SATISH SCIENCE ACADEMY
DHANORI PUNE - 411015

PCM
ENTRANCE EXAM - MHT - CET

Time Allowed: 3 hours **Maximum Marks :** 200

General Instructions:

- All questions are compulsory.
- There are two sections.
- Section A has 100 questions from Physics and Chemistry.
- Section B has 50 questions from Mathematics.

Section - A (Physics)

1) The projectile attains maximum height when it is projected at an angle of **[1]**
   a) 30^o b) 120^o
   c) 45^o d) 90^o

2) The gravitational force of attraction between Earth and Venus, if the distance between them is 2.5×10^7 km, is [mass of Venus = 4.8×10^{24}kg, mass of the Earth = 6×10^{24} kg]**[1]**
   a) 4.1×10^{18}N b) 3.1×10^{18}N
   c) 2.1×10^{18}N d) 5.1×10^{18} N

3) A particle of mass m is subjected to an attractive central force of magnitude $\frac{k}{r^2}$, k being a constant. At the instant when the particle is at its extreme position in its closed orbit at a distance 'a' from the centre of force, its speed is $\frac{k}{2ma}$. If the distance of other extreme is b, find $\frac{a}{b}$. **[1]**
   a) 2 b) - 1
   c) 4 d) 3

4) Equal masses of two liquids are filled in two identical calorimeters. The rate of cooling will **[1]**
   a) Be same for both the liquids.
   b) Depend on the specific heat of liquids.
   c) Depend on the mass of the liquids.
   d) Depend on the nature of calorimeters.

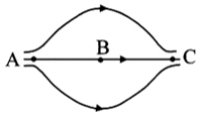
5) Neon is 20 times heavier than hydrogen. The equal volumes of hydrogen and neon are mixed. The ratio of speed of sound in the mixture to that in hydrogen is **[1]**
   a) $\sqrt{\frac{32}{17}}$ b) $\sqrt{\frac{2}{17}}$
   c) $\sqrt{\frac{1}{8}}$ d) $\sqrt{\frac{2}{21}}$

6) For an angle of incidenceθ on an equilateral prism of refractive index $\sqrt{3}$, the ray refracted is parallel to the base inside the prism. The value of θ is **[1]**
   a) 75° b) 60°
   c) 30° d) 45°

7) If the critical angle for the material of a prism is C and the angle of the prism is A, then there will be no emergent ray when **[1]**
   a) A $<\frac{C}{2}$ b) A < 2C
   c) A > 2 C d) A = 2 C

8) The power of a thin convex lens ($^a n_g$= 1.5) is +5.0 D. When it is placed in liquid of refractive index $^a n_l$ then it behaves as a concave lens of focal length 100 cm. The refractive index of liquid $^a n_l$ will be **[1]**
   a) $\sqrt{3}$ b) $\sqrt{2}$
   c) 1.875 d) 1.68

9) The figure shows some of the electric field lines corresponding to an electric field. The figure suggests



[1]
   a) $E_A = E_C > E_B$ b) $E_A = E_B = E_C$
   c) $E_B = E_A < E_C$ d) $E_A > E_B > E_C$

10) The rate of change of angular momentum is called **[1]**
   a) Angular velocity. b) Torque.
   c) Force. d) Linear momentum.

11) The P.E. of particle of mass 0.1 kg moving along x - axis is given by U = 5x (x - 4) J where x is in metres. It can be concluded that the wrong option is **[1]**
   a) The period of oscillation of particle is $\frac{\pi}{5}$ s
   b) The particle executes SHM
   c) The speed of the particle is maximum at x = 2 m
   d) The particle is acted upon by a constant force

12) A simple pendulum of length l has a brass bob attached at its lower end. Its period is T. If a steel bob of same size having density x times that of brass replaces the brass bob and its length is changed so that period becomes 2T, then new length is **[1]**
   a) $\frac{4l}{x}$ b) 2l
   c) 4l d) 4l x

13) A particle is executing S.H.M. of periodic time 'T'. The time taken by a particle in moving from mean position to half the maximum displacement is (sin 30°= 0.5) **[1]**
   a) $\frac{T}{12}$ b) $\frac{T}{4}$
   c) $\frac{T}{2}$ d) $\frac{T}{8}$

14) In series LCR circuit R = 18Ω and impedance is 33 Ω . An r.m.s. voltage 220 V is applied across the circuit. The true power consumed in a.c. circuit is **[1]**
   a) 400 W b) 800 W
   c) 220 W d) 600 W

15) If n drops of a liquid, each with surface energy E, join to form a single drop, then **[1]**
   a) The energy released will be E(n - $n^{2/3}$).
   b) The energy absorbed or released will be nE ($2^{2/3}$ - 1).
   c) Some energy will be absorbed in the process.
   d) The energy released in the process will be nE (n - $n^{1/3}$).

16) For a certain organ pipe, three successive resonance frequencies are observed at 425, 595 and 765 Hz, respec-

tively. The length of the pipe is (speed of sound in air = 340 ms^{-1}) **[1]**

a) 1.5 m b) 1 m
c) 0.5 m d) 2 m

17) A uniform string of length 20 m is suspended from a rigid support. A short wave pulse is introduced at its lowest end. It starts moving up the string. The time taken to reach the support is (take g = 10 ms^{-2}) **[1]**

a) $2\sqrt{2}$ s b) $\sqrt{2}$ s
c) $2\pi\sqrt{2}$ s d) 2 s

18) The vibrations of a string of length 60 cm fixed at both ends are represented by displacement y = 4 $\sin\left(\frac{\pi x}{15}\right)$ cos (96π t) where x and y are in cm and t in second. The particle velocity at x = 22.5 cm and t = 0.25 s is **[1]**

a) 100 cm s^{-1} b) $4\times$ 96 cm s^{-1}
c) 96 cm s^{-1} d) Zero

19) At what temperature will the rms speed of oxygen molecules become just sufficient for escaping from the Earth's atmosphere?
(Given: Mass of oxygen molecule (m) = 2.76×10^{-26} kg, Boltzmann's constant $k_B = 1.38 \times 10^{-23}$ JK^{-1}) **[1]**

a) 2.508×10^4 K b) 8.360×10^4 K
c) 5.016×10^4 K d) 1.254×10^4 K

20) Two beams, A and B, of plane polarised light with mutually perpendicular planes of polarisation are seen through a polaroid. From the position when the beam A has maximum intensity (and beam B has zero intensity), a rotation of polaroid through 30° makes the two beams appear equally bright. If the initial intensities of the two beams are I_A and I_B respectively, then $\frac{I_A}{I_B}$ equals **[1]**

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

21) In practice, the range of strain gauge resistance is from _____. **[1]**

a) 30 to 3000 ohms b) 30 to 300 ohms
c) 3 to 3000 ohms d) 3 to 30 ohms

22) A wire of length 100 cm is connected to a cell of e.m.f. 2 V and negligible internal resistance. The resistance of the wire is 3Ω . The additional resistance required to produce a potential drop of 1 millivolt per cm is **[1]**

a) 47Ω b) 60Ω
c) 35Ω d) 57Ω

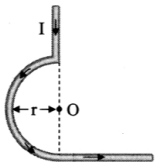
23) A potentiometer has uniform potential gradient across it. Two cells connected in series (i) to support each other and (ii) to oppose each other are balanced over 6 m and 2 m respectively on the potentiometer wire. The e.m.f.s of the cells are in the ratio of **[1]**

a) 1 : 2 b) 3 : 1
c) 1 : 1 d) 2 : 1

24) A galvanometer of resistance G, is shunted by a resistance S ohm. To keep the main current in the circuit unchanged, the resistance to be put in series with the galvanometer is **[1]**

a) $\frac{G}{(S+G)}$
b) $\frac{SG}{(S+G)}$
c) $\frac{S^2}{(S+G)}$
d) $\frac{G^2}{(S+G)}$

25) In the figure, what is the magnetic field at the point O?



[1]

a) $\frac{\mu_0 I}{4r} - \frac{\mu_0 I}{4\pi r}$
b) $\frac{\mu_0 I}{4\pi r} + \frac{\mu_0 I}{2\pi r}$
c) $\frac{\mu_0 I}{4\pi r}$
d) $\frac{\mu_0 I}{4r} + \frac{\mu_0 I}{4\pi r}$

26) A circular coil of radius r carries a current I. The magnetic field at its centre is B. At what distance from the centre, on the axis of the coil the magnetic field will be $\frac{B}{8}$? **[1]**

a) $\sqrt{3}$ r b) $\sqrt{2}$ r
c) 3 r d) 2 r

27) The maximum kinetic energy of protons in a cyclotron of radius 0.4 m in a magnetic field of 0.5 T is (mass of proton = 1.67×10^{-27} kg, charge of proton = 1.6×10^{-19} C) **[1]**

a) 4 MeV b) 5 MeV
c) 1.9 MeV d) 3 MeV

28) Magnetic induction due to a toroid does not depend upon **[1]**

a) Permeability of a free space.
b) Current flowing through a toroid.
c) Radius of a toroid.
d) Number of turns per unit length.

29) Which of the following are uses of electromagnets? **[1]**

a) To lift ferromagnetic substances such as iron.
b) All of these
c) In circuit brakers, braking system of train.
d) Used in charged particles accelerators (cyclotrons).

30) A ferromagnetic material is heated above its Curie temperature. Which one is a correct statement? **[1]**

a) Ferromagnetic domains are not influenced.
b) Ferromagnetic domains are perfectly arranged.
c) Ferromagnetic domains become random.
d) Ferromagnetic material changes itself into diamagnetic material.

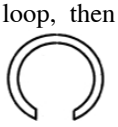
31) Permeability of diamagnetic materials are **[1]**

a) Zero b) Greater than unity
c) Less than unity d) Equal to unity

32) The use of study of hysteresis curve for a given material is to estimate the **[1]**

a) Voltage loss b) Current loss
c) Power loss d) Hysteresis loss

33) A copper ring is held horizontally and a bar magnet is dropped through the ring with its length along the axis of the ring. The reading of A.C. voltmeter is 220 V, if the copper ring has a cut such as not to form a complete loop, then the acceleration of the falling magnet is



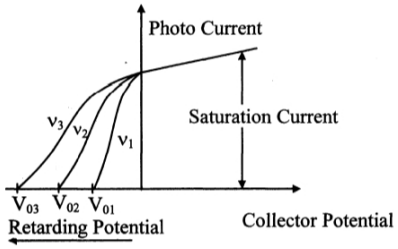
[1]

a) Equal to 'g' b) Greater than 'g'
c) Less than 'g' d) Zero

34) In a step - up transformer, if the voltage in the secondary is increased, then the current in the primary **[1]**
a) Decreases b) Increases
c) Does not change d) Becomes zero

35) The current induced in 100Ω coil when the magnetic flux decreases from 1 Wb to 0.1 Wb in 0.1s, is **[1]**
a) 90 A b) 0.9 A
c) 9 A d) 0.09 A

36) The variation of photo - current with collector potential for different frequencies of incident radiationν_1 , ν_2 , and ν_3 is as shown in the graph, then



[1]

a) $\nu_1 < \nu_2 < \nu_3$
b) $\nu_1 = \nu_2 = \nu_3$
c) $\nu_3 = \frac{\nu_1+\nu_2}{2}$
d) $\nu_1 > \nu_2 > \nu_3$

37) A photoelectric surface is illuminated successively by monochromatic light of wavelengthλ and $\frac{\lambda}{2}$. If the maximum kinetic energy of the emitted photoelectrons in the second case is 3 times that in the first case, the work function of the surface of the material is: (h = Planck's constant, c = speed of light) **[1]**

a) $\frac{hc}{\lambda}$
b) $\frac{hc}{3\lambda}$
c) $\frac{2hc}{\lambda}$
d) $\frac{hc}{2\lambda}$

38) An electron of mass 'm' has de - Broglie wavelength 'λ ' when accelerated through potential difference 'V'. When proton of mass 'M', is accelerated through potential difference '9V', the de - Broglie wavelength associated with it will be (Assume that wavelength is determined at low voltage) **[1]**

a) $\frac{\lambda}{3} \cdot \frac{\mathrm{m}}{\mathrm{M}}$
b) $\frac{\lambda}{3} \cdot \frac{\mathrm{M}}{\mathrm{m}}$
c) $\frac{\lambda}{3}\sqrt{\frac{\mathrm{M}}{\mathrm{m}}}$
d) $\frac{\lambda}{3}\sqrt{\frac{\mathrm{m}}{\mathrm{M}}}$

39) Highly energetic electrons are bombarded on a target of an element containing 30 neutrons. The ratio of radii of nucleus to that of Helium nucleus is $14^{\frac{1}{3}}$. The atomic number of nucleus will be **[1]**
a) 26 b) 30
c) 56 d) 25

40) α - particles deflected at more than 90° in Marsden experiment were **[1]**
a) 1 in 8000 b) 1 in 100000
c) 1 in 10000 d) 1 in 1000

41) In a hydrogen like atom, electron makes transition from an energy level with quantum number n to another with quantum number (n - 1). If n » 1, the frequency of radiation emitted is proportional to **[1]**

a) $\frac{1}{n^2}$
b) $\frac{1}{\mathrm{n}^3}$
c) $\frac{1}{n^{\frac{3}{2}}}$
d) $\frac{1}{n}$

42) If an electron in hydrogen atom jumps from an orbit of level n = 3 to an orbit of level n = 2, emitted radiation has a frequency (R = Rydberg's constant, c = velocity of light) **[1]**

a) $\frac{3Rc}{27}$
b) $\frac{5\mathrm{Rc}}{36}$
c) $\frac{8Rc}{9}$
d) $\frac{\mathrm{Rc}}{25}$

43) A beam of monochromatic light of wavelengthλ ejects photoelectrons from a cesium surface $(\phi_0 = 1.9\mathrm{eV})$ which are made to collide with hydrogen atoms in ground state. The maximum value of λ for which hydrogen atoms may be ionised is **[1]**
a) 77 nm b) 7.7 nm
c) 770 nm d) 0.77 nm

44) Whose discovery implied that atom cannot be indestructible? **[1]**

a) Rutherford's discovery of electron
b) Thomson's discovery of electron
c) Geiger - Marsden's discovery of nucleus
d) Dalton's atomic structure

45) In the hydrogen atom spectrum, the series which lies in ultraviolet region is **[1]**
a) Brackett series b) Lyman series
c) Paschen series d) Balmer series

46) Shortest wavelength in the Lyman series is $912\overset{o}{A}$. The longest wavelength in this series will be **[1]**
a) $2100\overset{o}{A}$ b) $1216\overset{o}{A}$
c) $1800\overset{o}{A}$ d) $3648\overset{o}{A}$

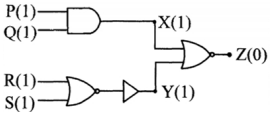
47) The arrow head on the transistor symbol always points in the direction of **[1]**

a) Flow of electrons in the emitter region.
b) Minority carriers flow in the emitter region.
c) Flow of holes in the emitter region.
d) Majority carriers flow in the emitter region.

48) A solar cell is a p - n junction operating in **[1]**

a) Forward bias condition.
b) Reverse bias condition.
c) Unbiased condition.
d) In both forward and reverse bias condition.

49) The circuit diagram shows a logic combination with the states of outputs X, Y and Z given for inputs P, Q, R and S all at state 1. When input P and R change to state 0 with input Q and S still at 1, the states of outputs X, Y and Z change to



[1]
a) 1, 1, 1 b) 0, 1, 0
c) 1, 0, 0 d) 0, 0, 1

50) The current gain of a transistor in common - emitter configuration is 80. If the emitter current be 8.1 mA, then what is the collector current? **[1]**

a) 8.1 mA b) 1.0 mA
c) 8.0 mA d) 0.1 mA

Section - A (Chemistry)

51) Which of the following statements is INCORRECT? **[1]**

a) Composition of a mixture can be varied to any extent.
b) Pure substances have a definite chemical composition.
c) Water and table salt are examples of a compound.
d) The constituents of a compound can be easily separated by physical methods.

52) The number of unpaired electrons in chromium (Z = 24) is _____. **[1]**

a) 6 b) 3
c) 8 d) 5

53) What is the oxidation number of gold in the complex $[AuCl_4]^-$? **[1]**

a) +1 b) +4
c) +3 d) +2

54) Chloride of metal Y was found to be deliquescent and on crystallisation formed a hydrate. The metal Y is _____. **[1]**

a) Li b) M
c) Na d) K

55) At constant T and P, Avogadro law is represented as _____. **[1]**

a) $V \propto n$
b) $V \propto \frac{1}{n}$
c) $V \propto \frac{1}{N_A}$
d) $V \propto N_A$

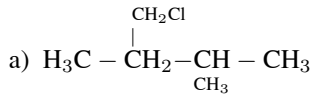
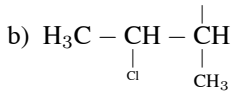
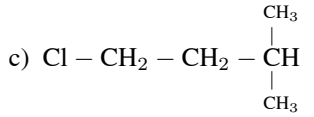
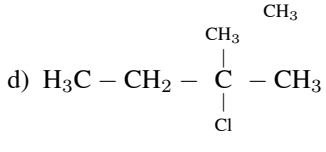
56) The colloidal system of a liquid dispersed in a liquid medium is called a/an _____. **[1]**

a) Gel b) Aerosol
c) Emulsion d) Foam

57) X $\xrightarrow[373\,K]{60\%H_2SO_4}$ Alkene
Y $\xrightarrow[413\,K]{75\%H_2SO_4}$ Alkene
X and Y are _____ respectively. **[1]**

a) X = n - Propyl alcohol, Y = tert - Butyl alcohol
b) X = Isopropyl alcohol, Y = n - Propyl alcohol
c) X = Isopropyl alcohol, Y = tert - Butyl alcohol
d) X = n - Propyl alcohol; Y = Isopropyl alcohol

58) An alkene **A** on reaction with O_3 and Zn - H_2O gives propanone and ethanal in an equimolar ratio. The addition of HCl to alkene **A** gives **B** as the major product. The structure of product **B** is _____. **[1]**

a) 
b) 
c) 
d) 

59) IUPAC name of the compound  is _____. **[1]**

a) 2 - ethylpentan - 2 - ol b) 3 - methylhexan - 2 - ol
c) 4 - methylhexan - 2 - ol d) 4 - ethylpentan - 2 - ol

60) _____ defect arises when foreign atoms, that is, atoms different from the host atoms, are present in the crystal lattice. **[1]**

a) Frenkel b) Metal excess
c) Impurity d) Schottky

61) In a close - packed arrangement of N particles, the number of tetrahedral holes is _____. **[1]**

a) 2N b) $\frac{N}{2}$
c) N d) 4N

62) The boiling point of chloroform was raised by 0.323 K when 0.5143 g of anthracene, was dissolved in 35 g of chloroform. The molecular mass of anthracene is _____. (K_b of $CHCl_3$ = 3.9 K kg mol^{-1}) **[1]**

a) 177.42 g/mol b) 242.32 g/mol
c) 132.32 g/mol d) 79.42 g/mol

63) Which among the following is TRUE for the value of Henry's law constant K_H? **[1]**

a) Increases with increase in temperature.
b) Is same for all gases.
c) First increases and then drcreases with incrase in temperature.
d) Is greater for gases with higher solubilities.

64) A system is said to be in thermodynamic equilibrium when, _____.

i. The temperature of the system is non - uniform and different from the temperature of the surroundings
ii. The mechanical properties are non - uniform throughout the system
iii. The state functions of the system do not change with time
iv. Only pressure of the reaction is at equilibrium

[1]

a) Option (c) b) Option (a)
c) Option (d) d) Option (b)

65) For the reaction, $C_3H_{8(g)} + 5O_{2(g)} \rightarrow 3CO_{2(g)} + 4H_2O_{(l)}$ at constant temperature and pressure, ΔH is equal to _____. **[1]**

a) $\Delta U - 5RT$ b) $\Delta U - 3RT$
c) $\Delta U - 2RT$ d) $\Delta U - RT$

66) E^o values of Mg^{2+}/Mg is - 2.37 V, of Zn^{2+}/Zn is - 0.76 V and Fe^{2+}/Fe is - 0.44 V. Which of the following statements is CORRECT? **[1]**

a) Zn oxidises Fe b) Zn Reduces Fe^{2+}
c) Mgl oxidises Fe d) Zn reduces Mg^{2+}

67) Which of the following is NOT a secondary voltaic cell? **[1]**

a) Mercury cell b) Dry cell
c) Nickel - cadmium cell d) Lead storage battery

68) The unit of rate constant for a certain reactions is $time^{-1}$. The order of the reaction is _____. **[1]**

a) 2 b) 0
c) 1 d) 3

69) In a first order reaction, the concentration of the reactant decreases from 0.8 M to 0.4 M in 15 minutes. The time taken for the concentration to change from 0.1 M to 0.025 M is _____. **[1]**
a) 60 minutes b) 30 minutes
c) 15 minutes d) 7.5 minutes

70) The solubility of $AgCl_{(S)}$ with solubility product 1.6×10^{-10} in 0.1 M NaCl solution would be _____. **[1]**
a) 1.6×10^{-9} M b) 1.26×10^{-5} M
c) 1.6×10^{-9} M d) Zero

71) The pH of 10^5 M KOH solution will be _____. **[1]**
a) 9 b) 5
c) 10 d) 11

72) The H^+ ion concentration of a solution is 0.1 M. Its pH is _____. **[1]**
a) 1.0 b) 0.01
c) 10 d) 0.1

73) Which of the following is NOT formed when HBr reacts with H_2SO_4? **[1]**
a) H_2O b) H_2S
c) Br_2 d) SO_2

74) Which of the following oxoacid contains a peroxide linkage? **[1]**
a) $H_2S_2O_8$ b) H_2SO_3
c) $H_2S_2O_3$ d) $H_2S_2O_7$

75) The stability of hexahalides (EX_6type) of group 16 elements follows the order _____. **[1]**

a) Iodides > bromides > fluorides > chlorides
b) Iodides > bromides > chlorides > fluorides
c) Chlorides > fluorides > bromides > iodides
d) Fluorides > chlorides > bromides > iodides

76) Which of the following pairs has both the ions coloured in aqueous solution? (Atomic numbers of Sc = 21, Ti = 22, Ni = 28, Cu = 29, Mn = 25) **[1]**
a) Mn^{2+}, Ti^{3+} b) Ti^{3+}, Cu^+
c) Ni^{2+}, Ti^{4+} d) Sc^{3+}, Mn^{2+}

77) The number of d - electrons in cobalt (Z = 27) is _____. **[1]**
a) 7 b) 5
c) 6 d) 8

78) Which among the following complexes is heteroleptic and cationic in nature? **[1]**
a) $[Ni(CO)_4]$ b) $[Co(NH_3)_4Cl_2]Cl$
c) $[Pt(NH_3)_2Cl_2]$ d) $K_4Fe(CN)_6]$

79) The color of the coordination compound is due to _____ transition of electrons. **[1]**
a) P - p b) P - d
c) D - d d) S - p

80) In the complex $K_3[Fe(CN)_6]$, _____. **[1]**

a) Charge on the complex ion is 0
b) Coordination sphere is K^+
c) Coordination number of Fe is 6
d) Oxidation number of Fe is +2

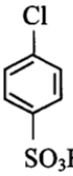
81) Identify the product (X).

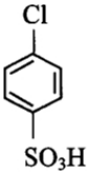
$$CH_2 = CH - CH_3 + Cl_2 \xrightarrow{\Delta} X + HCl$$

[1]
a) $CHCl = CH - CH_3$ b) $CH \equiv C - CH_2Cl$
c) $CH_2 = CCl - CH_3$ d) $CH_2 = CH - CH_2Cl$

82) Which one is most reactive towards S_N1 reaction? **[1]**
a) $PhCH_2Cl$ b) $PhCH(Ph)Cl$
c) $PhCH(CH_3)Cl$ d) $PhC(CH_3)(Ph)Cl$

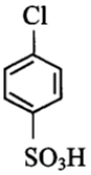
83) Chlorobenzene on treatment with concentrated sulphuric acid yields _____. **[1]**

a) 

b) Both 

and 

c) 

d) Neither 

nor 

84) What are a, b, c and d in the following reaction?
a$(CH_3)_3C - OH$ + **b** Al $\longrightarrow$ **c**$[(CH_3)_3C - O]_3Al$ + **d** H_2 **[1]**

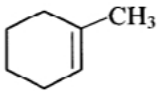
a) A : 6, b : 2, c : 2, d : 3
b) A : 3, b : 1, c : 1, d : 2
c) A : 4, b : 1, c : 1, d : 2
d) A : 4, b : 2, c : 1, d : 2

85) Name the catalyst used in commercial method of preparation of phenol. **[1]**

a) Cobalt naphthenate
b) Anhydrous aluminium chloride
c) Calcium phosphate
d) Silica

86) The common name of $C_6H_5 - O - CH_3$ is _____. **[1]**
a) Ethyl phenyl ether b) Methyl phenyl ether
c) Hexyl methyl ether d) Benzyl ethyl ether

87) Acetaldehyde on warming with Fehling solution gives a red precipitate of____. **[1]**
a) Cuprous oxide b) Cupric oxide
c) Elemental copper d) $Cu(OH)_2$

88) 

on reductive ozonolysis yields _____. **[1]**
a) 6 - oxoheptanoic acid b) 6 - hydroxyheptanal
c) 3 - hydroxypentanal d) 6 - oxoheptanal

89) Which of the following will give the addition product with $NaHSO_3$? **[1]**
a) CH_3COOH b) CH_3OH
c) CH_3COCH_3 d) CH_3CH_2Cl

90) An organic compound A having molecular formula C_2H_3N on reduction gave a compound B. On treatment with HONO, B gave ethyl alcohol, and on warming with $CHCI_3$ and alcoholic KOH, the product formed gave an offensive smell. The compound A is _____. **[1]**
   a) Acetamide b) Ethylamine
   c) Ethyl cyanide d) Methyl cyanide

91) IUPAC name of the compound $CH_3 - \underset{\underset{CH_3}{|}}{CH} - CH_2NH_2$ is _____. **[1]**
   a) Methylpropanamine
   b) 2 - methylbutan - 1 - amine
   c) 2 - methylethan - 1 - amine
   d) 2 - methylpropan - 1 - amine

92) In Hinsberg's test, ethylamine forms _____. **[1]**
   a) A product which soluble in alkali
   b) A silver mirror
   c) An orange dye
   d) A product which insoluble in alkali

93) Glucose $\xrightarrow{\square, HI}$
The product formed is _____. **[1]**
   a) N - hexane b) Gluconic acid
   c) Glucoxime d) Fructose

94) Which α - amino acid does NOT have optical isomer? **[1]**
   a) Leucine b) Lysine
   c) Glycine d) Alanine

95) A condensation polymer among the following is _____. **[1]**
   a) Teflon b) PVC
   c) Dacron d) Polystyrene

96) An example of an addition copolymer is _____. **[1]**
   a) Neoprene b) Dacron
   c) Buna - S d) Nylon 6,6

97) $\in$ - Caprolactam is used for the manufacture of _____. **[1]**
   a) Nylon 6,6 b) Nylon 6
   c) Terylene d) Teflon

98) Identify the CORRECT statements from the following.
   i. Silver nanoparticles act as highly effective bacterial disinfectant.
   ii. The leaves of the lotus plant are super hydrophilic.
   iii. Invention of UV - visible spectrophotometer led to the discovery of fullerenes in 1986.
   iv. Sol - gel processes are used in the motor vehicle industry to produce water repellent coatings for wind screens.
[1]
   a) I, III, IV b) II, III
   c) I, II d) I, IV

99) Which of the following can be categorised as green solvents?
   i. Supercritical CO_2
   ii. CH_2Cl_2
   iii. Water
   iv. CCl_4
[1]
   a) Ii, iv b) I, iii
   c) Iii, v d) I, v

100) Identify the INCORRECT statement from the following regarding nanotechnology. **[1]**
   a) It is pollution free.
   b) It will make solar power more economical.
   c) It can be used in treatment of life threatening diseases.
   d) It can bring revolution in electronics and computing.

Section - B (Mathematics)

101) Tan $\frac{A}{2}$ is equal to **[2]**
   a) $\sqrt{\frac{1+\cos A}{1-\cos A}}$
   b) $\sqrt{\frac{1-\sin A}{1+\sin A}}$
   c) $\sqrt{\frac{1-\cos A}{1+\cos A}}$
   d) $\sqrt{\frac{1+\sin A}{1-\sin A}}$

102) If points (3, 2) and (- 1, - 2) lie on the locus ax + by = 5, then a and b are **[2]**
   a) A = - 5, b = 3 b) A = 2, b = 3
   c) A = 5, b = 2 d) A = 5, b = - 5

103) The equation of a circle whose diameter is the line joining the points (- 4, 3) and (12, - 1) is **[2]**
   a) $X^2 + y^2 + 8x + 2y + 51 = 0$
   b) $X^2 + y^2 - 8x - 2y - 51 = 0$
   c) $X^2 + y^2 + 8x + 2y - 51 = 0$
   d) $X^2 + y^2 + 8x - 2y - 51 = 0$

104) The variance and C.V. for the following frequency distribution is

X_1	60	61	62	63	64	65
F_i	3	10	11	13	7	5

[2]
   a) 1.46 and 2.33 b) 1.46 and 3.33
   c) 3.12 and 3.33 d) 2.12 and 2.33

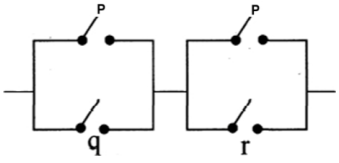
105) If the odds against an event be 2 : 3, then the probability of its occurrence is **[2]**
   a) 1 b) $\frac{3}{5}$
   c) $\frac{1}{5}$ d) $\frac{2}{5}$

106) The points in the argand plane given by Z_1 = - 3 + 5i, Z_2 = - 1 + 6i, Z_3 = - 2 + 8i, Z_4 = - 4 + 7i form a **[2]**
   a) Rhombus b) Parallelogram
   c) Square d) Rectangle

107) If (n + 2)! = 210 (n - 1)!, then the value of n is **[2]**
   a) 6 b) 4
   c) 5 d) 7

108) If the real valued function f(x) = $\frac{a^x-1}{x^r(a^x+1)}$ is even, then n equals **[2]**
   a) $\frac{-2}{3}$ b) $-\frac{1}{3}$
   c) $\frac{1}{4}$ d) 2

109) If



then the symbolic form is **[2]**
   a) $(p \vee q) \wedge (p \vee r)$
   b) $(p \wedge q) \wedge (p \wedge r)$
   c) $(p \wedge q) \wedge r$
   d) $(p \wedge q) \vee (p \vee r)$

110) If $\begin{bmatrix} 1 & 1 & 1 \\ 1 & -2 & -2 \\ 1 & 3 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ 3 \\ 4 \end{bmatrix}$, then $\begin{bmatrix} x \\ y \\ z \end{bmatrix}$ is equal to **[2]**

a) $\begin{bmatrix} 1 \\ 2 \\ -3 \end{bmatrix}$
b) $\begin{bmatrix} 1 \\ -2 \\ 1 \end{bmatrix}$
c) $\begin{bmatrix} 1 \\ -2 \\ 3 \end{bmatrix}$
d) $\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$

111) Let A and B be two matrices of order n× n. Let A be non - singular and B be singular. Consider the following:
i. AB is singular.
ii. AB is non - singular.
iii. A^{-1} B is singular.
iv. A^{-1} B is non - singular.
Which of the above is/are correct? **[2]**
a) I and iii b) I only
c) Iii only d) Ii and iv

112) The value ofλ for which the matrix $\begin{bmatrix} 1 & -2 & -1 \\ 2 & \lambda & 3 \\ -1 & 0 & 3 \end{bmatrix}$ will not be invertible, is **[2]**
a) $\frac{9}{2}$ b) $\frac{-9}{2}$
c) 9 d) - 9

113) The value of $\cos^{-1}(\cos 12) - \sin^{-1}(\sin 14)$ is **[2]**
a) $\frac{\pi}{2}$ b) - 2
c) $4\pi + 2$ d) $8\pi - 26$

114) $\cos\left[\tan^{-1}\frac{1}{3} + \tan^{-1}\frac{1}{2}\right]$ = **[2]**
a) $\frac{1}{\sqrt{2}}$ b) $\frac{\pi}{4}$
c) $\frac{1}{2}$ d) $\frac{\sqrt{3}}{2}$

115) The solution of the equation $\cos^2 x - 2\cos x = 4\sin x - \sin 2x$, $0 \le x \le \pi$, is **[2]**
a) $\pi - \tan^{-1}(2)$
b) $\pi - \cot^{-1}\left(\frac{1}{2}\right)$
c) $\pi + \tan^{-1}\left(-\frac{1}{2}\right)$
d) $\pi + \cot^{-1}\left(\frac{1}{2}\right)$

116) The two adjacent sides of a cyclic quadrilateral are 2 and 5 and the angle between them is 60°. If the third side is 3, the remaining fourth side is **[2]**
a) 2 b) 4
c) 5 d) 3

117) The value of x which satisfies the equation $\tan^{-1} x = \sin^{-1}\left(\frac{3}{\sqrt{10}}\right)$ is **[2]**
a) $\frac{1}{3}$ b) $-\frac{1}{3}$
c) 3 d) - 3

118) $\int_1^e \frac{1+\log x}{x}\,dx$ = **[2]**
a) $\frac{3}{2}$ b) $\frac{1}{e}$
c) $\frac{2}{3}$ d) $\frac{1}{2}$

119) $\int_0^{\frac{\pi}{4}} x\sec^2 x\,dx$ = **[2]**
a) $\frac{\pi}{4} + \log\sqrt{2}$
b) $1 - \frac{1}{2}\log\sqrt{2}$
c) $1 + \log\sqrt{2}$
d) $\frac{\pi}{4} - \log\sqrt{2}$

120) $\int_0^{\frac{\pi}{2}} \frac{2^{\sin x}}{2^{\sin x}+2^{\cos x}}\,dx$ = **[2]**
a) π b) 2π
c) 2 d) $\frac{\pi}{4}$

121) $\int_1^2 \frac{1}{x^2} e^{\frac{-1}{x}}\,dx$ = **[2]**
a) $\frac{\sqrt{e}-1}{e}$
b) $\sqrt{e} - 1$
c) $\frac{\sqrt{e}+1}{e}$
d) $\sqrt{e} + 1$

122) $\int_0^{\pi} \frac{x\tan x}{\sec x+\cos x}\,dx$ = **[2]**
a) $\frac{\pi^2}{4}$ b) $\frac{\pi^2}{2}$
c) $\frac{3\pi^2}{2}$ d) $\frac{\pi^2}{3}$

123) Let the position vectors of two points A and B be$\vec{a}+\vec{b}+\vec{c}$ and $\vec{a} - 2\vec{b} + 3\vec{c}$ respectively. If the points P and Q divide AB in the ratio 1 : 3 internally and externally respectively, then $3|\vec{AB}|$ = **[2]**
a) $3|\vec{PQ}|$
b) $4|\vec{PQ}|$
c) $2|\vec{PQ}|$
d) $\frac{1}{2}|\vec{PQ}|$

124) If$\vec{x}\cdot\vec{a} = 0$, $\vec{x}\cdot\vec{b} = 0$ and $\vec{x}\cdot\vec{c} = 0$ for some non - zero vector $\vec{x}$, then the true statement is **[2]**
a) $[\vec{a}\vec{b}\vec{c}] = 1$
b) $[\vec{a}\vec{b}\vec{c}] \neq 1$
c) $[\vec{a}\vec{b}\vec{c}] \neq 0$
d) $[\vec{a}\vec{b}\vec{c}] = 0$

125) Position vector of a point which divides line joining points A and B whose position vectors are$2\hat{i}+\hat{j}-\hat{k}$ and $\hat{i}-\hat{j}+2\hat{k}$ externally in the ratio 5 : 2 is **[2]**
a) $\hat{i} + 7\hat{j} - 12\hat{k}$
b) $\hat{i} - 7\hat{j} + 12\hat{k}$
c) $\frac{1}{3}(\hat{i} - 7\hat{j} + 12\hat{k})$
d) $\frac{1}{3}(\hat{i} + 7\hat{j} - 12\hat{k})$

126) The number of straight lines that are equally inclined to the three dimensional co - ordinate axes, is **[2]**
a) 8 b) 4
c) 6 d) 2

127) If lines $a^2x^2 + bcy^2 = a(b + c)xy$ are mutually perpendicular, then **[2]**
a) $A^2 + b^2 + c^2 = 0$ b) $B^2 + ca = 0$
c) $A^2 + bc = 0$ d) $C^2 + ab = 0$

128) A line from the origin meets the lines
$\frac{x-2}{1} = \frac{y-1}{-2} = \frac{z+1}{1}$ and $\frac{x-\frac{8}{3}}{2} = \frac{y+3}{-1} = \frac{z-1}{1}$
at P and Q respectively. If length PQ = d, then d^2 is equal to **[2]**
a) 4 b) 6
c) 3 d) 5

129) Foot of perpendicular of point (2, 2, 2) in the plan x + y + z = 9 is **[2]**
a) (9, 0, 0) b) (1, 1, 1)
c) (3, 3, 3) d) (2, 6, 1)

130) D.c.s of a line segment AB are$\frac{-2}{\sqrt{17}}, \frac{3}{\sqrt{17}}, \frac{-2}{\sqrt{17}}$. If AB = $\sqrt{17}$ and $A \equiv$ (3, - 6, 10), then co - ordinates of B will be **[2]**
a) (1, - 3, 8) b) (2, 5, 8)
c) (1, - 2, 4) d) (- 1, 3, - 8)

131) The derivative of sin x w.r.t. cos x is **[2]**
a) Cot x b) - tan x
c) - cot x d) Tan x

132) The derivative of $\sin^{-1}\left(2x\sqrt{1-x^2}\right)$ with respect to $\sin^{-1}\left(3x-4x^3\right)$ is **[2]**
a) $\frac{1}{2}$ b) $\frac{2}{3}$
c) 1 d) $\frac{3}{2}$

133) A stone is falling freely and describes a distance s in t seconds given by equation s = $\frac{1}{2}$ gt^2. The acceleration of the stone is **[2]**
a) Non - uniform b) Zero
c) Uniform d) Indeterminate

134) The function f(x) = 1 - x^3 - x^5 is decreasing for **[2]**
a) 1≤ x ≤ 5 b) X≤ 1
c) All values of x d) X≥ 1

135) The equation of the tangent to the curve $\sqrt{x}+\sqrt{y}$ = a at $\left(\frac{a^2}{4},\frac{a^2}{4}\right)$ is **[2]**
a) Xy = $\frac{a^2}{2}$ b) X - y = $\frac{a^2}{2}$
c) X + y = $\frac{a^2}{2}$ d) Xy = a^2

136) The tangent to the curve x^2 + y^2 - 2x - 3 = 0 is parallel to X - axis at the points **[2]**
a) (± 3, 0) b) (± 1, 2)
c) (1,± 2) d) (2,±$\sqrt{3}$)

137) If $\int \frac{f(x)}{\log\cos x}$ dx = - log (log cos x) + c, then f(x) is equal to **[2]**
a) - sin x b) - cos x
c) - tan x d) Tan x

138) $\int \frac{x\sin x}{x\cos x-\sin x-1}$ dx = _____ + c **[2]**
a) - log |x sin x - cos x - 1|
b) Log |x cos x - sin x - 1|
c) Log |x sin x - cos x - 1|
d) - log |x cos x - sin x - 1|

139) $\int \frac{x-1}{(x+1)^2}\,dx =$ **[2]**
a) 2 log |x + 1| - $\frac{1}{x+1}$ + c
b) Log |x + 1| - $\frac{2}{x+1}$ + c
c) $\frac{2}{x+1}$ - log |x + 1| + c
d) Log |x + 1| +$\frac{2}{x+1}$ + c

140) $\int \frac{1}{(e^{2x}+e^{-2x})^2}dx =$ **[2]**
a) $\frac{-1}{2(e^{4x}+1)}+c$
b) $\frac{-1}{4(e^{4x}+1)}+c$
c) $\frac{1}{2(e^{4x}+1)}+c$
d) $\frac{1}{4(e^{4x}+1)}+c$

141) The area bounded by the curve y = |sin x|, X axis and the lines x =$-\pi$ and x = π is **[2]**
a) 3 sq. units b) 2 sq. units
c) 1 sq. unit d) 4 sq. units

142) The area of the region above X - axis included between the parabola y^2 = x and the circle x^2 + y^2 = 2x in square units is **[2]**
a) $\frac{3}{2}-\frac{\pi}{4}$
b) $\frac{\pi}{4}-\frac{3}{2}$
c) $\frac{\pi}{4}-\frac{2}{3}$
d) $\frac{2}{3}-\frac{\pi}{4}$

143) The solution of the equation $\frac{dy}{dx}+\sqrt{\frac{1-y^2}{1-x^2}}=0$ is **[2]**
a) $x\sqrt{1-y^2}+y\sqrt{1-x^2}$ = c
b) None of these
c) $x\sqrt{1+y^2}+y\sqrt{1+x^2}$ = c
d) $x\sqrt{1-y^2}-y\sqrt{1-x^2}$ = c

144) The order of the differential equation$y\left(\frac{dy}{dx}\right)=\frac{x}{\frac{dy}{dx}}+\left(\frac{dy}{dx}\right)^3$ is **[2]**
a) 3 b) 4
c) 1 d) 2

145) The solution of the differential equation $\frac{dy}{dx}+\frac{3x^2}{1+x^3}y=\frac{\sin^2 x}{1+x^3}$ is **[2]**
a) Y(1 + x^3) = x + $\frac{1}{2}$ sin 2x + c
b) Y(1 + x^3) = cx + $\frac{1}{2}$ sin 2x + c
c) Y(1 + x^3) = cx - $\frac{1}{2}$ sin 2x + c
d) Y(1 + x^3) = $\frac{x}{2}-\frac{1}{4}\sin 2x+c$

146) If y = f(x), passes through the point (1, - 1) and satisfies the equation y(1 + xy)dx = x dy, then$f\left(\frac{1}{2}\right)$ is equal to **[2]**
a) $-\frac{4}{5}$ b) $\frac{4}{5}$
c) $\frac{2}{5}$ d) $-\frac{2}{5}$

147) A bag contains 4 red and 6 black balls. Three balls are drawn at random. Then the probability distribution of the number of red balls is **[2]**

a)

X	0	1	2	3
P(X)	$\frac{1}{5}$	$\frac{2}{3}$	$\frac{5}{9}$	$\frac{6}{9}$

b)

X	0	1	2	3
P(X)	$\frac{1}{9}$	$\frac{2}{9}$	$\frac{5}{6}$	$\frac{4}{6}$

c)

X	0	1	2	3
P(X)	$\frac{1}{6}$	$\frac{1}{2}$	$\frac{3}{10}$	$\frac{1}{30}$

d)

X	0	1	2	3
P(X)	$\frac{1}{6}$	$\frac{2}{3}$	$\frac{4}{10}$	$\frac{3}{10}$

148) Which of the following distribution of probabilities of a random variable X is the probability distribution? **[2]**

a)

X	0	1	2
P(X)	0.1	0.7	0.

b)

X	2	3	4	5
P(X)	0.2	0.2	0.2	0.5

c)

X	0	1	2	3
P(X)	0.3	0.2	0.4	0.1

d)

X	1	2	3	4
P(X)	0.5	0.5	0.2	0.3

149) If X follows a binomial distribution with parameters n = 6 and p. If 9P(X = 4) = P(X = 2), then p = **[2]**
a) $\frac{1}{4}$ b) $\frac{1}{2}$
c) $\frac{1}{3}$ d) 1

150) If X B (n, p) with n = 10, p = 0.4, then E(X^2) = **[2]**
a) 4 b) 2.4
c) 3.6 d) 18.4