SATISH SCIENCE ACADEMY
DHANORI PUNE - 411015

Mhtcet pcm 2
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) Two particles are projected from the same point with the same speed, at different angles θ_1 and θ_2 to the horizontal. Their times of flight are t_1 and t_2 respectively and they have the same horizontal range. Then the incorrect relation is [1]
   a) $\frac{t_1}{\sin\theta_1} = \frac{t_2}{\sin\theta_2}$
   b) $\frac{t_1}{t_2} = \tan\theta_2$
   c) $\frac{t_1}{t_2} = \tan\theta_1$
   d) $\theta_1 + \theta_2 = 90°$

2) A mass of 10 kg is suspended from a rope wound on a wheel of diameter 40 cm. The torque about the axis of rotation is [1]
   a) 4 N m
   b) 39.2 N m
   c) 19.6 N m
   d) 2 N m

3) A tunnel is dug along a chord of the earth at a perpendicular distance $\frac{R}{2}$ from the centre of earth. The wall of the tunnel may be assumed to be frictionless. A particle is released from one end of the tunnel. The pressing force by the particle on wall is depicted by the graph [1]

   a)

   b)

   c)

   d)
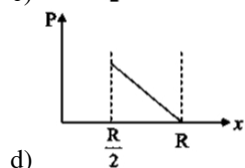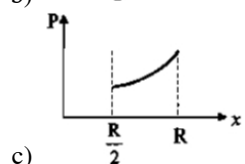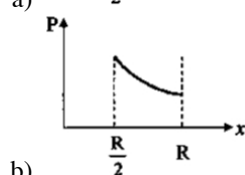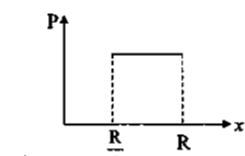
4) Absolute zero may be regarded as that temperature at which [1]
   a) All gases become liquids.
   b) Molecular motion in a gas would be the minimum possible.
   c) All substances are solid.
   d) Water freezes.

5) At a given temperature, the ratio of the velocity of sound in helium gas to that in nitrogen gas is [1]
   a) $\left(\frac{5}{\sqrt{21}}\right) : 1$
   b) $\sqrt{8} : 1$
   c) $\sqrt{7} : 1$
   d) $\left(\frac{\sqrt{21}}{5}\right) : 1$

6) For a small angled prism, angle of prism A, the angle of minimum deviation (δ) varies with the refractive index of the prism as shown in the graph
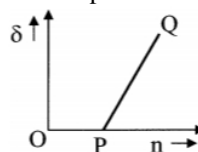
   [1]

   a) Point P corresponds to n = 1
   b) Slope of the line PQ $= \frac{A}{2}$
   c) Both point P corresponds to n = 1 and slope of line PQ = A are true
   d) Slope of line PQ = A

7) Angle of minimum deviation for a prism of refractive index 1.5 is equal to the angle of prism of given prism. Then the angle of prism is _____ (sin 48°36' = 0.75) [1]
   a) 41°24'
   b) 60°
   c) 82°48'
   d) 80°

8) Given a point source of light, which of the following can produce a convergent beam of light? [1]
   a) A plane mirror
   b) Convex mirror
   c) Convex lens
   d) Concave mirror

9) A metallic solid sphere is placed in a uniform electric field. The lines of force follow the path(s) shown in figure as
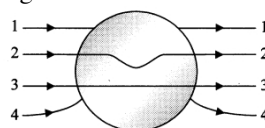
   [1]
   a) 3
   b) 4
   c) 2
   d) 1

10) A body of mass 1 kg tied to one end of string is revolved in a horizontal circle of radius 0.1 m with a speed of 3 revolution/s. Assuming the effect of gravity is negligible, then linear velocity, acceleration and tension in the string will be [1]

   a) 1.88 m/s, 35.5 m/s^2, 35.5 N

b) 2.88 m/s, 45.5 m/s^2, 45.5 N

c) 3.88 m/s, 55.5 m/s^2, 55.5 N

d) 4.88 m/s, 35.5 m/s^2, 35.5 N

11) A particle executes linear simple harmonic motion with an amplitude of 2 cm. When the particle is at 1 cm from the mean position, the magnitude of its velocity is equal to that of its acceleration. Then its time period in seconds is [1]

   a) $2\pi\sqrt{3}$

   b) $\frac{1}{2\pi\sqrt{3}}$

   c) $\frac{2\pi}{\sqrt{3}}$

   d) $\frac{\sqrt{3}}{2\pi}$

12) The length of seconds pendulum at a place where g = 4.9 m/s^2 is [1]

   a) 60 cm

   b) 99.54 cm

   c) 50 cm

   d) 101 cm

13) The equation, $m\frac{d^2y}{dt^2} + b\frac{dy}{dt} + \omega^2 y = 0$ represents the equation of motion for a [1]

   a) Resonant oscillator.

   b) Free vibrator.

   c) Damped harmonic oscillator.

   d) Forced oscillator.

14) The power factor of a series LCR circuit at resonance, is [1]

   a) 1

   b) Zero

   c) 0.5

   d) 1.5

15) S. I. unit of surface tension is [1]

   a) Nm^{-2}

   b) Nm^{-1}

   c) Nm

   d) Ns^{-1}

16) When the stationary waves are formed, then

   i. Transfer of energy is double of the energy of component waves.

   ii. Transfer of energy is zero.

   iii. No energy is present in the medium.

   iv. Value of energy density at each point of the path is infinite.

   [1]

   a) Option (c)

   b) Option (b)

   c) Option (a)

   d) Option (d)

17) The equation of the progressive wave is Y = 3 $\sin\left[\pi\left(\frac{t}{3} - \frac{x}{5}\right) + \frac{\pi}{4}\right]$ where x and Y are in metre and time in second. Which of the following is correct? [1]

   a) Velocity V = 1.5 m/s

   b) Amplitude A = 3 cm

   c) Frequency F = 0.2 Hz

   d) Wavelength λ = 10 m

18) The number of beats produced per second by two tuning forks when sounded together is 4. If one of them has a frequency of 250 Hz, the frequency of other cannot be more than [1]

   a) 252 Hz

   b) 246 Hz

   c) 254 Hz

   d) 248 Hz

19) At N.T.P., the R.M.S velocity of hydrogen molecule is (P = 1.013× 10^5 N/m^2, Density of hydrogen = 0.09 kg/m^3) [1]

   a) 1938 m/s

   b) 1738 m/s

   c) 1838 m/s

   d) 1640 m/s

20) In a single slit diffraction experiment, if the first minimum for λ_1 = 600 nm coincides with the first maximum for wavelength λ_2, then λ_2 will be equal to [1]

   a) 400 nm

   b) 240 nm

   c) 300 nm

   d) 345 nm

21) A galvanometer of resistance 30Ω is connected to a battery of emf 2 V with 1970 Ω resistance in series. A full scale deflection of 20 divisions is obtained in the galvanometer. To reduce the deflection to 10 divisions, the resistance in series required is [1]

   a) 4030Ω

   b) 3970Ω

   c) 4000Ω

   d) 2000Ω

22) An electric network is constructed with 1Ω and 2 Ω resistors as shown. The current through the 2 Ω resistor nearest to the battery is
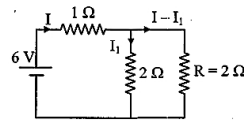
   [1]

   a) 3.0 A

   b) 2.0 A

   c) 4.0 A

   d) 1.5 A

23) A potentiometer consists of a wire of length 4 m and resistance 10Ω. It is connected to a cell of e.m.f. 2 V. The potential difference per unit length of the wire will be [1]

   a) 2 V/m

   b) 0.5 V/m

   c) 10 V/m

   d) 5 V/m

24) The reading of an ideal voltmeter in the circuit shown is,
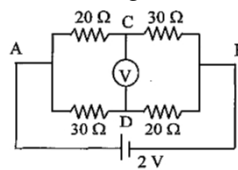
   [1]

   a) 0.5 V

   b) 0.4 V

   c) 0 V

   d) 0.6 V

25) A current carrying coil is equivalent to [1]

   a) Magnetic moment.

   b) Electric dipole.

   c) Both electric dipole and magnetic dipole.

   d) Magnetic dipole.

26) A, B and C are parallel conductors of equal length carrying currents I, I and 2I respectively. Distance between A and B is x. Distance between B and C is also x. F_1 is the force exerted by B on A and F_2 is the force exerted by C on A. Choose the correct answer.

   [1]

   a) $F_1 = -F_2$

   b) $F_1 = 2F_2$

   c) $F_2 = 2F_1$

   d) $F_1 = F_2$

27) If the current flowing in ABCD is I. Then the field at P as shown in the figure will be

   [1]

   a) $\frac{\mu_0 I\theta}{4\pi}\left(\frac{1}{b} - \frac{1}{a}\right)$

b) $\frac{\mu_0 I \theta}{4\pi}\left(\frac{1}{a} - \frac{1}{b}\right)$

c) $\frac{\mu_0 I \theta}{4\pi}(a + b)$

d) $\frac{\mu_0 I \theta}{4\pi}\left(\frac{1}{a} + \frac{1}{b}\right)$

28) The value of magnetic induction inside a solenoid along the radius [1]

    a) Increases with distance from the axis.

    b) Is zero.

    c) Decreases with distance from the axis.

    d) Is uniform.

29) The magnetic moment of electron due to orbital motion is proportional to (n = principal quantum numbers) [1]

    a) N^2 b) $\frac{1}{n}$

    c) $\frac{1}{n^2}$ d) N

30) Relative permeability of nickel is 600, then its magnetic susceptibility will be [1]

    a) 599   b) 600×10^{-7}

    c) 600×10^7 d) 601

31) A permanent magnet can be made from which one of the following substances? [1]

    a) Paramagnetic   b) Soft iron

    c) Ferromagnetic   d) Diamagnetic

32) A bar magnet of magnetic moment $\vec{M}$ is placed in a magnetic field of induction $\vec{B}$. The torque exerted on it is [1]

    a) $\vec{B} \times \vec{M}$

    b) $-\vec{M} \cdot \vec{B}$

    c) $\vec{M} \times \vec{B}$

    d) $\vec{M} \cdot \vec{B}$

33) A conducting rod of length 2l is rotating with constant angular speed ω about its perpendicular bisector. A uniform magnetic field $\vec{B}$ exists parallel to the axis of rotation. The e.m.f. induced between two ends of the rod is

[1]

    a) $\frac{1}{8} B\omega l^2$

    b) Zero

    c) $\frac{1}{2} B\omega l^2$

    d) $B\omega l^2$

34) A loss - free transformer has 500 turns on its primary winding and 2500 in secondary. The meters of the secondary indicate 200 volts at 8 ampere under these conditions. The voltage and current in the primary is [1]

    a) 100 V, 16 A   b) 40 V, 40 A

    c) 80 V, 20 A   d) 160 V, 10 A

35) A wheel with 10 spokes each of length 'L' m is rotated with a uniform angular velocity 'ω' in a plane normal to the magnetic field 'B'. The emf induced between the axle and the rim of the wheel. [1]

    a) $\frac{1}{2}\omega BL^2$

    b) $\frac{1}{2} N\omega BL^2$

    c) $N\omega BL^2$

    d) ωBL^2

36) The energy of an electron having de - Broglie wavelength 'λ' is (h = Planck's constant, m = mass of electron) [1]

    a) $\frac{h^2}{2\ m^2\lambda^2}$

    b) $\frac{h^2}{2\ m^2\lambda}$

    c) $\frac{h}{2\ m\lambda}$

    d) $\frac{h^2}{2\ m\lambda^2}$

37) A radiation of $3300\overset{o}{A}$ falls on a metal to eject electrons with a maximum velocity of 0.4×10^6 m/s, the value of the work function of metal is nearly ($h = 6.6 \times 10^{-34}$ J - s; $m_e = 9.1 \times 10^{-31}$ kg) [1]

    a) 5.3×10^{-21} J   b) 5.3×10^{-19} J

    c) 5.3×10^{-18} J   d) 5.3×10^{-16} J

38) In photoelectric effect, [1]

    a) Electrons are emitted from the metals when light rays (radiations) are reflected from it.

    b) Light of longer wavelength is more effective than light of shorter wavelength.

    c) Light of shorter wavelength is more effective than light of longer wavelength.

    d) Light is not used.

39) An α - particle moving with a constant energy is scattered by the nucleus. The scattering angle will be maximum when the α - particle [1]

    a) Just passes the nucleus

    b) Approaches the nucleus head on

    c) Passes at large distance from the nucleus

    d) Is attracted by the nucleus

40) In the Bohr model of a hydrogen atom, the centripetal force is furnished by the coulomb attraction between the proton and the electron. If ao is the radius of the ground state orbit, m is the mass, e is the charge on the electron and ε_0 is the vacuum permittivity, the speed of the electron is [1]

    a) 0

    b) $\frac{\sqrt{4\pi\varepsilon_0 a_0\ m}}{e}$

    c) $\frac{e}{\sqrt{4\pi\varepsilon_0 a_0\ m}}$

    d) $\frac{e}{\sqrt{\varepsilon_0 a_0\ m}}$

41) Which pair is isotonic? [1]

    a) $_6C^{14}, _7N^{14}$ b) $_7N^{13}, _6C^{12}$

    c) $_6C^{14}, _6C^{12}$ d) $_7N^{13}, _7N^{14}$

42) First orbit velocity of electron is 2.1×10^6 m/s then the velocity of 3rd orbit electron is [1]

    a) 0.7×10^6 m/s   b) 7×10^7 m/s

    c) 6×10^6 m/s   d) 7×10^6 m/s

43) If wavelength for a wave is $\lambda = 6000 \overset{o}{A}$, then wave number will be [1]

    a) $166 \times 10^8 m^{-1}$ b) $16.6 \times 10^7 m^{-1}$

    c) $1.66 \times 10^7 m^{-1}$ d) $1.66 \times 10^6 m^{-1}$

44) As an electron makes a transition from an excited state to the ground state of a hydrogen - like atom/ion

    i. Its kinetic energy increases but potential energy and total energy decrease

    ii. Kinetic energy, potential energy and total energy decrease

    iii. Kinetic energy decreases, potential energy increases but total energy remains same

    iv. Kinetic energy and total energy decrease but potential energy increases

[1]

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

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

45) According to Einstein's mass - energy equivalence, [1]

    a) Mass can be created but energy cannot created
    b) Energy can be created
    c) Mass and energy are interconvertible
    d) Mass and energy are equivalent

46) Binding energy of a nucleus is equivalent to [1]

    a) Mass of the proton
    b) Mass of the nucleus
    c) Mass defect of the nucleus
    d) Mass of the neutron

47) Identify the semiconductor devices whose characteristics are given below, in the order (a), (b), (c), (d):

    i. Zener diode, Simple diode, Light dependent resistance solar cell
    ii. Solar cell, Light dependent resistance, Zener diode, Simple diode
    iii. Zener diode, Solar cell, Simple diode, Light dependent resistance
    iv. Simple diode, Zener diode, Solar cell, Light dependent resistance

    [1]
    a) Option (a)   b) Option (d)
    c) Option (c)   d) Option (b)

48) An npn transistor circuit is arranged as shown in figure. It is

    [1]
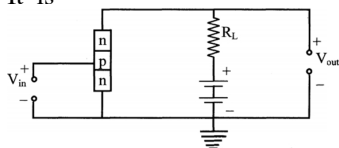
    a) A common - collector amplifier circuit.
    b) A common - emitter amplifier circuit.
    c) Rectifier circuit.
    d) A common - base amplifier circuit.

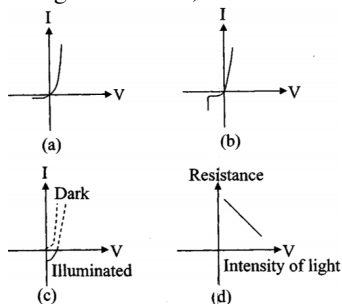49) The output Y of the logic circuit given below is

    [1]

    a) $\overline{(\overline{A} + B)} \cdot \overline{A}$
    b) $\overline{A}$ + B
    c) $\overline{\overline{A}}$
    d) $\overline{(\overline{A} + B) \cdot \overline{A}}$

50) The correct Boolean operation represented by the circuit diagram drawn is:

    [1]
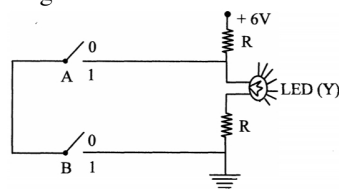
a) NAND   b) NOR
c) OR   d) AND

Section - A (Chemistry)

51) What is the mass of 0.5 mole of ozone molecule? [1]
    a) 16 g   b) 24 g
    c) 8 g   d) 48 g

52) Name the particle that was identified by J.J.Thomson in the cathode ray tube experiment. [1]
    a) Proton   b) Electron
    c) Neutron   d) Nucleon

53) Which of the following reactions involve both oxidation and reduction? [1]

    a) $2NaOH + H_2SO_4 \longrightarrow Na_2SO^4 + 2H_2O$
    b) $NaBr + HCl \longrightarrow NaCl + HBr$
    c) $H_2 + Br_2 \longrightarrow 2HBr$
    d) $HBr + AgNO_3 \longrightarrow AgBr + HNO_3$

54) Hydrogen combines with other elements by _____. [1]

    a) Losing, gaining or sharing of electrons
    b) Gaining electrons
    c) Losing electrons
    d) Sharing electrons

55) In the case of gases, relative density is measured with respect to _____ gas and is called vapour density [1]
    a) Hydrogen   b) Oxygen
    c) Helium   d) Nitrogen

56) The process that involves the conversion of a precipitate into colloidal sol by shaking with a dispersion medium in the presence of a small amount of an electrolyte is called _____. [1]
    a) Coagulation   b) Purification
    c) Peptization   d) Disintegration

57) Which of the following reagents will be able to distinguish between but - 1 - yne and but - 2 - yne? [1]
    a) Br_2 b) HCl
    c) O_2 d) $LiNH_2$

58) An alkene having molecular formula C_7H_{14} was subjected to ozonolysis in the presence of zinc dust. An equimolar amount of the following two compounds was obtained:
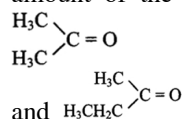
    The IUPAC name of the alkene is _____. [1]

    a) 3,4 - Dimethylpent - 3 - ene
    b) 2,3 - Dimethylpent - 3 - ene
    c) 3,4 - Dimethylpent - 2 - ene
    d) 2,3 - Dimethylpent - 2 - ene

59) Which of the following undergoes electromeric effect? [1]
    a) Ethyne   b) Methyl chloride
    c) Methyl bromide d) Ethane

60) Fourteen Bravais lattices are divided into _____ crystal systems. [1]
    a) 3   b) 4
    c) 7   d) 14

61) To get an n - type semiconductor, the impurity to be added to silicon should have which of the following number of valence electrons? [1]
    a) 5   b) 1
    c) 3   d) 2

62) Which of the following solutions exhibits positive deviation from Raoult's law? **[1]**
   a) Ethanol + Acetone
   b) Chloroform + Acetone
   c) Benzene + Toluene
   d) Aniline + Phenol

63) On dissolving 18 g solid in 100 g H_2O at 20 °C, water vapour pressure decreases from 17.53 mm to 17.22 mm. The molecular weight of the solid is _____. **[1]**
   a) 18 g mol^{-1}
   b) 27 g mol^{-1}
   c) 183 g mol^{-1}
   d) 274 g mol^{-1}

64) Considering entropy (S) as a thermodynamic parameter, the criterion for the spontaneity of any process is _____. **[1]**

   a) $\Delta S_{system} + \Delta S_{surroundings} > 0$
   b) $\Delta S_{System} > 0$ only
   c) $\Delta S_{system} \, \Delta S_{surroundings} > 0$
   d) $\Delta S_{surroundings} > 0$ only

65) Which is TRUE for heat and temperature?
   i. Intensive and extensive respectively. properties
   ii. Both are intensive properties.
   iii. Both are extensive properties.
   iv. Extensive and intensive respectively.
[1]
   a) Option (c)
   b) Option (d)
   c) Option (a)
   d) Option (b)

66) The resulting solution obtained at the end of electrolysis of concentrated aqueous solution of NaCl _____. **[1]**

   a) Turns blue litmus into red
   b) Turns red litmus into blue
   c) The colour of red or blue litmus does not change
   d) Remains colourless with phenolphthalein

67) Strong electrolytes are those which _____. **[1]**

   a) Completely dissociate into ions in aqueous solutions
   b) Do not dissociate into ions in aqueous solutions
   c) Do not conduct electricity when dissolved in water
   d) Dissociate to a smaller extent in aqueous solutions

68) When initial concentration of a reactant is doubled in a reaction, its half - life period is not affected. The order of the reaction is _____. **[1]**

   a) More than zero but less than first
   b) First
   c) Second
   d) Zero

69) For a reaction, rate law is rate = k [A][B]. If the concentration of A is doubled keeping [B] constant, then the rate of reaction would be _____. **[1]**
   a) Doubled
   b) Quadrupled
   c) Tripled
   d) Halved

70) For an aqueous neutral solution at 298 K, $[H_3O^+]$ is equal to _____ M. **[1]**
   a) 1×10^{-14}
   b) 1×10^{14}
   c) 1×10^{-7}
   d) 1×10^{7}

71) If the solubility product K_{sp} of a sparingly soluble salt MX_2 at 25 °C is 1.0×10^{-11}, the solubility of the salt in mole litre^{-1} at this temperature will be _____. **[1]**

   a) $\sqrt[3]{\frac{4}{1.0 \times 10^{-11}}}$
   b) $\sqrt[3]{\frac{1.0 \times 10^{-11}}{4}}$
   c) $\sqrt[3]{\frac{1.0 \times 10^{-11}}{2}}$
   d) $\sqrt[2]{\frac{1.0 \times 10^{-11}}{4}}$

72) Which of the following is NOT a weak acid? **[1]**
   a) H_2SO_4
   b) HF
   c) CH_3COOH
   d) H_2S

73) Which of the following is CORRECT?
   i. Atomic radius: O > S > Se > Te > Po
   Ionisation enthalpy: O > S > Se > Te > Po
   ii. Atomic radius: O < S < Se < Te < Po
   Ionisation enthalpy: O < S < Se < Te < Po
   iii. Atomic radius: O > S > Se > Te > Po
   Ionisation enthalpy: O < S < Se < Te < Po
   iv. Atomic radius: O < S < Se < Te < Po
   Ionisation enthalpy: O > S > Se > Te > Po
[1]
   a) Option (d)
   b) Option (c)
   c) Option (a)
   d) Option (b)

74) Identify the products formed in the following reaction.
$HCl + O_2 \xrightarrow[\Delta]{CuCl_2} ?$ **[1]**
   a) $H_2O_2 + Cl_2$
   b) $HClO + H_2$
   c) $Cl_2 + H_2O$
   d) $H_2 + ClO_2$

75) Which of the following compounds exhibit distorted octahedral geometry? **[1]**
   a) XeF4
   b) XeO_3
   c) $XeOF_4$
   d) XeF_6

76) Which of the following statement is INCORRECT?
   i. Blast furnace is tall cylindrical steel tower which is lined with refractory bricks.
   ii. Blast furnace works on counter current principle where the charge comes down and hot gases move up the tower.
   iii. The temperature goes on decreasing from top to bottom in the blast furnace.
   iv. The maximum temperature in the blast furnace is about 2000 K above the tuyers.
[1]
   a) Option (b)
   b) Option (a)
   c) Option (d)
   d) Option (c)

77) Which of the following has one electron in 5d orbital in it ground state? **[1]**
   a) Thulium
   b) Gadolinium
   c) Neodymium
   d) Terbium

78) In coordination compounds, the hydrate isomers differ in _____.
   i. The number of water molecules of hydration
   ii. The number of water molecules only present as ligands
   iii. Their coordination number of the metal atom
   iv. Both the number of water molecules of hydration and the number of water molecules only present as ligands
[1]
   a) Option (b)
   b) Option (c)
   c) Option (d)
   d) Option (a)

79) The stability of complex formed by metal ions of the same charge with the same ligand, _____. **[1]**

   a) Increases with decrease in atomic radii of metal ion
   b) Depends on the atomic mass of metal ion
   c) Independent of atomic radii of metal ion
   d) Increases with increase in atomic radii of metal ion

80) How many out of $[TiF_6]^{2-}$, $[CoF_6]^{3-}$, Cu_2Cl_2 and

$[NiCl_4]^{2-}$ are colorless? (Ti = 22, Co = 27, Cu = 29, Ni = 28) **[1]**
- a) 3
- b) 1
- c) 2
- d) 0

81) Which of the following is an aryl halide? **[1]**

a)

b)

c)

d)

82) R - Mg - Br + H_2O ⟶ $RH_{(gas)}$. Gas occupies 1.4 L g^{-1} of RH at S.T.P.
Hence, R - Mg - Br is _____. **[1]**
- a) C_6H_5MgBr
- b) CH_3CH_2MgBr
- c) $CH_3CH_2CH_2MgBr$
- d) CH_3MgBr

83) Consider the reaction:
R - CH_2 - OH + HCl ⟶ R - CH_2 - Cl + H_2O.
For the completion of the reaction, _____ is used. **[1]**
- a) Excess of water
- b) Conc. H_2SO_4
- c) $CaCl_2$
- d) Anhydrous $ZnCl_2$

84) Anisole is obtained from phenol by reaction with _____. **[1]**
- a) $NaOH + C_2H_5I$
- b) $NaOH + CO_2$
- c) $NaOH + CH_3I$
- d) $NaOH + CHCl_3$

85)

is an example for _____. **[1]**
- a) Allylic alcohol
- b) Benzylic alcohol
- c) Glycol
- d) Vinylic alcohol

86) C_6H_5 - CH = CHCHO $\xrightarrow{X}$ C_6H_5CH = $CHCH_2OH$ In the above sequence, X can be _____. **[1]**
- a) H_2/Pd
- b) $LiAlH_4$
- c) $K_2Cr_2O_7/H^+$
- d) H_2/Ni

87) The reagent used to prepare benzaldehyde by Stephen reaction is _____. **[1]**
- a) $SnCl_2$/dil. HCl
- b) $CO + HCl/AlCl_3$
- c) H_2, $Pd/BaSO_4$
- d) CrO_2Cl_2/CS_2

88) M - Nitrobenzaldehyde, on reaction with aqueous concentrated NaOH solution at room temperature, gives_____.
- i. Sodium m - nitrobenzoate and m - nitrobenzyl alcohol
- ii. M - hydroxybenzaldehyde and m - nitrobenzyl alcohol
- iii. M - nitrobenzyl alcohol and m - hydroxybenzyl alcohol
- iv. Sodium m - nitrobenzoate and m - hydroxybenzyl alcohol

[1]
- a) Option (b)
- b) Option (d)
- c) Option (a)
- d) Option (c)

89) Which class of compounds shows H - bonding even more than in alcohols? **[1]**
- a) Ethers
- b) Carboxylic acids
- c) Phenols
- d) Aldehydes

90) IUPAC name of n - propylamine is _____. **[1]**
- a) Propan - 2 - amine
- b) Butan - 1 - amine
- c) Propan - 1 - amine
- d) Butan - 2 - amine

91) The IUPAC name for $(CH_3)_2NC(CH_3)_3$ is _____. **[1]**
- a) N,N - dimethylbutan - 2 - amine
- b) N,N - dimethyl - 2 - methylpropan - 1 - amine
- c) N,N - dimethyl - 2 - methylpropan - 2 - amine
- d) N,N - dimethylpropanamine

92) Match the following.

	Column I		Column II
I.	β - Methylpropylamine	A.	Mixed 2° amine
Ii.	Di - isopropylamine	B.	1° Amine
Iii.	Dimethyl - sec - butylamie	C.	Simple 2° amine
Iv.	Ethylisopropylamine	D.	Mixed 3° amine

[1]

- a) I - c, ii - d, iii - b, iv - a
- b) I - b, ii - c, iii - d, iv - a
- c) I - b, ii - d, iii - a, iv - c
- d) I - d, ii - a, iii - b, iv - c

93) Acetylation of glucose gives _____. **[1]**
- a) Glucose triacetate
- b) Glucose diacetate
- c) Glucose pentaacetate
- d) Glucose acetate

94) Which one given below is a non - reducing sugar? **[1]**
- a) Lactose
- b) Glucose
- c) Maltose
- d) Sucrose

95) Which of the following can be remoulded and recycled? **[1]**
- a) Fibers
- b) Elastomers
- c) Thermosetting polymers
- d) Thermoplastic polymers

96) Which of the following is NOT a polymer ? **[1]**
- a) Glucose
- b) Enzyme
- c) RNA
- d) Starch

97) A similarity between nylon 6 and nylon 6,6 is that _____. **[1]**
- a) Starting materials used for their manufacture are isomers
- b) They are isomers
- c) They are polyamide polymers
- d) The sum of all the carbon atoms in their monomers is six

98) The green technology developed by Drath and Frost is used for the synthesis of _____. **[1]**
- a) HOOC - COOH
- b) CH_3 - $(CH_2)_4$ - COOH
- c) CH_2= CH - COOH
- d) HOOC - $(CH_2)_4$ - COOH

99) Salicylic acid + Acetyl chloride $\xrightarrow{pyridine}$ X + HCl
The % atom economy for the preparation of 'X' will be _____. **[1]**

a) $\frac{138}{180} \times 100$

b) $\frac{180}{138} \times 100$

c) $\frac{216.5}{180} \times 100$

d) $\frac{180}{216.5} \times 100$

100) Sol - gel process is based on _____ reactions. **[1]**

a) Organic precipitation

b) Inorganic precipitation

c) Inorganic polymerization

d) Organic decomposition

Section - B (Mathematics)

101) If $\sin\alpha = \frac{1}{\sqrt{5}}$ and $\sin \beta = \frac{3}{5}$, then $\beta - \alpha$ lies in the interval **[2]**

a) $[0,\pi]$

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

c) $\left(\pi, \frac{5\pi}{4}\right)$

d) $\left(0, \frac{\pi}{4}\right)$

102) On the portion of the straight line x + y = 2 which is intercepted between the axes, a square is constructed away from the origin with this portion as one of its side. If p denotes the perpendicular distance of a side of this square from the origin, then the maximum value of p is **[2]**

a) $3\sqrt{2}$

b) $\frac{2}{\sqrt{3}}$

c) $\frac{3}{\sqrt{2}}$

d) $2\sqrt{3}$

103) If one of the diameters of the curve $x^2 + y^2 - 4x - 6y + 9 = 0$ is a chord of a circle with centre (1, 1), then the radius of this circle is **[2]**

a) $\sqrt{2}$

b) 3

c) 2

d) 1

104) If the coefficient of variation of a distribution is 45% and the mean is 12, then its standard deviation is **[2]**

a) 5.2

b) 5.3

c) 5.4

d) 5.5

105) The probability that a leap year selected at random will contain 53 Sundays is **[2]**

a) $\frac{1}{7}$

b) $\frac{3}{7}$

c) $\frac{2}{9}$

d) $\frac{2}{7}$

106) For z = a + bi, if (a, b) lies in 3rd quadrant, then arg z = **[2]**

a) $\frac{\pi}{2} + \tan^{-1}\left|\frac{b}{a}\right|$

b) $2\pi + \tan^{-1}\left|\frac{b}{a}\right|$

c) $\tan^{-1}\left|\frac{b}{a}\right|$

d) $-\pi + \tan^{-1}\left|\frac{b}{a}\right|$

107) Three different prizes are to be distributed in a class of 20 boys. In how many ways can this be done, if a boy is eligible to get any number of prizes. **[2]**

a) 6480

b) 8000

c) 7220

d) 6840

108) If $f(x) = \frac{3x+4}{5x-7}$, $g(x) = \frac{7x+4}{5x-3}$ then f [g(x)]= **[2]**

a) - 41

b) - x

c) X

d) 41

109) Which of the following statement is contradiction? **[2]**

a) $(p \wedge q) \to q$

b) $p \to \sim (p \wedge \sim q)$

c) $(p \wedge q) \vee \sim q$

d) $(p \wedge \sim q) \wedge (p \to q)$

110) The inverse of the matrix A = $\begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 4 \end{bmatrix}$ is **[2]**

a) $\begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 4 \end{bmatrix}$

b) $\frac{1}{24}\begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 4 \end{bmatrix}$

c) $\begin{bmatrix} \frac{1}{2} & 0 & 0 \\ 0 & \frac{1}{3} & 0 \\ 0 & 0 & \frac{1}{4} \end{bmatrix}$

d) $\frac{1}{24}\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

111) If A = $\begin{bmatrix} a & 0 & 0 \\ 0 & a & 0 \\ 0 & 0 & a \end{bmatrix}$, then the value of |A| |adj A| is **[2]**

a) A^6

b) A^{27}

c) A^9

d) A^3

112) The inverse of the matrix $\begin{bmatrix} 3 & -2 \\ 1 & 4 \end{bmatrix}$ is **[2]**

a) $\begin{bmatrix} \frac{4}{14} & \frac{-2}{14} \\ \frac{1}{14} & \frac{3}{14} \end{bmatrix}$

b) $\begin{bmatrix} \frac{4}{14} & \frac{2}{14} \\ \frac{-1}{14} & \frac{3}{14} \end{bmatrix}$

c) $\begin{bmatrix} \frac{3}{14} & \frac{-2}{14} \\ \frac{1}{14} & \frac{4}{14} \end{bmatrix}$

d) $\begin{bmatrix} \frac{3}{14} & \frac{2}{14} \\ \frac{1}{14} & \frac{4}{14} \end{bmatrix}$

113) In triangle ABC if a, b, c are in A. P., then the value of $\frac{\sin \frac{A}{2} \sin \frac{C}{2}}{\sin \frac{B}{2}}$ = **[2]**

a) - 1

b) $\frac{1}{2}$

c) 1

d) 2

114) $\sin\left(\frac{\pi}{3} - \sin^{-1}\left(-\frac{1}{2}\right)\right)$ is equal to **[2]**

a) 1

b) $\frac{1}{4}$

c) $\frac{1}{3}$

d) $\frac{1}{2}$

115) If $\cos (2 \tan^{-1} x) = \frac{1}{2}$, then the value of x is **[2]**

a) $\sqrt{3}$ - 1

b) $\pm \frac{1}{\sqrt{3}}$

c) $1 - \frac{1}{\sqrt{3}}$

d) $\pm \sqrt{3}$

116) The number of solutions of the equation $2 \cos (e^x) = 5^x + 5^{-x}$, are **[2]**

a) No solution

b) One solution

c) Infinitely many solutions

d) Two solutions

117) If in a triangle ABC, 2 cos A = sin B cosec C, then **[2]**

a) A = b

b) 2a = bc

c) B = c

d) C = a

118) Let $I = \int_0^{100\pi} \sqrt{(1 - \cos 2x)}$ dx, then **[2]**

a) I = 0

b) $I = \pi \sqrt{2}$

c) I = 100

d) $I = 200\sqrt{2}$

119) Let $\frac{d}{dx}[f(x)] = \frac{e^{\sin x}}{x}$, x > 0.

If $\int_1^4 \frac{3e^{\sin x^3}}{x} dx = f(k) - f(1)$, then one possible of k is **[2]**

   a) 63   b) 64

   c) 16   d) 15

120) $\int_0^{\frac{\pi}{6}} (2 + 3x^2) \cos 3x \; dx = $ **[2]**

   a) $\frac{1}{36} (\pi - 16)$

   b) $\frac{1}{36} (\pi^2 - 16)$

   c) $\frac{1}{36} (\pi + 16)$

   d) $\frac{1}{36} (\pi^2 + 16)$

121) $\int_0^{\frac{\pi}{2}} \log(\tan x) \; dx = $ **[2]**

   a) $-\frac{\pi}{2} \log_e 2$

   b) $\pi \; \log_e 2$

   c) 0

   d) $\frac{\pi}{2} \log_e 2$

122) If $\int_0^{\frac{\pi}{2}} \log(\cos x) \; dx = -\frac{\pi}{2} \log 2$, then $\int_0^{\frac{\pi}{2}} \log(\operatorname{cosec} x) \; dx = $ **[2]**

   a) $\frac{\pi}{2} - \frac{\pi}{2} \log 2$

   b) $\frac{\pi}{2} \log 2$

   c) $-\frac{\pi}{2} \log 2$

   d) $\frac{\pi}{2} + \frac{\pi}{2} \log 2$

123) $(\vec{a} \cdot \hat{i})\hat{i} + (\vec{a} \cdot \hat{j})\hat{j} + (\vec{a} \cdot \hat{k})\hat{k} = $ **[2]**

   a) $4\vec{a}$ b) $2\vec{a}$

   c) 0   d) $\vec{a}$

124) The projection of the vector $\hat{i} - 2\hat{j} + \hat{k}$ on the vector $4\hat{i} - 4\hat{j} + 7\hat{k}$ is **[2]**

   a) $\frac{\sqrt{6}}{19}$

   b) $\frac{19}{9}$

   c) $\frac{9}{19}$

   d) $\frac{5\sqrt{6}}{10}$

125) If $3\hat{i} - 2\hat{j} + 5\hat{k}$ and $-2\hat{i} + p\hat{j} - q\hat{k}$ are collinear vectors, then **[2]**

   a) $p = \frac{10}{3}, q = \frac{4}{3}$

   b) $p = \frac{4}{3}, q = \frac{-10}{3}$

   c) $p = \frac{4}{3}, q = \frac{10}{3}$

   d) $p = \frac{-4}{3}, q = \frac{10}{3}$

126) The value of a so that the volume of parallelopiped formed by vectors $\hat{i} + a\hat{j} + \hat{k}$, $\hat{j} + a\hat{k}$, $a\hat{i} + \hat{k}$ becomes minimum is **[2]**

   a) $\sqrt{3}$ b) $\frac{1}{\sqrt{3}}$

   c) 2   d) 3

127) If $12x^2 + 7xy + by^2 + gx + 7y - 1 = 0$ represents a pair of perpendicular lines then **[2]**

   a) B = 12, g = 1

   b) B = - 12, g = $-\frac{1}{2}$

   c) B = - 12, g = - 1

   d) B = - 12, g = 1

128) If L_1 is the line of intersection of the planes 2x - 2y + 3z - 2 = 0, x - y + z + 1 = 0 and L_2 is the line of intersection of the planes x + 2y - z - 3 = 0, 3x - y + 2z - 1 = 0, then the distance of the origin from the plane containing the lines L_1 and L_2 is **[2]**

   a) $\frac{1}{4\sqrt{2}}$ b) $\frac{1}{2\sqrt{2}}$

   c) $\frac{1}{\sqrt{2}}$ d) $\frac{1}{3\sqrt{2}}$

129) If P be the point (2, 6, 3), then the equation of the plane through P at right angle to OP, O being the origin, is **[2]**

   a) 2x + 6y + 3z = 7   b) 2x + 6y - 3z = 49

   c) 2x + 6y + 3z = 49   d) 2x + 6y + 3z = 7

130) Equation of a line passing through point (2, - 1, 3) and parallel to line $\frac{2x-1}{2} = \frac{1-y}{1} = \frac{z}{3}$ is **[2]**

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

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

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

   d) $\frac{x-2}{1} = \frac{y+1}{-1} = \frac{z-3}{3}$

131) The derivative of $f(x) = x^{\tan^{-1} x}$ with respect to $g(x) = \sec^{-1}\left(\frac{1}{2x^2-1}\right)$ is **[2]**

   a) $-\frac{1}{2}\sqrt{1-x^2}x^{\tan^{-1} x}\left[\log\left(\tan^{-1} x\right) + x\left(1+x^2\right)\tan^{-1} x\right]$

   b) $\frac{1}{2}\sqrt{1-x^2}x^{\tan^{-1} x}\left[\frac{\log x}{1+x^2} + \frac{\tan^{-1} x}{x}\right]$

   c) $\frac{-2\tan^{-1} x\left[\frac{\log x}{1+x^2}+\frac{\tan^{-1} x}{x}\right]}{\sqrt{1-x^2}}$

   d) $-\frac{1}{2}\sqrt{1-x^2}x^{\tan^{-1} x}\left[\frac{\log x}{1+x^2} + \frac{\tan^{-1} x}{x}\right]$

132) If x = log t, t > 0 and $y = \frac{1}{t}$, then $\frac{d^2 y}{dx^2}$ is **[2]**

   a) $-\frac{dy}{dx}$ b) Y

   c) $\frac{dy}{dx}$ d) $\frac{y}{x}$

133) Twenty meters of wire is available for fencing off a flower - bed in the form of a circular sector. Then the maximum area (in sq. m) of the flower - bed, is **[2]**

   a) 25   b) 10

   c) 30   d) 12.5

134) Let P be any point on the curve $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$. Then the length of the segment of the tangent between the coordinate axes is of length **[2]**

   a) 5a   b) A

   c) 4a   d) 3a

135) If the normal to the curve $y^2 = 5x - 1$ at the point (1, - 2) is of the form ax - 5y + b = 0, then a and b are **[2]**

   a) 4, - 14   b) - 4, 14

   c) - 4, - 14   d) 4, 14

136) The equation of the tangent to the curve $(1 + x^2)y = 2 - x$, where it crosses the X - axis, is **[2]**

   a) X + 5y = 2   b) 5x + y = 2

   c) 5x - y = 2   d) X - 5y = 2

137) $\int \tan^{-1} \sqrt{\frac{1-x}{1+x}} \; dx = $ **[2]**

   a) $2 (x \cos^{-1} x - \sqrt{1 - x^2}) + c$

   b) $\frac{1}{2} (\cos^{-1} x - \sqrt{1 - x^2}) + c$

   c) $\frac{1}{2} (x \cos^{-1} x - \sqrt{1 - x^2}) + c$

   d) $\frac{1}{2} (x \sin^{-1} x - \sqrt{1 - x^2}) + c$

138) $\int \frac{dx}{1 - \sin x} = $ **[2]**

   a) Sec x + tan x + c   b) X + cos x + c

   c) 1 + sin x + c   d) Sec x - tan x + c

139) $\int x^4 e^{2x} dx = $ **[2]**

   a) $\frac{e^{2x}}{4} (2x^4 - 4x^3 + 6x^2 - 6x + 3) + c$

   b) $-\frac{e^{2x}}{4} (2x^4 + 4x^3 + 6x^2 + 6x + 3) + c$

   c) $\frac{e^{2x}}{8} (2x^4 + 4x^3 + 6x^2 + 6x + 3) + c$

   d) $\frac{e^{2x}}{4} (2x^4 - 4x^3 + 6x^2 - 6x + 3) + c$

140) Let $I = \int \frac{e^x}{e^{4x} + e^{2x} + 1} dx$, $J = \int \frac{e^{-x}}{e^{-4x} + e^{-2x} + 1} dx$. Then, for an arbitrary constant C, the value of J - I equals **[2]**

a) $\frac{1}{2} \log \left| \frac{e^{4x} - e^{2x} + 1}{e^{4x} + e^{2x} + 1} \right| + C$

b) $\frac{1}{2} \log \left| \frac{e^{4x} + e^{2x} + 1}{e^{4x} - e^{2x} + 1} \right| + C$

c) $\frac{1}{2} \log \left| \frac{e^{2x} + e^{x} + 1}{e^{2x} - e^{x} + 1} \right| + C$

d) $\frac{1}{2} \log \left| \frac{e^{2x} - e^{x} + 1}{e^{2x} + e^{x} + 1} \right| + C$

141) The area enclosed by the parabola $(y - 2)^2 = x - 1$, the tangent to the parabola at (2, 3) and the X - axis is **[2]**
   a) 12 sq. units
   b) 9 sq. units
   c) 4 sq. units
   d) 6 sq. units

142) Area bounded by the curve y = log x, X - axis and the ordinates x = 1, x = 2 is **[2]**

   a) Log 4 sq. units
   b) Log 2 sq. units
   c) (log 4 - 1) sq. units
   d) (log 4 + 1) sq. units

143) General solution of $(x+y)^2 \frac{dy}{dx} = a^2$, $a \neq 0$ is (c is arbitrary constant) **[2]**

   a) $\tan \frac{y+c}{a} = \frac{x+y}{a}$
   b) $\frac{x}{a} = \tan \frac{y}{a} + c$
   c) $\tan xy = c$
   d) $\tan (x + y) = c$

144) Let y'(x) + y(x)g'(x) = g(x) g'(x), y(0) = 0, x∈ R, where f'(x) denote $\frac{d}{dx}$ (f(x)) and g(x) is a given non - constant differentiable function on R with g(0) = g(2) = 0. Then the value of y(2) is **[2]**
   a) - 1
   b) 1
   c) 2
   d) 0

145) The solution of the equation $\frac{dy}{dx} = \frac{x}{2y - x}$ is **[2]**

   a) Y = x + c
   b) $y = \frac{x}{2y - x} + c$
   c) $(x + y)(x - 2y)^2 = c$
   d) $(x - y)(x + 2y)^2 = c$

146) The differential equation for all the straight lines which are at a unit distance from the origin is **[2]**

   a) $\left(y + x \frac{dy}{dx} \right)^2 = 1 - \left(\frac{dy}{dx} \right)^2$
   b) $\left(y - x \frac{dy}{dx} \right)^2 = 1 + \left(\frac{dy}{dx} \right)^2$
   c) $\left(y + x \frac{dy}{dx} \right)^2 = 1 + \left(\frac{dy}{dx} \right)^2$
   d) $\left(y - x \frac{dy}{dx} \right)^2 = 1 - \left(\frac{dy}{dx} \right)^2$

147) What is the mean of f(x) = 3x + 2 where x is a random variable with probability distribution

X = x	1	2	3	4
P(X = x)	$\frac{1}{6}$	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{6}$

[2]
   a) $\frac{19}{2}$
   b) $\frac{5}{2}$
   c) $\frac{5}{3}$
   d) $\frac{15}{2}$

148) A random variable X has the following probability distribution:

X = x_i	1	2	3	4
P(X = x_i)	0.1	0.2	0.3	0.4

The mean and the standard deviation are respectively **[2]**
   a) 3 and 1
   b) 2 and 1
   c) 3 and $\sqrt{3}$
   d) 3 and 2

149) A die is thrown two times. If getting an odd number is considered as a success, then the probability of two successes is **[2]**
   a) $\frac{1}{2}$
   b) $\frac{2}{3}$
   c) $\frac{3}{4}$
   d) $\frac{1}{4}$

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