SATISH SCIENCE ACADEMY
DHANORI PUNE - 411015

Mhtcet pcb 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 100 questions from Biology.

Section - A (Physics)

1) The displacement of a particle moving in a straight line is given by the expression $x = At^3 + Bt^2 + Ct + D$ in metres, where 't' is in second and A, B, C and D are constants. The ratio between the initial acceleration and initial velocity is [1]
   a) $\frac{2B}{C}$
   b) $2C$
   c) $\frac{2C}{B}$
   d) $\frac{C}{2B}$

2) Three particles of the same mass lie in the x - y plane. The (x, y) coordinates of their position are (1, 1), (2, 2) and (3, 3) respectively. The (x, y) coordinates of the centre of mass are [1]
   a) (2, 2)
   b) (6, 6)
   c) (1, 2)
   d) (4, 2)

3) Two bodies of masses m and 2m are kept at distance r apart from each other. Then the value of G varies as [1]
   a) R^0
   b) R^{-2}
   c) R^2
   d) R^4

4) Mercury thermometer can be used to measure temperature upto [1]
   a) 260 °C
   b) 360 °C
   c) 500 °C
   d) 100 °C

5) Transverse waves cannot propagate through liquids and gases because [1]

   a) Gases can flow.
   b) Gases are compressible.
   c) Liquids and gases have low density.
   d) Liquids and gases do not have modulus of rigidity of shape.

6) Magnifying power of an astronomical telescope is M. If the focal length of the eye - piece is doubled, then its magnifying power will become [1]
   a) 2 M
   b) $\sqrt{2}$ M
   c) 3 M
   d) $\frac{M}{2}$

7) A compound microscope has a magnifying power of 35. Assume that the final image is formed at DDV (25 cm). If the focal length of eyepiece is 8 cm, the magnification produced by objective is [1]
   a) 12.84
   b) 14.12
   c) 8.48
   d) 1.3

8) A ray of light is incident normally on one of the faces of a prism of apex angle 30° and refractive index $\sqrt{2}$. The angle of deviation through prism is [1]
   a) 45°
   b) 30°
   c) 60°
   d) 15°

9) Two charges q_1 and q_2 repel each other with a force of 0.1 N. What will be the force exerted by q_1 on q_2, when a third charge is placed near them? [1]

   a) 0.1 N
   b) Less than 0.1 N if q_1 and q_2 are similar and more than 0.1 N if q_1 and q_2 are dissimilar.
   c) Less than 0.1 N
   d) More than 0.1 N

10) The graphs below show angular velocity as a function of θ. In which one of these is the magnitude of angular velocity constantly decreasing with time? [1]

11) A particle executes simple harmonic motion with a frequency f. The frequency with which its kinetic energy oscillates is [1]
    a) 4f
    b) $\frac{f}{2}$
    c) F
    d) 2f

12) A particle executing simple harmonic motion has amplitude of 0.1 metre and time period 4 second. At t = 0, x = 5 going towards positive x direction. Then the equation for the displacement x at time t [1]

    a) $X = 15 \cos\left(\frac{\pi t}{6} + \frac{\pi}{3}\right)$ cm
    b) $X = 15 \sin\left(\frac{\pi t}{6} + \frac{\pi}{3}\right)$ cm
    c) $X = 10 \cos\left(\frac{\pi t}{3} + \frac{\pi}{6}\right)$ cm
    d) $X = 10 \sin\left(\frac{\pi t}{2} + \frac{\pi}{6}\right)$ cm

13) The amplitude and periodic time of a S.H.M. are 5 cm and 6 s respectively. At a distance of 2.5 cm away from the mean position, the phase will be [1]

a) $\frac{\pi}{6}$ b) $\frac{\pi}{4}$

c) $\frac{5\pi}{12}$ d) $\frac{\pi}{3}$

14) When a 60 mH inductor and resistor are connected in series with an AC voltage source, the voltage leads the current by 60°. If the inductor is replaced by a 0.5 mF capacitor, the voltage lags behind the current by 30°. What is the frequency of the AC supply? [1]

     a) $\frac{1}{\pi} \times 10^4$ Hz

     b) $\frac{1}{2\pi} \times 10^8$ Hz

     c) $\frac{3}{2\pi} \times 10^4$ Hz

     d) $\frac{1}{2\pi} \times 10^4$ Hz

15) Rain drops are spherical because of [1]

     a) Viscosity.

     b) Gravitation.

     c) Surface tension.

     d) Atmospheric pressure.

16) A pipe of length 10 cm, closed at one end, has frequency equal to half the 2nd overtone of another pipe open at both the ends. The length of the open pipe is [1]

     a) 10 cm   b) 20 cm

     c) 30 cm   d) 35 cm

17) Two waves of wavelength 2m and 2.02m, with the same speed, superimpose to produce 2 beats per second. The speed of each wave is [1]

     a) 406 ms^{-1} b) 400 ms^{-1}

     c) 404 ms^{-1} d) 402 ms^{-1}

18) A wave shown by the equation y = A cos (ω t - ϕ)) is totally reflected by a closed end. After reflection, [1]

     a) Onlyϕ changes.

     b) Bothω and ϕ change.

     c) ϕ does not change.

     d) ω changes.

19) A jar A is filled with a gas characterised by parameters P, V and T and another jar B with a gas with parameters 2P,$\frac{V}{8}$ and 2T, where the symbols have their usual meaning. The ratio of the number of molecules of jar A to those of jar B is [1]

     a) 4 : 1   b) 1 : 1

     c) 8 : 1   d) 1 : 2

20) In Young's double slit experiment, the intensity on the screen at a point where path differenceλ is K. What will be the intensity at the point where path difference is $\frac{\lambda}{4}$? [1]

     a) K   b) $\frac{K}{2}$

     c) $\frac{K}{4}$ d) Zero

21) A galvanometer of resistance 36Ω is shunted by a resistance of 4 Ω . The percentage of the total current passing through the galvanometer is [1]

     a) 9%   b) 11%

     c) 8%   d) 10%

22) In Kelvin's method of finding the resistance of a galvanometer, we

     i. Use the balance point method.

     ii. Use the null point method.

     iii. Use the half deflection method.

     iv. Interchange the positions of the battery and the galvanometer.

[1]

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

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

23) Four resistances arranged to form a Wheatstone network are 8Ω , 12 Ω , 6 Ω and 27 Ω . The resistance should be shunted across 27 Ω resistance, so that the bridge is balanced, is [1]

     a) 14.5Ω b) 14Ω

     c) 13.5Ω d) 13Ω

24) In thermocouple, the variation of emf and temperature is shown by a graph of _____. [1]

     a) Hyperbola   b) Ellipse

     c) Circle   d) Parabola

25) A current I ampere flows in a circular arc of wire whose radius is R, which subtends an angle$\frac{3\pi}{2}$ radian at its centre. The magnetic induction B at the centre is

[1]

     a) $\frac{\mu_0 I}{2r}$

     b) $\frac{3\mu_0 I}{8r}$

     c) $\frac{2\mu_0 I}{r}$

     d) $\frac{\mu_0 I}{r}$

26) When a proton is released from rest in a room, it starts with an initial acceleration a_0 towards west. When it is projected towards north with a speed v_0 it moves with an initial acceleration $3a_0$ toward west. The electric and magnetic fields in the room are [1]

     a) $\frac{ma_0}{e}$ east, $\frac{3ma_0}{ev_0}$ up

     b) $\frac{ma_0}{e}$ west, $\frac{2ma_0}{ev_0}$ up

     c) $\frac{ma_0}{e}$ west, $\frac{2ma_0}{ev_0}$ down

     d) $\frac{ma_0}{e}$ east, $\frac{3ma_0}{ev_0}$ down

27) The magnetic field at the centre C of the arrangement shown in figure is

[1]

     a) $\frac{\mu_0 i}{\pi r}(1+\pi)$

     b) $\frac{\mu_0 i}{r}(1+\pi)$

     c) $\frac{\mu_0 i}{4\pi r}(1+\pi)$

     d) $\frac{\mu_0 i}{2\pi r}(1+\pi)$

28) A toroidal coil has 1500 turns. The inner and outer radii are 10 cm and 14 cm respectively. If current flowing is 10 A, then the magnetic field inside the toroid will be [1]

     a) 0.25 T   b) 25$\times 10^{-3}$ T

     c) 25$\times 10^{-5}$ T   d) 25$\times 10^{-4}$ T

29) The magnetic susceptibility of a paramagnetic material is 1.0$\times 10^{-5}$ at 27 °C temperature. Then, at what temperature its magnetic susceptibility would be 1.5 $\times 10^{-5}$? [1]

     a) 200 °C   b) - 18 °C

     c) 18 °C   d) - 73 °C

30) Maximum magnetization of a paramagnetic and ferromagnetic sample [1]

     a) Cannot be predicted.

b) Is of the same order.

c) Is smaller for para and larger for ferro.

d) Is smaller for ferro and larger for para.

31) According to Curie's law, **[1]**

   a) $\chi \propto \frac{1}{T - T_c}$

   b) $\chi \propto (T - T_c)$

   c) $\chi \propto T$

   d) $\chi \propto \frac{1}{T}$

32) What is the magnetization of a bar magnet having length 4 cm and area of cross section 6 cm^2? (M = 1 Am^2) **[1]**

   a) 1.25×10^{-4} A/m   b) 4.2×10^4 A/m

   c) 1.2×10^{-4} A/m   d) 4.2×10^{-4} A/m

33) The ratio of secondary to the primary turns in a transformer is 3 : 2. If the power output be P, then the input power neglecting all loses must be equal to **[1]**

   a) $\frac{2}{5}$ P   b) P

   c) 5 P   d) 1.5 P

34) The coefficient of mutual induction between two coils is 4 H. If the current in the primary reduces from 5 A to zero in 10^{-3} second, then the induced e.m.f. in the secondary coil will be **[1]**

   a) 2×10^4 V   b) 15×10^3 V

   c) 25×10^3 V   d) 10^4 V

35) A square loop of side a is rotating about its diagonal with angular velocity ω in perpendicular magnetic field $\vec{B}$. It has 10 turns. The e.m.f. induced is
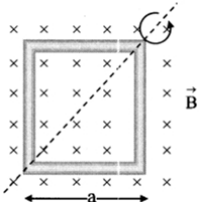
[1]

   a) $Ba^2 \sin \omega t$

   b) $5\sqrt{2} \ Ba^2$

   c) $10 \ Ba^2 \ \omega \ \sin \omega t$

   d) $Ba^2 \cos \omega t$

36) Light of wavelength λ strikes a photo - sensitive surface and electrons are ejected with kinetic energy E. If the kinetic energy is to be increased to 2E, the wavelength must be changed to λ' where **[1]**

   a) $\lambda' > \lambda$

   b) $\lambda' = 2\lambda$

   c) $\lambda' = \frac{\lambda}{2}$

   d) $\frac{\lambda}{2} < \lambda'$

37) The phenomenon which does not prove the particle nature of electromagnetic wave is **[1]**

   a) Compton effect   b) Diffraction

   c) Refraction   d) Photoelectric effect

38) Lights of two different frequencies whose photons have energies 1 eV and 2.5 eV respectively illuminate successively a metal surface whose work function is 0.6 eV. The ratio of the maximum speeds of the emitted electrons will be **[1]**

   a) 1 : 2   b) 1 : 5

   c) 1 : 4   d) 1 : 3

39) A radioactive substance of half - life 6 minutes is placed near a Geiger counter which is found to register 1024 particles per minute. How many particles per minute will it register after 42 minutes? **[1]**

   a) 24   b) 32

   c) 16   d) 8

40) Ratio of velocity in first orbit of H_2 to speed of light is **[1]**

   a) $2e^2/\varepsilon_0 h n^2 c$

   b) $e^2/2\varepsilon_0 hc$

   c) $e^2/\varepsilon_0 hc$

   d) $2e^2/\varepsilon_0 hc$

41) If T is the half - life of a radioactive material, then the fraction that would remain after a time $\frac{T}{2}$ is **[1]**

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

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

   c) $\frac{3}{4}$

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

42) Half - life of a substance is 10 minutes. The time between 33% decay and 67% decay is **[1]**

   a) 20 min   b) 5 min

   c) 10 min   d) 40 min

43) When a_4Be^9 atom is bombarded with α - particles, one of the product of nuclear transmutation is $_6C^{12}$. The other is **[1]**

   a) $_1H^1$ b) $_1D^2$

   c) $_0n^1$ d) $_{-1}e^0$

44) If in nature there may not be an element for which the principal quantum number n > 4, then the total possible number of elements will be **[1]**

   a) 64   b) 4

   c) 32   d) 60

45) A nucleus of mass 20 u emits a γ photon of energy 6 MeV. If the emission assume to occur when nucleus is free and rest, then the nucleus will have kinetic energy nearest to (take 1 u = 1.6×10^{-27} kg) **[1]**

   a) 0.1 keV   b) 1 ke V

   c) 100 ke V   d) 10 keV

46) Given a sample of Radium - 226 having half - life of 4 days. Find the probability that a nucleus disintegrates after 2 half lives **[1]**

   a) 1   b) $\frac{3}{4}$

   c) $\frac{1}{2}$ d) 1.5

47) To get output 1 for the following circuit, the correct choice for the input is
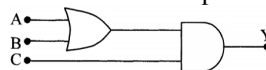
[1]

   a) A = 1, B = 0, C = 0   b) A = 1, B = 0, C = 1

   c) A = 1, B = 1, C = 0   d) A = 0, B = 1, C = 0

48) Usually Si is used in the designing of photodiodes because **[1]**

   a) It is portable.

   b) Current due to thermally generated minority carriers is quite small.

   c) It requires less forward biasing.

   d) It is easily available.

49) A typical solar cell develops a voltage of about **[1]**

   a) 10 V to 15 V   b) 0.5 V to 1 V

   c) 0.5 mV   d) 5 V

50) What can be said about the output frequency of a rectifier circuit? **[1]**

    a) It is more in case of full wave rectifier.
    b) It is always zero.
    c) It is more in case of half wave rectifier.
    d) It is always equal to the input frequency.

Section - A (Chemistry)

51) The number of sulphur atoms present in 0.2 moles of S_8 molecules is _____. **[1]**
    a) 9.63×10^{22} b) 4.82×10^{23}
    c) 9.63×10^{23} d) 1.20×10^{23}

52) The quantum number of four electrons are given below:
    i. N = 4, l = 2, m_l = - 2, $m_s = -\frac{1}{2}$
    ii. N = 3, l = 2, m_l = 1, $m_s = +\frac{1}{2}$
    iii. N = 4, l = 1, m_l = 0, $m_s = +\frac{1}{2}$
    iv. N = 3, l = 1, m_l = 1, $m_s = -\frac{1}{2}$
    The CORRECT order of their increasing energies will be _____.

[1]
    a) I < II < III < IV   b) IV < III < II < I
    c) IV < II < III < I   d) I < III < II < IV

53) The oxidation number of C in sucrose ($Cl_2H_{22}O_{11}$) is _____. **[1]**
    a) +3   b) +4
    c) 0   d) +2

54) Which of the following is NOT an alkali metal? **[1]**
    a) Strontium   b) Potassium
    c) Rubidium   d) Caesium

55) Select the CORRECT formula for a gas collected over water in a closed container. **[1]**

    a) $P_{Dry\ gas}$ = P_{Total} / Aqueous tension
    b) $P_{Dry\ gas}$ = P_{Total} - Aqueous tension
    c) $P_{Dry\ gas}$ = P_{Total} + Aqueous tension
    d) $P_{Dry\ gas}$ = P_{Total} × Aqueous tension

56) Which of the following can explain heterogeneous catalysis? **[1]**

    a) Adsorption theory
    b) Ideal gas equation
    c) Kinetic theory of gases
    d) Laws of motion

57) The number of primary, secondary, tertiary and quaternary carbons in neopentane are respectively: **[1]**
    a) 5, 0, 0 and 1   b) 4, 0, 1 and 1
    c) 4, 3, 2 and 1   d) 4, 0, 0 and 1

58) What is Lindlar's catalyst? **[1]**

    a) Alkaline $KMnO_4$
    b) Pd/$CaCO_3$ + $(CH_3COO)_2Pb$
    c) Zn dust
    d) Acidic $KMnO_4$

59) The IUPAC name of $CH_3 - \underset{OH}{C}H - CH_2 - \underset{CH_3}{C}H - CHO$ will be _____. **[1]**

    a) 3 - hydroxy - 3 - methylpentanal
    b) 4 - hydroxy - 1 - methylpentanal
    c) 3 - hydroxy - 2 - methylpentanal
    d) 4 - hydroxy - 2 - methylpentanal

60) Amorphous solids _____. **[1]**

    a) Possess long range ordered structure
    b) Possess sharp melting points
    c) Are supercooled liquids
    d) Exhibit anisotropy

61) Which of the following is INCORRECT about the Schottky defect?
    i. Electrical neutrality is not maintained.
    ii. Density decreases due to this defect.
    iii. Some other ions are missing from normal lattice sites.
    iv. It is a type of stoichiometric defects.
[1]
    a) Option (b)   b) Option (a)
    c) Option (d)   d) Option (c)

62) The amount of urea to be dissolved in 500 g of water to produce a depression of 0.186 K in the freezing point is _____.
(K_f for water = 1.86 K kg mol^{-1})
(Molecular mass = 60 g mol^{-1}) **[1]**
    a) 0.6 g   b) 60 g
    c) 3 g   d) 6 g

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

    a) The size of particles of true solutions are less than the size of particles of colloids.
    b) The component of a solution which is in smaller proportion is called solvent.
    c) Air is a mixture of gases.
    d) Mixtures are either homogeneous or heterogeneous.

64) An ideal gas expands in volume from 1×10^{-3} m^3 to 1×10^{-2} m^3 at 300 K against a constant pressure of 1×10^5 N m^{-2}. The work done is _____. **[1]**
    a) 270 kJ   b) - 900 kJ
    c) 900 kJ   d) - 900 J

65) The difference between heat of reaction at constant pressure and constant volume for the reaction,
$C_{(s)} + \frac{1}{2}O_{2(g)} \longrightarrow CO_{2(g)}$ _____. (Assume that R = 0.002 kcal and temperature = TK) **[1]**
    a) $-\frac{T}{2}$ cal   b) T cal
    c) - T cal   d) $\frac{T}{2}$ cal

66) Conductivity of an electrolytic solution and cell constant are related by _____. **[1]**

    a) $k = R \times \frac{a}{l}$
    b) $k = \frac{l}{R} \times \frac{a}{l}$
    c) $k = R \times \frac{l}{a}$
    d) $k = \frac{1}{R} \times \frac{l}{a}$

67) Which among the following equations represents the reduction reaction taking place in lead accumulator at positive electrode, while it is being used as a source of electrical energy? **[1]**

    a) $Pb^{4+} \rightarrow Pb$
    b) $Pb \rightarrow Pb^{2+}$
    c) $Pb^{2+} \rightarrow Pb$
    d) $Pb^{4+} \rightarrow Pb^{2+}$

68) For the reaction A$\rightarrow$ B, the concentration of the reactant decreases from 0.2 M to 0.1 M in 10 minutes. The rate of the reaction is _____. **[1]**
    a) 0.01 mol dm^{-3} b) 1 mol dm^{-3} min^{-1} min^{-1}
    c) 0.01 M   d) 10^{-2} min^{-1} mol^{-1}

69) The reaction takes place in two steps as

i. $NO_2Cl_{(g)} \xrightarrow{k_1} NO_{2(g)} + Cl_{(g)}$

ii. $NO_2Cl_{(g)} + \xrightarrow{k_2} NO_{2(g)} + Cl_{2(g)}$

Identify the reaction intermediate. **[1]**
a) $NO_2Cl_{(g)}$ b) $Cl_{(g)}$
c) $Cl_{2(g)}$ d) $NO_{2(g)}$

70) If the pH of a 0.1 M monoacidic base at 298 K is 9.0, the value of K_b and pK_b at the same temperature are _____ respectively. **[1]**
a) 1×10^{-5}, 5.0   b) 1×10^{-4}, 4.0
c) 1×10^{-9}, 9.0   d) 1×10^{-10}, 10.0

71) Which of the following is CORRECT for a salt of a weak acid and weak base?
i. If $K_a = K_b$, the solution is neutral.
ii. If $K_a > K_b$, the solution is basic.
iii. If $K_a < K_b$, the solution is acidic.
[1]
a) Only (I)   b) Both (I) and (III)
c) Both (I) and (II)   d) Only (III)

72) What should be the concentration of solution for 2% dissociation of CH_3COOH? ($K_a = 1.6 \times 10^{-5}$) **[1]**
a) 0.45 M   b) 0.045 M
c) 4.5 M   d) 0.0045 M

73) In which of the following reactions, SO_2 is NOT formed as a product? **[1]**

a) $HI + H_2SO_4 \longrightarrow$
   $_{(Conc.)}$
b) $CaF_2 + H_2SO_4 \longrightarrow$
   $_{(Conc.)}$
c) $Cu + H_2SO_4 \longrightarrow$
   $_{(Conc.)}$
d) $C + H_2SO_4 \longrightarrow$
   $_{(Conc.)}$

74) Which of the following represents the formula of cryolite? **[1]**
a) Na_3AlF_6 b) $3Ca_3(PO_4)_2.CaF_2$
c) $CuFeS_2$ d) $CaSO_4.2H_2O$

75) What is the oxidation state of iodine in the product?
$I_2 + 3Cl_2 \longrightarrow$? **[1]**
   $_{(excess)}$
a) +1   b) +3
c) +2   d) +5

76) Percentage of carbon in steel is _____. **[1]**
a) Less than 0.2%   b) 4%
c) More than 4%   d) 0.2 to 2%

77) Which of the following element belongs to 5d series? **[1]**
a) Au   b) Ag
c) Cd   d) Mo

78) $[Co(NH_3)_5Br]SO_4$ and $[Co(NH_3)_5SO_4]Br$ are _____ isomers. **[1]**
a) Linkage   b) Ionization
c) Geometrical   d) Optical

79) Inner complexes are formed when _____ orbitals are used for hybridization. **[1]**
a) (n - 1) d   b) Nd
c) (n + 1) d   d) (n - 2) d

80) In which of the following complex ions, the magnitude of Δ_0 (CFSE in the octahedral field) will be minimum? **[1]**
a) $[CoF_6]^{3-}$ b) $[Co(en)_3]^{3+}$
c) $[Co(H_2O)_6]^{3+}$ d) $[Co(NH_3)_6]^{3+}$

81) Heterolysis of carbon - chlorine bond produces _____. **[1]**

a) Carbocation and chloride ion
b) Two carbocations
c) Carbanion and chloronium ion
d) Two free radicals

82) Which one is used as a source of dichlorocarbene? **[1]**
a) CH_4 b) CH_3Cl
c) CH_2Cl_2 d) $CHCl_3$

83) For the reaction;
$C_2H_5OH + HX \xrightarrow{znCl_2} C_2H_5X + H_2O$,
where HX is a halogen acid, the order of reactivity of halogen acids for their reaction is: **[1]**
a) HCl > HBr > HI   b) HBr > HI > HCl
c) HI > HBr > HCl   d) HI > HCl > HBr

84) The starting raw material in Dow's process is _____. **[1]**
a) Chlorobenzene   b) Benzene
c) Aniline   d) Phenol

85) Which of the following is the best method for making isopropyl methyl ether? **[1]**

a) $(CH_3)_2CHCl + CH_3OH \longrightarrow$
b) $(CH_3)_2CHI + CH_3OH \longrightarrow$
c) $C_2H_5I + (CH_3)_2CHONa \longrightarrow$
d) $CH_3I + (CH_3)_2CHONa \longrightarrow$

86) The reaction that involves the formation of salicylic acid from phenol is called _____. **[1]**

a) Reimer - Tiemann reaction
b) Williamson's synthesis
c) Kolbe's reaction
d) Esterification reaction

87) When ethanal reacts with CH_3MgBr followed by acid hydrolysis, compound X is formed. When ethanal reacts with C_2H_5OH/dry HCl, compound Y is formed. X and Y are _____ respectively. **[1]**

a) Propan - 1 - ol and 1,1 - diethoxyethane
b) Propane and methyl acetate
c) Ethyl alcohol and propan - 2 - ol
d) Propan - 2 - ol and 1,1 - diethoxyethane

88) The reagent one would choose to transform CH_3CH_2COCl into $CH_3CH_2COCH_3$ is _____. **[1]**
a) CH_3Cl b) CH_3MgI
c) $(CH_3O)_2 Mg$ d) $(CH_3)_2Cd$

89) In CH_3COOH and HCOOH, HCOOH will be _____. **[1]**
a) Basic   b) Equally acidic
c) Less acidic   d) More acidic

90) Lowest boiling point will be of the compound _____. **[1]**
a) $C_2H_5N(CH_3)_2$ b) $CH_3CH_2CH_2NHCH_3$
c) $(C_2H_5)_2NH$ d) $CHCH_2CH_2CH_2NH_2$

91) 1 mole of ethylamine on reaction with excess of nitrous acid gives how many grams of nitrogen? (atomic weight of nitrogen =14) **[1]**
a) Eight   b) Fourteen
c) Twenty eight   d) Seven

92) Reduction of aromatic nitro compounds using $LiAlH_4$ in ether gives corresponding _____. **[1]**

a) Diazonium salt
b) Amide
c) Aromatic primary amine
d) Aromatic hydrocarbon

93) Hydrolysis of starch forms _____. **[1]**
   a) β - D - glucose
   b) β - D - fructose
   c) α - D - glucose
   d) α - D - fructose

94) Glucose $\xrightarrow{\text{Dil. HNO}_3}$ X
   Glucose $\xrightarrow{\text{Br}_2\text{ water}}$ Y $\xrightarrow{\text{Dil. HNO}_3}$ Z
   Identify X and Z. **[1]**
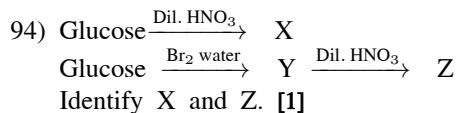
   a) X = Z = Saccharic acid
   b) X = Saccharic acid; Z = Gluconic acid
   c) X = Z = Gluconic acid
   d) X = Gluconic acid; Z = Saccharic acid

95) Match the polymers in column I with its use in column II

	Polymers		Uses
I.	Polyacrylamide	A.	Unbreakable dinnerwares
Ii.	Acrylic glass	B.	Used in electrophoresis
Iii.	Buna - N	C.	Shoe soles
Iv.	Urea formaldehyde resin	D.	Lenses

   [1]

   a) (i) - (b), (ii) - (d), (iii) - (c), (iv) - (a)
   b) (i) - (c), (ii) - (a), (iii) - (d), (iv) - (b)
   c) (i) - (c), (ii) - (a), (iii) - (b), (iv) - (d)
   d) (i) - (a), (ii) - (b), (iii) - (c), (iv) - (d)

96) Thermosetting polymers are _____. **[1]**

   a) Crystalline
   b) Linear polymers
   c) Either linear or branched chain polymers
   d) Highly cross - linked polymers

97) Carboxy radicals formed from acetyl peroxide on _____ gives methyl radical. **[1]**
   a) Dehydration
   b) Dehydrogenation
   c) Decarboxylation
   d) Dehalogenation

98) Which of the following nanostructured material is used in tyres of car to increase the life of tyre? **[1]**
   a) Ruby
   b) Carbon black
   c) Gold
   d) Fumed silica

99) Drath and Frost developed a green technology for the synthesis of adipic acid from _____. **[1]**
   a) Fructose
   b) Glucose
   c) Ribose
   d) Sucrose

100) Which of the following nanomaterials does NOT have all three dimensions < 100 nm? **[1]**
   a) Quantum dots
   b) Nanowires
   c) Microcapsules
   d) Nanorings

Section - B (Biology)

101) The sequence of amino acids in a protein is called: **[1]**

   a) Tertiary structure
   b) Primary structure
   c) Quarternary structure
   d) Secondary structure

102) Enzymes functional inside the living cells are called: **[1]**
   a) Endoenzymes
   b) Holoezymes
   c) Exoenzymes
   d) Coenzymes

103) Which of the following is not a macromolecule? **[1]**
   a) DNA
   b) Protein
   c) Polysaccharide
   d) Lipid

104) Water potential of pure water at standard temperature is equal to: **[1]**
   a) 15
   b) 20
   c) 10
   d) Zero

105) With regard to the Biological Nitrogen Fixation by Rhizobium in association with soybean, which one of the following statement/statements does not hold true? **[1]**

   a) Nitrogenase may require oxygen for its functioning.
   b) Nitrogenase helps to convert N_2 gas into two molecules of ammonia.
   c) Leghemoglobin is a pink coloured pigment.
   d) Nitrogenase is MO $^-$ Fe protein.

106) Most active nitrogen fixer in the Ricefield is: **[1]**

   a) Rhodo pseudomonas
   b) Aulosira fertilissima
   c) Nostoc
   d) Anabaena

107) Absorption of food takes place in stomach as well as intestine but villi are present in intestine only because: **[1]**

   a) The stomach is already provided with microvilli
   b) Intestine receives better blood supply than other parts of the alimentary canal
   c) The stomach is not much provided with microvilli
   d) Food is converted into absorbable form within the intestine

108) The reflex action of vomiting is controlled by ____. **[1]**
   a) Cerebellum
   b) Medulla
   c) Pons varoli
   d) Cerebrum

109) It is said that Mendel proposed that the factor controlling any character is discrete and independent. His proposition was based on the: **[1]**

   a) Results of F_3 generation of a cross.
   b) Observations that the offspring of a cross made between the plants having two contrasting characters shows only one character without any blending.
   c) Cross pollination of F_1 generation with recessive parent
   d) Self pollination of F_1 offsprings

110) Metastasis is associated with: **[1]**

   a) Crown gall tumour
   b) Malignant tumour
   c) Both Benign tumour and Malignant tumour
   d) Benign tumour

111) Checkerboard method of calculations was developed by **[1]**
   a) Mendel
   b) Bateson
   c) Morgan
   d) Punnett

112) The process of removal of introns and joining of exons is called: **[1]**
   a) Splicing
   b) Tailing
   c) Capping
   d) Termination

113) In some viruses, DNA is synthesised by using RNA as a template. Such a DNA is called: **[1]**
   a) RDNA
   b) CDNA
   c) A - DNA
   d) B - DNA

114) In an experiment, E. coli is grown in a medium containing $^{14}NH_4Cl$. (^{14}N is the light isotope of Nitrogen) followed by growing it for six generations in a medium having heavy isotope of nitrogen (^{15}N). After six generations, their DNA was extracted and subjected to CsCl density gradient centrifugation. Identify the correct density (Light/Hybrid/Heavy) and ratio of the bands of DNA in CsCl density gradient centrifugation. [1]

    a) Light : Heavy, 1 : 31
    b) Hybrid : Heavy, 1 : 16
    c) Hybrid : Heavy, 1 : 31
    d) Light : Heavy, 1 : 05

115) Consider the following statements _____.
    i. R - RNA provides the template for synthesis of proteins.
    ii. t - RNA brings amino acids and reads the genetic code.
    iii. RNA polymerase binds to promoter and initiates transcription.
    iv. A segment of DNA coding for polypeptide is called intron.
    [1]

    a) I, II and III are correct
    b) II and III are correct
    c) I and II are correct
    d) I and III are correct

116) DNA is a polymer of nucleotides which are linked to each other by 3' - 5' phosphodiester bond. To prevent polymerisation of nucleotides, which of the following modifications would you choose? [1]

    a) Both 'Remove/Replace 3' OH group in deoxy ribose' and 'Remove/Replace 2' OH group with some other group in deoxy ribose'
    b) Remove/Replace 2' OH group with some other group in deoxy ribose
    c) Remove/Replace 3' OH group in deoxy ribose
    d) Replace purine with pyrimidines

117) Which one of the following is used during **RNA i** process, to silence the desired gene? [1]
    a) DsRNA   b) DsDNA
    c) DNA polymerase   d) RDNA

118) A foreign DNA and plasmid cut by the same restriction endonuclease can be joined to form a recombinant plasmid using: [1]
    a) Taq Polymerase   b) Eco RI
    c) Polymerase III   d) Ligase

119) The role of DNA ligase in the construction of a recombinant DNA molecule is: [1]

    a) Formation of hydrogen bonds between sticky part of DNA fragments.
    b) Ligation of all purine and pyrimidine bases.
    c) Formation of the phosphodiester bond between two DNA fragments.
    d) Formation of hydrogen bonds between sticky ends of DNA fragments.

120) B_2 is got from: [1]
    a) Pseudomonas   b) Acetobacter
    c) Ashbya gossypii d) Bacillus megatherium

121) How many documented varieties of Basmati rice are grown in India? [1]

    a) 37   b) 17
    c) 24   d) 27

122) Which one of the following statements is/are correct for the greatest benefit of shoot tip (meristem) culture is?
    i. Production of virus - free plants.
    ii. Development of somaclonal variations.
    iii. Development of transgenic plants.
    iv. Large callus formation.
    [1]
    a) Only statement 'd'   b) Only statement 'c'
    c) Only statement 'a'   d) Only statement 'b'

123) Resistance to a virus can be obtained by inoculating a host with: [1]

    a) Gene for viral nuclease
    b) Gene for viral protein
    c) Gene of wild plants
    d) Gene for virus resistance

124) The biggest constraint of plant breeding is: [1]

    a) Availability of desirable gene in the crop and its wild relatives
    b) Infrastructure
    c) Transfer of genes from unrelated sources.
    d) Trained manpower

125) Single - cell protein (SCP) is: [1]

    a) Protein obtained from unicellular organisms
    b) Biomass got from microorganisms
    c) Protein obtained from a clone of cells
    d) Protein obtained from biomass of microorganisms

126) Tissue culture technique was first performed successfully by: [1]
    a) White   b) Haberlandt
    c) Gautheret   d) Nobecoourt

127) Food poisoning is caused by: [1]
    a) Lactobacillus   b) Archaebacteria
    c) Nitrosomonas   d) Escherichia coli

128) A completely free living organism which takes part in N_2 - fixation is: [1]
    a) Bacillus   b) Rhizobium
    c) Anabaena   d) Azotobacter

129) Which one is a nitrogen fixer? [1]
    a) Anabaena   b) Hydrodictyon
    c) Ulva   d) Ulothrix

130) Which of the following is a gram - negative bacterium? [1]

    a) Streptomyces coelicolor
    b) Bacillus subtilis
    c) Escherichia coli
    d) Amycolatopsis orientali

131) IPM programme is related with: [1]
    a) Biocontrol agents   b) Biofertilisers
    c) Biogas   d) Organic farming

132) A chemical substance derived from a living source and has the capacity to inhibit the growth or destroy the microbes is called: [1]
    a) Antibiotic   b) Toxoid
    c) Toxin   d) Vaccine

133) Bacillus thuringiensis is used to control: [1]
    a) Fungal pathogens   b) Nematodes
    c) Insect pests   d) Bacterial pathogens

134) First transitory biochemical produced in reaction between CO_2 and RuBP is: **[1]**

   a) DiHAP
   b) PGAL
   c) 2 - carboxy 3 - keto 1,5 - biphosphoribotol
   d) PGA

135) How does photosystem II maintain the continuous supply of electrons during electron transport system? **[1]**

   a) By splitting water
   b) By reduction of NADP to NADPH
   c) By splitting CO_2
   d) By utilizing ATP

136) Which one is the correct location for Kreb's cycle? **[1]**

   a) Inner membrane of mitochondria
   b) Outer membrane of mitochondria
   c) Matrix of mitochondria
   d) Cristae

137) Reduction in consumption of respiratory substrate when the mode of respiration is changed from aerobic to anaerobic is called: **[1]**
   a) Substrate Effect
   b) Krebs Effect
   c) London Effect
   d) Pasteur Effect

138) The outermost and innermost wall layers of microsporangium in an anther are respectively: **[1]**

   a) Endothecium and tapetum
   b) Epidermis and middle layer
   c) Epidermis and endodermis
   d) Epidermis and tapetum

139) In ovule, archesporial cell differentiates from nucleus: **[1]**

   a) At chalazal region
   b) Middle of nucellus
   c) Hypodermally in the micropylar region
   d) Laterally near endothelium

140) Nematode resistant tobacco plants have been developed by introduction of the DNA that produces: **[1]**

   a) Toxin protein
   b) Only Sense RNA
   c) Sense and Antisense RNA
   d) A particular hormone

141) Continued self - pollination results in: **[1]**

   a) Homozygous for its characters
   b) Heterozygous for its characters
   c) Infertility
   d) Incompatibility from self - pollination

142) The process of embryo formation without fertilisation is known as: **[1]**
   a) Polyembryony
   b) Apogamy
   c) Parthenocarpy
   d) Apospory

143) Embryo sac is also known as: **[1]**
   a) Microgametophyte
   b) Microsporangium
   c) Megagametophyte
   d) Megasporangium

144) Egg apparatus consists of: **[1]**
   a) Nucellus
   b) Antipodal
   c) Polar nuclei
   d) Egg +2 synergids

145) When the body of ovule, embryo sac, micropyle and funicle, all lie in one vertical plane, the ovule is: **[1]**
   a) Campylotropous
   b) Orthotropous
   c) Amphitropous
   d) Anatropous

146) The ploidy of the apomictic embryos developing from the integument cells and synergids respectively would be: **[1]**
   a) 2n, n
   b) 3n, 2n
   c) N. 2n
   d) 2n, 3n

147) Synergids are: **[1]**
   a) Diploid
   b) Triploid
   c) Haploid
   d) Tetraploid

148) The ecological niche of an organism will not represent: **[1]**

   a) Resources it cannot utilize
   b) Range of conditions that it can tolerate
   c) Its functional role in the ecological system
   d) Its specialization

149) Bacteria and fungi in a forest ecosystem are generally: **[1]**
   a) Producers
   b) Primary consumers
   c) Secondary consumers
   d) Decomposers

150) An inverted pyramid of number and an inverted pyramid of biomass are respectively seen in: **[1]**

   a) Sea and tree ecosystem
   b) Grassland and tree ecosystem
   c) Tree and sea ecosystem
   d) Sea and grassland ecosystem

151) In a food chain, the total amount of living material is depicted by : **[1]**
   a) Trophic levels
   b) Pyramid of number
   c) Pyramid of energy
   d) Pyramid of biomass

152) The ecological niche of an organism will represent the following except: **[1]**

   a) Its functional role in the ecological system.
   b) Range of conditions that it can tolerate.
   c) Resources it cannot utilize.
   d) Its specialization.

153) Characteristic algal growth and water bloom are usually caused by **[1]**
   a) Bacteria
   b) Blue - green Algae
   c) Red algae
   d) Brown algae

154) The process in which heritable variations enabling better survival are enabled to reproduce and leave a greater number of progeny is called: **[1]**
   a) Mutation
   b) Natural selection
   c) Genetic drift
   d) Founder effect

155) Evolutionary history of an organism is known as: **[1]**
   a) Phylogeny
   b) Ancestory
   c) Ontogeny
   d) Palaeontology

156) The theory of spontaneous generation stated that: **[1]**

   a) Life can arise from non - living things only.
   b) Life arises spontaneously, neither from living nor from the non - living.
   c) Life can arise from both living and non - living.
   d) Life arose from living forms only.

157) Pre - historic man who gave a proper burial to the dead for the first time was: **[1]**
   a) Cro - magnon man
   b) Pecking man
   c) Neanderthal man
   d) Java man

158) Which of the following variations are temporary and have nothing to do with the last or next generation? **[1]**

   a) Both Hereditary variations and Discontinuous variations

b) Discontinuous variations

c) Hereditary variations

d) Environmental variations

159) Every cell of the body contributes gemmules to the germ cells and so shares in the transmission of characters to next generation. This theory is known as: [1]

a) Mutation theory

b) Inheritance of acquired characters

c) Germplasm theory

d) Pangenesis theory

160) Sex determination in a human being is: [1]
a) XX and XO type   b) XY and XX type
c) YY and XX type   d) XXY type

161) Epicanthral skin fold and simian crease are characteristics of: [1]

a) Down's syndrome

b) Thalassaemia

c) Turner's syndrome

d) Klinefelter's syndrome

162) In human males, some recessive genes express their effect because: [1]

a) Only two sex chromosome

b) Only one Y - chromosome

c) Single genome

d) Only one X - chromosome

163) Among the seven pairs of contrasting traits in pea plant studied by Mendel, number of traits related to flower, pod and seed were respectively: [1]
a) 1, 2, 1   b) 1, 1, 2
c) 2, 1, 2   d) 2, 2, 2

164) Down's syndrome is associated with trisomy of chromosome number: [1]
a) 22   b) 23
c) 21   d) 20

165) Toxicity of drug on human can be studied by using transgenic animal by [1]

a) Introducing complementary gene into organism

b) Inoculating gene that make them more sensitive to toxic substances

c) Introducing gene that show change in physiology of organism

d) All of the these

166) In the nomenclature of enzyme restriction endonuclease, the Roman numerals indicates: [1]

a) Number of cuts on DNA.

b) Number of recombinants formed.

c) Number of times it is used.

d) The order of discovery from source.

167) RRNA is synthesized in: [1]

a) Nucleolus

b) Endoplasmic reticulum

c) Nucleus

d) Cytoplasm

168) Pathogenecity of bacteria causing tuberculosis and leprosy is due to: [1]
a) Cholesterol   b) Wax - D
c) Ergosterol   d) Prostglandins

169) Which of the following drug are a very effective sedative and painkiller? [1]
a) Heroine   b) Morphine
c) Coke   d) Alcohol

170) Only one of the following four ways through which AIDS can spread: [1]

a) Looking after AIDS patient

b) Infected needles and syringes

c) Shaking hands, coughing, sneezing, hugging

d) Through mosquito bites

171) Which of the following causes prostate cancer? [1]
a) Aflatoxin   b) Vinyl chloride
c) Cadmium oxide   d) Chromium

172) Transplantation of tissues/organs to save certain patients often fails due to rejection of such tissues/organs by the patient. Which type of immune response is responsible for such rejections? [1]

a) Humoral immune response

b) Physiological immune response

c) Auto - immune response

d) Cell - mediated immune response

173) Heroin is obtained from a plant of family: [1]
a) Papaveraceae   b) Solanaceae
c) Leguminoseae   d) Liliaceae

174) Patients suffering from cholera are given a saline drip because: [1]

a) Na^+ ions help in stopping nerve impulses and hence sensation of pain.

b) Na^+ ions help in the retention of water in the body tissues.

c) NaCl is an important component of energy supply.

d) NaCl furnishes most of the fuel required for cellular activity.

175) Lysis of foreign cells is mediated through: [1]
a) Ig M and Ig G   b) Ig A only
c) Lg D and lg E   d) Ig M only

176) Which of the following is the most abundant type of antibody? [1]
a) IgG   b) IgA
c) IgE   d) IgD

177) The blood cells involved in the production of humoral immunity are: [1]
a) Eosinophils   b) B - lymphocytes
c) Monocytes   d) T - lymphocytes

178) Individual related by descent and having a similar genotype constitute: [1]
a) Breed   b) Variety
c) Strain   d) Line

179) Which of the following fungi is used as food: [1]
a) Mushroom   b) Mucor
c) Bread mold   d) Rhizopus

180) For a healthy individual, calculate stroke volume for him if other values are; heartbeat per minute = 72 and cardiac output is 5 litre? [1]
a) 0.05   b) 0.09
c) 0.06   d) 0.08

181) Manoj has AB blood group, so he will have the following antibodies in his blood plasma: [1]

a) A antibody
b) Both A and B antibodies
c) B antibody
d) No antibodies are present

182) Among mammals, the nucleus is absent in: [1]

a) WBCs and platelets
b) Lymphocytes and RBCs
c) Mature RBCs and platelets
d) Only RBCs

183) Which of the following actions is controlled by the parasympathetic neural system? [1]

a) Increased heart rate during stress
b) Jumping
c) Increased breathing
d) Digestion

184) The nerve in our body transmits messages as _____. [1]

a) Electromagnetic waves
b) Radio waves
c) Longitudinal waves
d) Electrical impulses

185) Menstrual cycle occurs due to lack of: [1]
a) Oxytocin
b) FSH
c) Vasopressin
d) Progesterone

186) Progesterone production fails during: [1]
a) Gestation
b) Menopause
c) Menstruation
d) Lactation

187) Menstrual cycle, in the human female, is completed in: [1]
a) 30 days
b) 31 days
c) 28 days
d) 27 days

188) Which one of the following hormones is secreted by the human placenta that helps in the maintenance of pregnancy? [1]

a) Human Chorionic Gonadotropin
b) Relaxin
c) Oxytocin
d) Human Placental Lactogen

189) Sperm acrosome is derived from: [1]

a) Mesosome
b) Endoplasmic reticulum
c) Lysosome
d) Golgi body

190) Acessory sexual character in female is promoted by: [1]
a) Estrogens
b) Testosterone
c) Progesterone
d) Androgens

191) Which of the following hormones are active during the ovulatory phase of menstrual cycle in a normal human female? [1]

a) FSH and LH

b) LH and Estrogen
c) FSH and Estrogen
d) Estrogen and Progesterone

192) Menstrual cycle is affected by: [1]
a) LH + FSH + Estrogens
b) Progesterone only
c) LH only
d) Estrogens only

193) In the absence of acrosome, the sperm... [1]

a) Cannot penetrate the egg
b) Cannot get energy
c) Cannot get food
d) Cannot swim

194) Main function of mammalian corpus luteum is to produce: [1]

a) Estrogen only
b) Relaxin only
c) Human chorionic gonadotropin
d) Progesterone

195) Endemism refers to: [1]

a) The distribution of species at a cosmopolitan distribution and Distribution of certain species in a restricted area.
b) Distribution of certain species in a restricted area.
c) A common feature of all organisms seen in the biosphere.
d) The distribution of species at a cosmopolitan distribution.

196) Important attributes belonging to a population but not to an individual are:
   i. Birth rate and death rate
   ii. Male and female
   iii. Birth and death
   iv. Sex - ratio
Select the correct option from the given options: [1]
a) (ii) only
b) (i) only
c) (i) and (iv)
d) (ii) and (iii)

197) Filtration of the blood takes place at: [1]
a) DCT
b) Glomerulus
c) Collecting ducts
d) PCT

198) That biomacromolecule of which all end products of metabolism can't be stored therefore processed for removal via excretion is/are : [1]
a) Proteins
b) Vitamin
c) Fats
d) Carbohydrates

199) To increase production in sugarcanes, they are sprayed with: [1]
a) IAA
b) Cytokinin
c) Gibberellin
d) Ethylene

200) Antiauxin used in picking cotton bolls is____. [1]
a) NNA
b) Ethylene
c) 2,4 - D
d) TIBA