with dil. H_2SO_4 .

48. In Cannizzaro reaction given below $2\text{PhCHO} \xrightarrow{\text{OH}^-} \text{PhCH}_2\text{OH} + \text{PhCO}_2^-$ the slowest step is :

- (a) the transfer of proton to the carbonyl group
(b) the abstraction of proton from the carboxylic group
(c) the deprotonation of PhCH_2OH
(d) the attack of: OH^- at the carboxyl group

49. The reaction is described as



- (a) $\text{S}_{\text{E}}2$ (b) $\text{S}_{\text{N}}1$
(c) $\text{S}_{\text{N}}2$ (d) $\text{S}_{\text{N}}0$

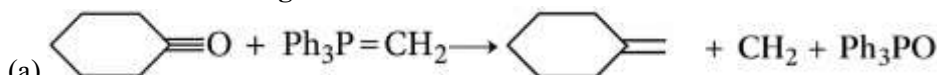
50. The number and type of bonds in ion in CaC_2 are:

- (a) One σ bond and one π -bond
(b) One σ bond and two π -bond
(c) Two σ bond and two π -bond
(d) Two σ bond and one π -bond

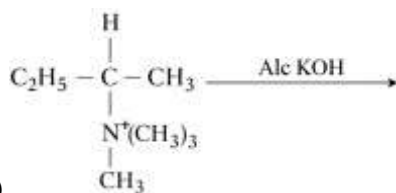
51. The difference between the reaction enthalpy change ($\Delta_r H$) and reaction internal energy change ($\Delta_r U$) for the reaction: $2\text{C}_6\text{H}_6(\text{l}) + 15\text{O}_2(\text{g}) \rightarrow 12\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{l})$ at 300 K is ($R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$)

- (a) 0 J mol^{-1} (b) 2490 J mol^{-1}
(c) -2490 J mol^{-1} (d) -7482 J mol^{-1}

52. Which of the following reactions is elimination reaction?



- (a) $\text{C}_2\text{H}_5\text{Cl} + \text{KOH} \rightarrow \text{C}_2\text{H}_5\text{OH} + \text{KCl}$



- (c) $\text{CH}_3\text{CH} = \text{CH} - \text{CH}_3 + \text{N}(\text{CH}_3)_3$
 (d) None of them

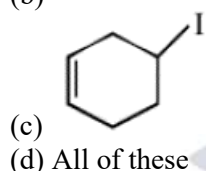
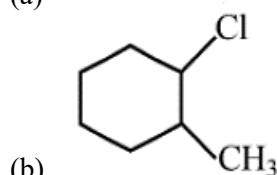
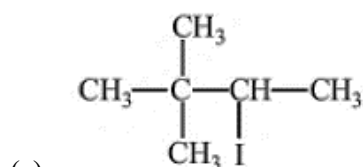
53. Vapour pressure of solution containing 2 mol of liquid A ($P_A^0 = 80$ torr) and 3 mol of liquid B ($P_B^0 = 100$ torr) is 87 torr. We can conclude that
 (a) there is negative deviation from Raoult's law
 (b) boiling point is higher than that expected for ideal solution
 (c) molecular attractions between unlike molecules are stronger than those between like molecules
 (d) All of these statements are correct
54. For an electrolyte solution of 0.05 mol L^{-1} , the conductivity has been found to be 0.0110 S cm^{-1} . The molar conductivity is
 (a) $0.055 \text{ S cm}^2 \text{ mol}^{-1}$
 (b) $550 \text{ S cm}^2 \text{ mol}^{-1}$
 (c) $0.22 \text{ S cm}^2 \text{ mol}^{-1}$
 (d) $220 \text{ S cm}^2 \text{ mol}^{-1}$
55. Given below are a few electrolytes, indicate which one among them will bring about the coagulation of a gold sol quickest and in the least of concentration?
 (a) NaCl (b) MgSO_4
 (c) $\text{Al}_2(\text{SO}_4)_3$ (d) $\text{K}_4[\text{Fe}(\text{CN})_6]$
56. In neutral or alkaline solution, MnO_4^- oxidises thiosulphate to:
 (a) $\text{S}_2\text{O}_7^{2-}$ (b) $\text{S}_2\text{O}_8^{2-}$
 (c) SO_3^{2-} (d) SO_4^{2-}
57. Which one of the following statements is not true?
 (a) Lactose contains α -glycosidic linkage between C_1 of galactose and C_4 of glucose.
 (b) Lactose is a reducing sugar and it gives Fehling's test.
 (c) Lactose ($\text{C}_{11}\text{H}_{22}\text{O}_{11}$) is a disaccharide and it contains 8 hydroxyl groups.
 (d) On acid hydrolysis, lactose gives one molecule of D(+)-glucose and one molecule of D(+)-galactose.
58. The decreasing order of the ionization potential of the following elements is
 (a) $\text{Ne} > \text{Cl} > \text{P} > \text{S} > \text{Al} > \text{Mg}$
 (b) $\text{Ne} > \text{Cl} > \text{P} > \text{S} > \text{Mg} > \text{Al}$
 (c) $\text{Ne} > \text{Cl} > \text{S} > \text{P} > \text{Mg} > \text{Al}$
 (d) $\text{Ne} > \text{Cl} > \text{S} > \text{P} > \text{Al} > \text{Mg}$
59. Two fast moving particles X and Y are associated with de Broglie wavelengths 1 nm and 4 nm respectively. If mass of X is nine times the mass of Y, the ratio of kinetic energies of X and Y would be
 (a) 3:1 (b) 9:1
 (c) 5:12 (d) 16:9
60. The Nernst equation $E = E^\circ - \frac{RT}{nF} \ln Q$ indicates that the Q will be equal to equilibrium constant K_c when :
 (a) $E = E^\circ$ (b) $\frac{RT}{nF} = 1$
 (c) $E = \text{zero}$ (d) $E^\circ = 1$
61. At 30°C , the half life for the decomposition of AB_2 is 200 s and is independent of the initial concentration of AB_2 . The time required for 80% of the AB_2 to decompose is (Given: $\log 2 = 0.30$; $\log 3 = 0.48$)
 (a) 200 s (b) 323 s
 (c) 467 s (d) 532 s
62. Nickel ($Z = 28$) combines with a uninegative monodentate ligand to form a diamagnetic complex $[\text{NiL}_4]^{2-}$. The hybridisation involved and the number of unpaired electrons present in the complex are respectively:

- (a) sp^3 , two (b) dsp^2 , zero
(c) dsp^2 , one (d) sp^3 , zero

63. Melamine plastic crockery is a codensation polymer of

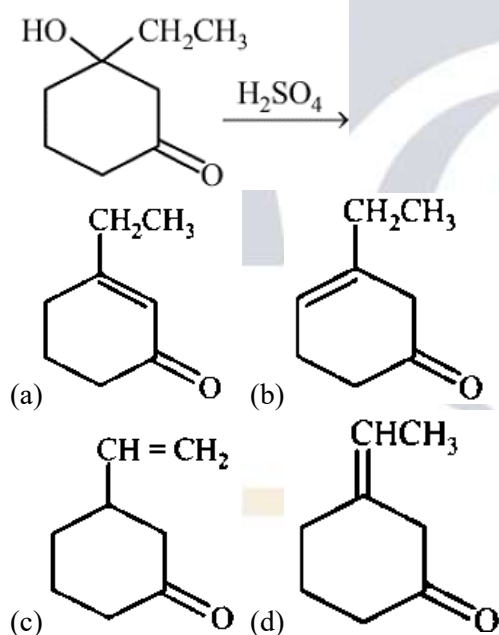
- (a) HCHO and melamine
(b) HCHO and ethylene
(c) melamine and ethylene
(d) None of these

64. Which of the following alkyl halide undergo rearrangement in S_N1 reaction?

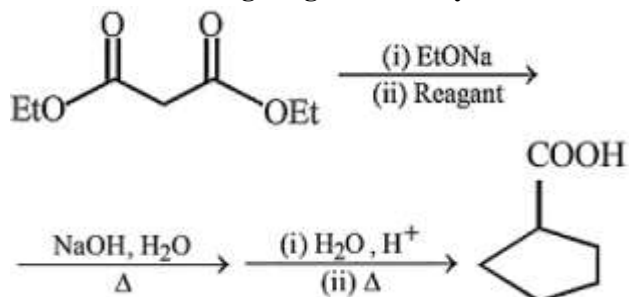


- (d) All of these

65. The major product of the following reaction is :

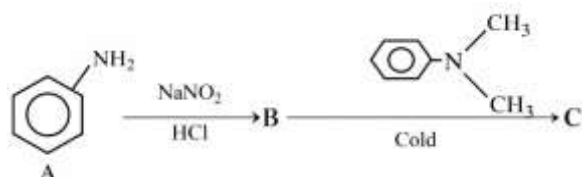


66. What is the missing reagent in the synthesis shown below



- (a) bromocyclopentane
- (b) 1,5-dibromo pentane
- (c) 1,4-dibromo butane
- (d) 1,1 - dibromo cyclopentane

67. In a reaction of aniline a coloured product C was obtained.



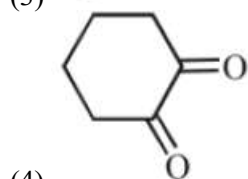
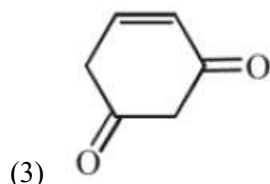
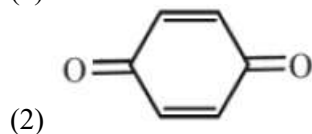
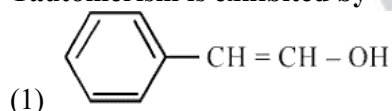
The Structure of C would Be.

- (a)
- (b)
- (c)
- (d)

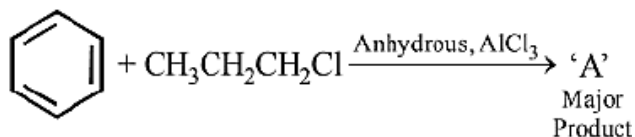
68. Which is correct statement?

- (a) Starch is a polymer of α -glucose
- (b) In cyclic structure of fructose, there are four carbons and one oxygen atom
- (c) Amylose is a component of cellulose
- (d) Proteins are composed of only one type of amino acids

69. Tautomerism is exhibited by-

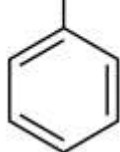
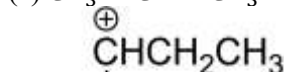
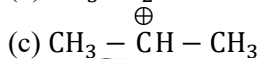
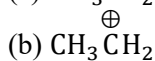
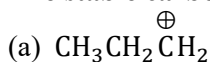


- (a) (1), (3) and (4)
- (b) (2), (3), and (4)
- (c) (1), (2) and (4)
- (d) None of these



70.

The stable carbocation formed in the above reaction is :



71.

PART - III (MATHEMATICS)

71. The values of p and q for which the function $f(x) = \begin{cases} \frac{\sin(p+1)x + \sin x}{x} & , x < 0 \\ q & , x = 0 \\ \frac{\sqrt{x+x^2} - \sqrt{x}}{x^{3/2}} & , x > 0 \end{cases}$

is continuous for all x in R , are

(a) $p = \frac{5}{2}, q = \frac{1}{2}$

(b) $p = -\frac{3}{2}, q = \frac{1}{2}$

(c) $p = \frac{1}{2}, q = \frac{3}{2}$

(d) $p = \frac{1}{2}, q = -\frac{3}{2}$

72. If the inverse trigonometric functions take principal values, then $\cos^{-1}\left(\frac{3}{10}\cos\left(\tan^{-1}\left(\frac{4}{3}\right)\right)\right) +$

$\frac{2}{5}\sin\left(\tan^{-1}\left(\frac{4}{3}\right)\right)$ is equal to :

(a) 0

(b) $\frac{\pi}{4}$

(c) $\frac{\pi}{3}$

(d) $\frac{\pi}{6}$

73. The limit $\lim_{x \rightarrow 2} \frac{2^x + 2^{3-x} - 6}{\sqrt{2-x} - 2^{1-x}}$ is equal to

(a) 1

(b) 2

(c) 4

(d) 8

74. The centre of the smallest circle touching the circles $x^2 + y^2 - 2y - 3 = 0$ and $x^2 + y^2 - 8x - 18y + 93 = 0$ is

(a) (3,2)

(b) (4,4)

(c) (2,7)

(d) (2,5)

75. Let E_1, E_2, E_3 be three mutually exclusive events such that $P(E_1) = \frac{2+3p}{6}, P(E_2) = \frac{2-p}{8}$ and $P(E_3) = \frac{1-p}{2}$. If the maximum and minimum values of p are p_1 and p_2 , then $(p_1 + p_2)$ is equal to:

(a) $\frac{2}{3}$

(b) $\frac{5}{3}$

(c) $\frac{5}{4}$

(d) 1

76. Let $A = \{n \in N : \text{H.C.F.}(n, 45) = 1\}$ and let $B = \{2k : k \in \{1, 2, \dots, 100\}\}$. Then the sum of all the elements of $A \cap B$ is

- (a) 5260 (b) 5264
(c) 5236 (d) 5300

77. The function $f(x) = |x^2 - 2x - 3| \cdot e^{|9x^2 - 12x + 4|}$ is not differentiable at exactly :

- (a) four points (b) three points
(c) two points (d) one point

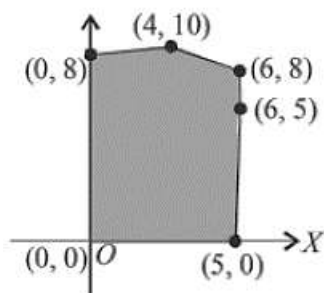
78. If $f(x) = \int e^{\log_e x^2} \log_e x dx$ and $f(1) = -\frac{1}{4}$, then the value of $f(e)$ is

- (a) $\frac{e^2}{4}$ (b) $\frac{e^2}{2}$
(c) $-\frac{e^2}{4}$ (d) $-\frac{e^2}{2}$

79. Let S be the set of all real values of k for which the system of linear equations $x + y + z = 2$; $2x + y - z = 3$; $3x + 2y + kz = 4$ has a unique solution. Then S is

- (a) an empty set (b) equal to R
(c) equal to $\{0\}$ (d) equal to $R - \{0\}$

80. The feasible region for a LPP is shown shaded in the figure. Let $Z = 3x - 4y$ be the objective function. Minimum of Z occurs at



- (a) (0,0) (b) (0,8)
(c) (5,0) (d) (4,10)

81. Let p, q, r be three statements. Then $\sim (p \vee (q \wedge r))$ is equal to

- (a) $(\sim p \wedge \sim q) \wedge (\sim p \wedge \sim r)$
(b) $(\sim p \vee \sim q) \wedge (\sim p \vee \sim r)$
(c) $(\sim p \wedge \sim q) \vee (\sim p \wedge \sim r)$
(d) $(\sim p \vee \sim q) \vee (\sim p \wedge \sim r)$

82. The function $f: (-\infty, -1) \rightarrow (0, e^5]$ defined by $f(x) = e^{x^3 - 3x + 2}$ is

- (a) many-one and onto
(b) many-one and into
(c) one-one and onto
(d) one-one and into

83. Let A and B be two non-singular square matrices such that $B \neq I$ and $AB^2 = BA$. If $A^3 = B^{-1}A^3B^n$, then value of n is.

- (a) 6 (b) 5
(c) 4 (d) 8

84. If x is real and $(x^2 + 2x + c)/(x^2 + 4x + 3c)$ can take all real values, then

- (a) $0 \leq c \leq 1$ (b) $2 < c < 3$
(c) $c > 4$ (d) None of these

85. Let $f(x) = \frac{x}{\sqrt{a^2 + x^2}} - \frac{d-x}{\sqrt{b^2 + (d-x)^2}}$, $x \in R$ where a, b and d are non-zero real constants. Then

- (a) f' is not a continuous function of x
(b) f is neither increasing nor decreasing function of x
(c) f is an increasing function of x
(d) f is a decreasing function of x

86. Let $f(x)$ be a function defined as follows : $f(x) = \sin(x^2 - 3x), x \leq 0$; and $6x + 5x^2, x > 0$

Then at $x = 0, f(x)$

- (a) has a local maximum
- (b) has a local minimum
- (c) is discontinuous
- (d) None of these

87. Let $f(x)$ be a positive function and $I_1 = \int_{-\frac{1}{2}}^1 2xf(2x(1-2x))dx$ and $I_2 = \int_{-1}^2 f(x(1-x))dx$. Then the value of $\frac{I_2}{I_1}$ is equal to

- (a) 9
- (b) 6
- (c) 12
- (d) 4

88. The solution of the differential equation $(1 + e^{\frac{x}{y}})dx + e^{\frac{x}{y}}(1 + \frac{x}{y})dy = 0$ is

- (a) $ye^x + x = C$
- (b) $xe^y + y = C$
- (c) $ye^{\frac{y}{x}} + y = C$
- (d) $ye^{\frac{x}{y}} + x = C$

89. If A is a matrix of order 3 such that $|A| = 5$ and $B = \text{adj}A$, then the value of $||A^{-1}| \cdot (AB)^T|$ is equal to

- (a) 1
- (b) 2
- (c) 3
- (d) 4

90. The domain of the real valued function $f(x) = \frac{\sqrt{6x^2+5x-6}}{\sqrt{4-x}-\sqrt{x+4}}$ is

- (a) $[-4, -\frac{3}{2}] \cup [\frac{2}{3}, 4]$
- (b) $(-\infty, -\frac{3}{2}] \cup [\frac{2}{3}, \infty)$
- (c) $[-4, 4]$
- (d) $[-\frac{3}{2}, \frac{2}{3}]$

91. Modulus of $z = \frac{(1+i\sqrt{3})(\cos\theta+i\sin\theta)}{2(1-i)(\cos\theta-i\sin\theta)}$ is

- (a) $\frac{1}{\sqrt{3}}$
- (b) $-\frac{1}{\sqrt{2}}$
- (c) $\frac{1}{\sqrt{2}}$
- (d) 1

92. The area bounded by the curves $y = |x-1| + |x-2|$ and $y = 3$ is equal to

- (a) 3
- (b) 4
- (c) 5
- (d) 6

93. What is the middle term in the expansion of $(\frac{x\sqrt{y}}{3} - \frac{3}{y\sqrt{x}})^{12}$?

- (a) $C(12,7)x^3y^{-3}$
- (b) $C(12,6)x^{-3}y^3$
- (c) $C(12,7)x^{-3}y^3$
- (d) $C(12,6)x^3y^{-3}$

94. $5^{1+x} + 5^{1-x}, \frac{a}{2}, 5^{2x} + 5^{-2x}$ are in A.P., then the value of a is:

- (a) $a < 12$
- (b) $a \leq 12$
- (c) $a \geq 42$
- (d) $a \geq \frac{17}{4}$

95. If a focal chord of the parabola $y^2 = ax$ is $2x - y - 8 = 0$ then equation of the directrix is

- (a) $x + 4 = 0$
- (b) $x - 4 = 0$
- (c) $y - 4 = 0$
- (d) $y + 4 = 0$

96. The minimum and maximum values of $a\sin x + b\sqrt{(1-a^2)}\cos x + c(|a| < 1, b > 0)$ respectively are

- (a) $\{b-c, b+c\}$
- (b) $\{b+c, b-c\}$
- (c) $\{c-b, b+c\}$
- (d) None of these

97. The equation of the straight line that passes through the point $(3, 4)$ and perpendicular to the line $3x + 2y + 5 = 0$ is

- (a) $2x + 3y + 6 = 0$
 (b) $2x - 3y - 6 = 0$
 (c) $2x - 3y + 6 = 0$
 (d) $2x + 3y - 6 = 0$

98. Two cards from an ordinary deck of 52 cards are missing. What is the probability that a random card drawn from this deck is a spade?

- (a) $\frac{3}{4}$ (b) $\frac{2}{3}$
 (c) $\frac{1}{2}$ (d) $\frac{1}{4}$

99. A random variable X has the following distribution.

X	P(X)
0	a
1	4 a
2	3 a
3	7 a
4	8 a
5	10 a
6	6 a
7	9 a

Find $P(X < 3)$, $P(X \geq 4)$, $P(0 < X < 5)$ respectively.

- (a) $\frac{1}{6}, \frac{11}{24}, \frac{33}{48}$ (b) $\frac{1}{6}, \frac{33}{48}, \frac{11}{24}$
 (c) $\frac{1}{4}, \frac{11}{26}, \frac{21}{44}$ (d) $\frac{11}{26}, \frac{1}{4}, \frac{21}{44}$

100. Let $\vec{a} = 3\hat{i} + \hat{j} - \hat{k}$ and $\vec{c} = 2\hat{i} - 3\hat{j} + 3\hat{k}$. If $\vec{b}$ is a vector such that $\vec{a} = \vec{b} \times \vec{c}$ and $|\vec{b}|^2 = 50$, then $|72 - |\vec{b} + \vec{c}|^2|$ is equal to

- (a) 67 (b) 60
 (c) 66 (d) 170

101. Find the mean deviation about the mean for the following data.

Mark obtained	Number of students
10 – 20	2
20 – 30	3
30 – 40	8
40 – 50	14
50 – 60	8
60 – 70	3
70 – 80	2

- (a) 12 (b) 10
 (c) 11 (d) 9

102. The eccentricity of an ellipse having centre at the origin, axes along the co-ordinate axes and passing through the points $(4, -1)$ and $(-2, 2)$ is :

- (a) $\frac{1}{2}$ (b) $\frac{2}{\sqrt{5}}$
 (c) $\frac{\sqrt{3}}{2}$ (d) $\frac{\sqrt{3}}{4}$

103. If the sum of the first 20 terms of the series $\log_{(7^{1/2})} x + \log_{(7^{1/3})} x + \log_{(7^{1/4})} x + \dots$ is 460, then x is equal to :

- (a) 7^2 (b) $7^{1/2}$
 (c) e^2 (d) $7^{46/21}$

104. The equation of the line passing through the point $(1, 2, -4)$ and perpendicular to the two lines $\frac{x-8}{3} = \frac{y+19}{-16} = \frac{z-10}{7}$ and $\frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{-5}$ will be

(a) $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z+4}{6}$

(b) $\frac{x-1}{-2} = \frac{y-2}{3} = \frac{z+4}{8}$

(c) $\frac{x-1}{3} = \frac{y-2}{2} = \frac{z+4}{8}$

(d) None of these

105. The distance of the point $P(4, 6, -2)$ from the line passing through the point $(-3, 2, 3)$ and parallel to a line with direction ratios $3, 3, -1$ is equal to :

(a) 3

(b) $\sqrt{6}$

(c) $2\sqrt{3}$

(d) $\sqrt{14}$

106. Find the locus of the point which is equidistant from the point $A(0, 2, 3)$ and $B(2, -2, 1)$

(a) $x - 2y = 1$

(b) $x + 2y = 1$

(c) $2x + y = 1$

(d) $4x + y = 3$

107. If $f(x) = \frac{\cos x}{(1-\sin x)^3}$, then

(a) $\lim_{x \rightarrow \frac{\pi}{2}} f(x) = -\infty$

(b) $\lim_{x \rightarrow \frac{\pi}{2}} f(x) = \infty$

(c) $\lim_{x \rightarrow \frac{\pi}{2}} f(x) = \infty$

(d) None of these

108. Let $x < 1$, then value of $\begin{vmatrix} x^2 + 2 & 2x + 1 & 1 \\ 2x + 1 & x + 2 & 1 \\ 3 & 3 & 1 \end{vmatrix}$ is

(a) Non-negative

(b) Non-positive

(c) Negative

(d) Positive

109. Differential coefficient of $\sqrt{\sec \sqrt{x}}$ is

(a) $\frac{1}{4\sqrt{x}} \sec \sqrt{x} \sin \sqrt{x}$

(b) $\frac{1}{4\sqrt{x}} (\sec \sqrt{x})^{3/2} \cdot \sin \sqrt{x}$

(c) $\frac{1}{2} \sqrt{x} \sec \sqrt{x} \sin \sqrt{x}$

(d) $\frac{1}{2} \sqrt{x} (\sec \sqrt{x})^{3/2} \cdot \sin \sqrt{x}$

110. Let $f\left(x + \frac{1}{x}\right) = x^2 + \frac{1}{x^2}$, $x \neq 0$ then $f(x) =$

(a) x^2

(b) $x^2 - 1$

(c) $x^2 - 2$

(d) $x^2 + 1$

PART - IV (APTITUDE TEST)

111. Statement: All Grapes are Bananas.

Conclusions:

(I). Some Bananas are Grapes.

(II). All Bananas are Grapes.

(III). Some Grapes are Bananas.

(IV). Some Bananas are not Grapes.

(a) Only I follow.

(b) Only II follow.

(c) Only I and III follow.

(d) None follow.

112. Statement: Some Cows are Hens.

Conclusions:

(I). Some Hens are Cows

(II). All Hens are Cows

(III). All Cows are Hens

(IV). No Cows are Hens

(a) Only I follow.

- (b) Only II follow.
- (c) Only I and III follow.
- (d) None follow.

113. **Statement: No book is Pens.**

Conclusions:

- (I). No Pens is book.
- (II). Some Pens are not books.
- (III). All books are not Pens.
- (IV). All books are Pens.

- (a) Only I follow.
- (b) Only II follow.
- (c) Only I, II and III follow.
- (d) None follow.

114. **In a code language, 'TIGER' is written as 'JUISF'. How will 'EVENT' be written in that language?**

- (a) WFUGO
- (b) WFGUO
- (c) WFFUO
- (d) WFUFO

115. **Images of consonants of the capital English alphabets are observed in a mirror. What is the number of images of these which do not look like their original shapes?**

- (a) 14
- (b) 9
- (c) 7
- (d) 5

116. **Identify the pair that follows the same pattern as that followed by first pair.**

RDV : IFE :: GWH : ?

- (a) PRS
- (b) TSY
- (c) TYS
- (d) RVO

117. **A is the brother of D. D is the mother of B. B is the sister of C. How is B related to A ?**

- (a) Nephew
- (b) Niece
- (c) Aunt
- (d) Cannot be determined

118. **How is U related to I?**

Statements:

(I). Q is the son of I.

(II). U is the brother of Q .

- (a) If Statement I, alone is sufficient to answer the question
- (b) If Statement II, alone is sufficient to answer the question
- (c) If Statements I and II together are needed to answer the question
- (d) If Statements I and II together are not sufficient to answer the question

119. **Select the number from among the given options that can replace the question mark (?) in the following series: 1, 4, 10, ?, 46, 94**

- (a) 22
- (b) 24
- (c) 20
- (d) 28

120. **From the given options, choose the correct one that will replace the question mark (?) in the following series: 2, 6, 12, 20, ?, 42, 56**

- (a) 25
- (b) 20
- (c) 30
- (d) 32

PART - V (ENGLISH)

DIRECTIONS(Qs. 121-125) : Read the passage carefully and choose the best answer to each questions out of the four alternatives.

Artificial Intelligence (AI) has evolved rapidly since the mid20th century, influencing various aspects of modern life. It encompasses adaptive, self-learning technologies used in facial recognition, robotics, speech, and language understanding. AI enhances human abilities and benefits from progress in computing power and data science. AI holds vast potential in promoting global good, aiding the UN's Sustainable Development Goals (SDGs) in areas such as healthcare, agriculture, education, and disaster relief. However, access to AI remains unequal, mainly benefiting powerful nations and corporations. UN Secretary-General António Guterres has emphasized the need for global collaboration to bridge the digital divide and ensure AI supports humanity equitably.

To guide responsible AI use, the UN has formed a High-Level Advisory Body of 39 experts that recommends inclusive governance strategies. Alongside, the Global Digital Compact adopted in 2024-outlines digital cooperation measures for a safe, human-rights-based digital space. An AI Panel and Global Dialogue, co-led by Costa Rica and Spain, aims to ensure ethical and scientific guidance on AI use and governance with global representation and emphasis on human rights.

121. What does the phrase "bridge the digital divide" most likely mean as used in the passage?

- (a) Create a new type of digital platform
- (b) Increase competition among tech companies
- (c) Reduce the gap in access to AI between nations
- (d) Strengthen online security for all users

122. What is the author's purpose in mentioning the "High-Level Advisory Body of 39 experts"?

- (a) To highlight the risks of AI
- (b) Governance of AI through expert collaboration
- (c) Criticizing the lack of global consensus
- (d) Suggesting the intervention of UN in AI

123. Which of the following best describes the central theme of the passage?

- (a) The economic challenges of AI
- (b) The technical limitations of AI systems
- (c) How robots can replace humans in jobs
- (d) Promoting equitable and ethical AI governance

124. Choose the word that is closest in meaning to "inclusive" as used in the passage.

- (a) Comprehensive
- (b) Exclusive
- (c) Unified
- (d) Selective

125. Which word from the following is the most suitable antonym of "strategies"?

- (a) Frameworks
- (b) Approaches
- (c) Chaos
- (d) Strategies