Monthly Progressive Test

Class: XII

Subject: PCMB

Academic Excellence Programme TECHNO ACE

Test Booklet No.: MPT-01 **Test Date:** 0 7 0 7 2 0 2 5

Time: 120 mins **Full Marks: 200**

Important Instructions :

1. The Test is of 120 mins duration and the Test Booklet contains 100 multiple choice questions of single correct option only. There are four sections with four subjects. You have to attempt all 100 questions (Candidates are advised to read all 100 questions). Questions 1 to 25 contain Physics, Questions 26 to 50 contain Chemistry, Questions 51 to 75 contain Mathematics, Questions 76 to 100 contain Biology.
2. Each question carries 2 marks. For each correct response, the candidate will get 2 marks. There is no negative mark for wrong response. The maximum mark is 200.
3. Use Blue / Black Ball point Pen only for writing particulars marking responses on Answer Sheet.
4. Rough work is to be done in the space provided for this purpose in the Test Booklet only.
5. On completion of the test, the candidate must handover the Answer Sheet to the invigilator before leaving the Room / Hall. The candidates are allowed to take away this Test Booklet with them.
6. The CODE for this Booklet is Off Line MPT01 07072025.
7. The candidates should ensure that the Answer Sheet is not folded. Do not make any stray marks on the Answer Sheet. Do not write your UID No. anywhere else except in the specified space. Use of white fluid for correction is NOT permissible on the Answer Sheet. **Do not scribble or write on or beyond discrete bars of OMR Sheet at both sides**.
8. Each candidate must show on-demand his/her Registration document to the Invigilator.
9. No candidate, without special permission of the Centre Superintendent or Invigilator, would leave his/her seat.
10. Use of Electronic Calculator/Cellphone is prohibited.
11. The candidates are governed by all Rules and Regulations of the examination with regard to their conduct in the Examination Hall. All cases of unfair means will be dealt with as per Rules and Regulations of this examination.
12. No part of the Test Booklet and Answer Sheet shall be detached under any circumstances.
13. There is no scope for altering response mark in Answer Sheet.

Space For Rough Works

Physics

1. Four charges equal to Q are placed at the four corners of a square and a charge q is at its centre. If the system is in equilibrium, the value of q is

   Ⓐ $-\frac{Q}{4}\left(1+2\sqrt{2}\right)$ Ⓑ $\frac{Q}{4}\left(2+\sqrt{2}\right)$ Ⓒ $-\frac{Q}{2}\left(1+2\sqrt{2}\right)$ Ⓓ $\frac{Q}{2}\left(1+2\sqrt{2}\right)$

2. In electric dipole $E_{11} : E_{\perp} =$

   Ⓐ 1 : 2 Ⓑ 2 : 1 Ⓒ 3 : 2 Ⓓ 2 : 3

3. Select the correct statement.

   Ⓐ Mobility is dependent on applied potential difference
   Ⓑ Mobility is independent on applied potential difference
   Ⓒ Mobility sometimes depends on applied potential difference
   Ⓓ None of the above

4. Can the terminal potential difference of a cell be greater than emf of a cell?

   Ⓐ Yes, during discharging of cell Ⓑ Yes, during charging of cell
   Ⓒ No Ⓓ It is always equal

5. Internal resistance of a cell depends upon

   (I) distance between the plates (II) nature of electrolyte
   (III) nature of electrodes (IV) area of plates, immersed in electrolytes

   Ⓐ I only Ⓑ I and II only Ⓒ I, II only Ⓓ I, II, III and IV

6. Charges ±20 nC are separated by 5 mm. The magnitude of dipole moment is

   Ⓐ 10^{-10} cm Ⓑ 10^{-8} cm Ⓒ 10^{-6} cm Ⓓ 10^{-12} cm

7. The ratio of electric field on axial line of electric dipole at a distance r is proportion to, $|\vec{E}| \propto$

   Ⓐ $\frac{1}{r^2}$ Ⓑ $\frac{1}{r^3}$ Ⓒ $\frac{1}{r}$ Ⓓ all the above

8. Electric field intensity at any point on the axis of a uniformly charged (Q coulomb) ring (Radius R) at a distance x from the centre of ring is

   Ⓐ $\frac{1}{4\pi\varepsilon_0}\cdot\frac{Q}{\left(R^2+x^2\right)^{3/2}}$ Ⓑ $\frac{1}{4\pi\varepsilon_0}\cdot\frac{Qx^2}{\left(R^2+x^2\right)^{3/2}}$ Ⓒ $\frac{1}{4\pi\varepsilon_0}\cdot\frac{Qx}{\left(R^2+x^2\right)^{3/2}}$ Ⓓ None of the above

9. Two charges of ±1000 μC are separated by 2 mm. The dipole so formed is held at an angle of 30° with a uniform electric field of 15×10^4 N/C. The magnitude of torque acting on the dipole is

   Ⓐ 0.1 N-m Ⓑ 0.2 N-m Ⓒ 0.3 N-m Ⓓ 0.15 N-m

10. Two point charges of +2 μC and +6 μC repel each other with a force of 12 N. If each is given an additional charge of –4 μC, then the new force will be

    Ⓐ –4 N Ⓑ +4 N Ⓒ –6 N Ⓓ –3 N

11. Capacitance of a parallel plate capacitor (air filled) with a conducting slab of thickness t is given by ($t < d$)

    Ⓐ $\frac{A\varepsilon_0 t}{d}$ Ⓑ $\frac{A\varepsilon_0}{d-t}$ Ⓒ $\frac{A\varepsilon_0}{d+t}$ Ⓓ $\frac{A\varepsilon d}{t}$

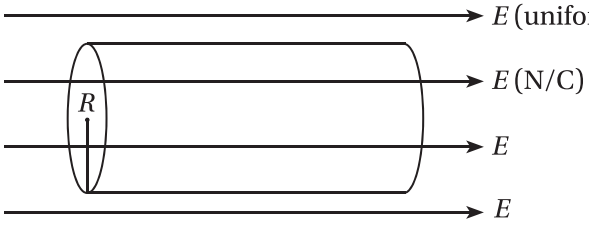
12. Capacitance of a parallel plate capacitor (air filled) with a dielectric slab of thickness t is given by ($t < d$, dielectric strength is k)

Ⓐ $\frac{kA\varepsilon_0}{d-t}$ Ⓑ $\frac{kA\varepsilon_0}{d}$ Ⓒ $\frac{A\varepsilon_0}{d-t\left(1-\frac{1}{k}\right)}$ Ⓓ none of the above

13. Electric field intensity at any point is

Ⓐ $\left|\vec{E}\right| = V\left|\frac{dV}{dr}\right|$ Ⓑ $\left|\vec{E}\right| = \frac{V}{r}$ Ⓒ $\left|\vec{E}\right| = -\frac{dV}{dr}$ Ⓓ $\left|\vec{E}\right| = r\frac{dV}{dr}$

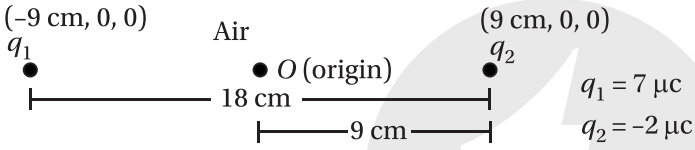
14.



The total electric flux through the cylinder is

Ⓐ 0 Ⓑ 1 unit Ⓒ 2 unit Ⓓ $\pi R^2 E$

15.



Suppose that the above system of charges is now placed in an external field $E = A/r^2$ where $A = 9 \times 10^5$ C/m^2. Then electrostatic potential energy of the configuration is

Ⓐ 150 J Ⓑ 49.3 J Ⓒ 30 J Ⓓ 60 J

■ Assertion-Reason type Questions (Q16–Q19)

Directions: Read the following questions and choose any one of the following four responses.

Ⓐ If both Assertion and Reason are true and Reason is the correct explanation of the Assertion.

Ⓑ If both Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

Ⓒ Assertion is true but the Reason is false.

Ⓓ Assertion is False and Reason is true.

16. **Assertion:** Drift speed of free electrons in a metallic conductor decreases with the increase in temperature.

Reason: $v_d \propto \tau$ (relaxation time) and relaxation time decreases with rise in temperature.

17. A 4 ohm insulated resistance wire is bent in the middle by 180° and both the halves are twisted with each other.

Assertion: The new resistance is 4 ohm.

Reason: $R = \frac{\rho l}{A} = 4$ and $R' = \frac{\rho(l/2)}{2A} = 1$ Ohm

18. A conductor of length L is connected to a d.c. source of emf E. If this conductor is replaced by another conductor of same material and same area of cross-section but of length $3L$.

Assertion: Drift speed decreases.

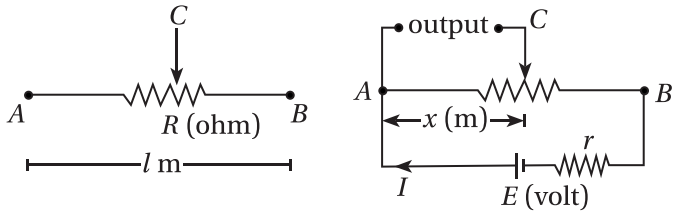
Reason: $v_d \propto \frac{1}{L}$

19. **Assertion:** The charge carriers in an electrolyte are positive and negative ions.

Reason: The charge carriers in an ionised gas are electrons and positively charged ions.

■ **Case Based Questions**

(I) Potential divider circuit :



The circuit for rheostat used as a potential divider is shown above, where l is the length of resistance R (ohm) and x is the length of resistance tapped for output voltage (V Volt). E is the emf of battery used and r is the internal resistance of cell E.

20. The circuit current I =

Ⓐ $\frac{E}{R+r}$ Ⓑ $\frac{\varepsilon x}{l}$ Ⓒ $\frac{ER}{l}$ Ⓓ $\frac{ERx}{l}$

21. The output voltage V =

Ⓐ $\left(\frac{Ex}{R+r}\right)$ Ⓑ $\frac{ERx}{(R+r)l}$ Ⓒ $\frac{ERl}{(R+r)x}$ Ⓓ $\frac{E(R+r)}{l \cdot x}$

22. $V_A - V_B$ =

Ⓐ $I \cdot r$ Ⓑ $E + Ir$ Ⓒ $E - Ir$ Ⓓ None of these

(II) When a charged particle is projected perpendicular to the magnetic field, its path is circular in a plane perpendicular to the plane of magnetic field (B) and direction of motion (v) of the charged particle (q). The speed (v) and kinetic energy of the particle (mass m) remain constant. The velocity of the charged particle changes only in direction.

23. The force F acting on the charged particle is

Ⓐ $F \propto r^0$ (r = radius of circular path) Ⓑ $F \propto v^2$

Ⓒ $F \propto r^{-1}$ Ⓓ none of the above

24. $F \propto$

Ⓐ v^{-1} Ⓑ v Ⓒ v^2 Ⓓ v^{-2}

25. r =

Ⓐ $\frac{m}{qB}$ Ⓑ $\frac{v}{qB}$ Ⓒ $\frac{mv}{B}$ Ⓓ $\frac{mv}{qB}$

Chemistry

26. The osmotic pressure of equimolar solutions of NaCl, $BaCl_2$ and glucose will be in the order :

Ⓐ NaCl > $BaCl_2$ > Glucose Ⓑ $BaCl_2$ > NaCl > Glucose

Ⓒ Glucose > NaCl > $BaCl_2$ Ⓓ NaCl > Glucose> $BaCl_2$

27. In which case Raoult's law is not applicable ?

Ⓐ 1(M) NaCl Ⓑ 1 M Urea Ⓒ 1 M Glucose Ⓓ 1 M Sucrose

28. Which has the least freezing point?

Ⓐ 1% Sucrose Ⓑ 1% NaCl Ⓒ 1% $CaCl_2$ Ⓓ 1% Glucose

29. Mole fraction of a given sample of I_2 in C_6H_6 (M. W = 78) is 0.2. The molality of I_2 in C_6H_6 will be :

Ⓐ 0.16 Ⓑ 0.32 Ⓒ 1.6 Ⓓ 3.2

30. 200 ml 0.1 (N) NaOH solution is added to 50 ml 0.01 (N) KOH solution. What is the final concentration in normality of the mixture solution?

Ⓐ 0.062 N Ⓑ 0.072 N Ⓒ 0.082 N Ⓓ 0.092 N

31. What is the concentration when 3.6 g $C_6H_{12}O_6$ (M.W. = 180) is dissolved in 200 gm water?

Ⓐ 0.01 m Ⓑ 0.01 m Ⓒ 0.2 m Ⓓ 0.02 m

32. At 300 k temperature, a solution is formed by acetone in chloroform and Henry's law constant is 150 torr and mole fraction of acetone is 0.12. What is the vapour pressure of acetone ?

Ⓐ 1.8 torr Ⓑ 0.18 torr Ⓒ 18 torr Ⓓ 9 torr

33. At high altitude, anoxia occurs due to :

Ⓐ decrease of partial pressure of oxygen in human blood

Ⓑ decrease of partial pressure of carbondioxide in human blood

Ⓒ increase of rate of decomposion of haemoglobin in human blood

Ⓓ increase of partial pressure nitrogen in human lungs

34. Consider the following data and select the correct order of water solubility at 300 K ?

Gas	Henry's law constant value (k bar)
P ⟶	46.54
Q ⟶	124.65
R ⟶	36.78
S ⟶	144.89

Ⓐ S > Q > P > R Ⓑ S > P > Q > R Ⓒ R > P > Q > S Ⓓ R > S > Q > P

35. When mercuric iodide is added to an aqueous solution of K I, then

Ⓐ Boiling point increase Ⓑ Boiling point decrease

Ⓒ Freezing point decrease Ⓓ Osmotic pressure increase

36. The vapour pressure of pure liquid A is 70 torr at 27°C. It form an ideal solution with another liquid B. The mole fraction of B is 0.2 and total vapour pressure of the solution is 84 torr at 27°C. The vapour pressure of pure liquid B at 27°C is

Ⓐ 140 torr Ⓑ 50 torr Ⓒ 14 torr Ⓓ 70 torr

37. The vapour pressure at a given temperature of an ideal solution containing 0.2 mol of a non-volatile solute and 0.8 mol of solvent is 60 mm of Hg. The vapour pressure of the pure solvent at the same temperature is :

Ⓐ 150 mm of Hg Ⓑ 60 mm of Hg Ⓒ 75 mm of Hg Ⓓ 120 mm of Hg

38. A 0.2 molal aqueous solution of weak acid HX 20% ionized. The freezing point of solution is (K_f = 1.86).

Ⓐ – 0.45°C Ⓑ – 0.9°C Ⓒ – 0.31°C Ⓓ – 0.53°C

39. The molal freezing point constant of water is 1.86 K kg $(mole)^{-1}$. Therefore, the freezing point of 0.1 M NaCl solution in water is expected to be :

Ⓐ $-1.86^{\circ}c$ Ⓑ $-0.186^{\circ}c$ Ⓒ $-0.372^{\circ}c$ Ⓓ $+0.372^{\circ}c$

40. Calculate the amount of KCl which must be added to 1 Kg of water so that its freezing point is depressed by 2 K. [K_f of water = 1.86 K kg$(mole)^{-1}$]

k = 39, Cl = 35.5

Ⓐ 23.04 g Ⓑ 4.23 g Ⓒ 40.23 g Ⓓ 23.04 g

Assertion and Reason : (Q41 – 44)

Directions: Read the following questions and choose any one of the following four responses.

a: Assertion and Reason both are correct and Reason is the correct explanation of Assertion.
b: Assertion and Reason both are correct and Reason is not the correct explanation of Assertion.
c: Assertion is correct but Reason is wrong.
d: Assertion is wrong but Reason is correct.

41. **Assertion (A) :** Relative lowering of vapour pressure is equal to mole fraction

Reason (R) : Relative lowering of vapour pressure is a colligative property

Ⓐ a Ⓑ b Ⓒ c Ⓓ d

42. **Assertion (A) :** When HgI_2 is added to the aqueous solution of KI, the freezing point is raised.

Reason (R) : Freezing point generally increases by adding non-volatile solute in solvent.

Ⓐ a Ⓑ b Ⓒ c Ⓓ d

43. **Assertion (A) :** At low concentration benzene and toluene ideal solution.

Reason (R) : Component with structural similarities form ideal solution.

Ⓐ a Ⓑ b Ⓒ c Ⓓ d

44. **Assertion (A) :** Molality and mole fraction are temperature independent quantity

Reason (R) : Molality and Mole fraction are unit less quantity.

Ⓐ a Ⓑ b Ⓒ c Ⓓ d

Case Base Question (Q45 to Q47)

In mixing of two non-ideal solutions A and B, final solution becomes cold (F = intermolecular force of attraction).

45. Correct statement about final solution is :

Ⓐ evolution of some heat takes place
Ⓑ $F_{AB} > F_{AA}$ and $F_{AB} > F_{BB}$
Ⓒ inter molecular H-bonds may be broken out
Ⓓ Contraction of volume takes place

46. If final solution becomes hot, incorrect option :

Ⓐ Exothermic dissolution may takes place
Ⓑ Vapour pressure increases than expected value
Ⓒ Maximum boiling azeotropes are formed
Ⓓ Negative deviations from Raoults law

47. Which of the following is correct about a solution showing negative deviation?

Ⓐ $\Delta H_{mix} > 0$ Ⓑ $P_A > P^\circ_A X_A$

Ⓒ $\Delta V_{mix} > 0$ Ⓓ forms maximum boiling azeotropes mixture

Case Base Question (Q23 – Q25)

In non-ideal solution at one of the intermediate compositions, the total vapour pressure is highest and the boiling point is lowest. At this point, the composition of the liquid and vapour phases is same. So, if liquid mixture vapourises at this point and vapours are condensed, the condensate contains same composition as present in original liquid mixture. It means at this point liquid behaves like a pure liquid and is called an azeotropic mixture.

48. Choose the correct statement :

Ⓐ Ideal solutions can not be separated into their components by fractional distillation.

Ⓑ For ideal solutions enthalpy of mixing is always greater than zero.

Ⓒ Only non-ideal solution showing positive deviation can not be separated out by fractional distillation

Ⓓ Non-ideal solution showing both positive and negative deviation cannot be separated out by fractional distillation.

49. Which of the following can not form low boiling point azeotrope ?

Ⓐ n-heptane & n-hexane Ⓑ acetone & aniline Ⓒ Both (A) & (B) Ⓓ $CHCl_3$ and C_2H_5OH

50. When 25 cc. CCl_4 is mixed with 25cc. of $CHCl_3$, the total volume.

Ⓐ 50 cc Ⓑ < 50 cc Ⓒ > 50 cc Ⓓ none of these

Mathematics

51. The value of $\cos\left[\frac{1}{2}\cos^{-1}\left\{\cos\left(\sin^{-1}\frac{\sqrt{63}}{8}\right)\right\}\right]$ is

Ⓐ $\frac{3}{16}$ Ⓑ $\frac{3}{8}$ Ⓒ $\frac{3}{4}$ Ⓓ $\frac{3}{2}$

52. The inverse of the matrix $\begin{bmatrix} 7 & -3 & -3 \\ -1 & 1 & 0 \\ -1 & 0 & 1 \end{bmatrix}$ is

Ⓐ $\begin{bmatrix} 1 & 1 & 1 \\ 3 & 4 & 3 \\ 3 & 3 & 4 \end{bmatrix}$ Ⓑ $\begin{bmatrix} 1 & 3 & 1 \\ 4 & 3 & 8 \\ 3 & 4 & 1 \end{bmatrix}$ Ⓒ $\begin{bmatrix} 1 & 1 & 1 \\ 3 & 3 & 4 \\ 3 & 4 & 3 \end{bmatrix}$ Ⓓ $\begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$

53. Consider the matrix $P = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$. Then the number of 3×3 invertible matrices Q with integer entries, such that $Q^{-1} = Q^t$ and $PQ = QP$ is

Ⓐ 32 Ⓑ 8 Ⓒ 16 Ⓓ 24

54. Let the set of all relations R on the set {a, b, c, d, e, f} such that R is reflexive and symmetric and R contains exactly 10 elements be denoted by S. Then the number of elements in S is

Ⓐ 105 Ⓑ 805 Ⓒ 435 Ⓓ 5

55. Considering only the principal values, the value of $\frac{3}{2}\cos^{-1}\sqrt{\frac{2}{2+\pi^2}}+\frac{1}{4}\sin^{-1}\left(\frac{2\sqrt{2}\pi}{2+\pi^2}\right)+\tan^{-1}\frac{\sqrt{2}}{\pi}$ is

Ⓐ $\tan^{-1}\left(\frac{\pi}{\sqrt{2}}\right)$ Ⓑ $\pi+\tan^{-1}\left(\frac{\pi}{\sqrt{2}}\right)$ Ⓒ $\frac{\pi}{2}+\tan^{-1}\left(\frac{\pi}{\sqrt{2}}\right)$ Ⓓ None of these

CASE STUDY BASED QUESTION- I (Q56 – Q58):

To promote the making of toilets for women, an organisation tried to generate awareness through (i) house calls (ii) emails and (iii) announcements. The cost for each mode per attempt is given below: (i) ₹50 (ii) ₹20 (iii) ₹40. The number of attempts made in the village X, Y and Z are given below:

	(i)	(ii)	(iii)
X	400	300	100
Y	300	250	75
Z	500	400	150

Also, the chance of making of toilets corresponding to one attempt of given modes is (i) 2% (ii) 4% (iii) 20%

On the basis of above answer the following.

56. The cost incurred by the organisation on village X is

Ⓐ ₹10000 Ⓑ ₹15000 Ⓒ ₹30000 Ⓓ ₹20000

57. The cost incurred by the organisation on village Z is

Ⓐ ₹19000 Ⓑ ₹39000 Ⓒ ₹45000 Ⓓ ₹50000

58. The total number of toilets that can be expected after the promotion in village Z is

Ⓐ 26 Ⓑ 36 Ⓒ 46 Ⓓ 56

CASE STUDY BASED QUESTION- II (Q.59- Q. 61):

Shonam and Danish are playing Ludo at home during Covid-19. While rolling the dice, Shonam's sister Kavita observed and noted the possible outcomes of the throw every time belongs to set {1,2,3,4,5,6}. Let A be the set of players while B be the set of all possible outcomes. A = {S, D}, B = {1,2,3,4,5,6}

On the basis of above answer the following

59. Let R : B → B be defined by R = {(x, y) : y is divisible by x} is

Ⓐ Reflexive and transitive but not symmetric
Ⓑ Reflexive and symmetric and not transitive
Ⓒ Not reflexive but symmetric and transitive
Ⓓ Equivalence

60. Kavita wants to know the number of functions from A to B. How many numbers of functions are possible?

Ⓐ 6^2 Ⓑ 2^6 Ⓒ 6! Ⓓ 2^{12}

61. Let R : B → B be defined by R = {(1, 1), (1, 2), (2, 2), (3, 3), (4, 4), (5, 5), (6, 6)}, then R is

Ⓐ Symmetric
Ⓑ Reflexive and Transitive
Ⓒ Transitive and symmetric
Ⓓ Equivalence

ASSERTION-REASON BASED QUESTIONS (62–65) :

Directions: Each of these questions contains two statements Assertion (A) and Reason (R). Each of the questions has four alternative choices, any one of the which is the correct answer. You have to select one of the codes (a, (b), (c) and (d) given below:

A: A is true; R is true, R is a correct explanation of A.
B: A is true, R is true; R is not a correct explanation of A.
C: A is true, R is false.
D: A is false, R is true.

62. **Assertion (A) :** The function defined by $f(x) = \cos(x^2)$ is a continuous function.

Reason (R) : The cosine function is continuous in its domain i.e., $x \in R$

Ⓐ a Ⓑ b Ⓒ c Ⓓ d

63. Let $A = \begin{bmatrix} 1 & 0 & a \\ 2 & 3 & b \\ -3 & 1 & c \end{bmatrix}$, $B = \begin{bmatrix} 1 & 0 & x \\ 2 & 3 & y \\ -3 & 1 & z \end{bmatrix}$

and $C = \begin{bmatrix} 1 & 0 & a+x \\ 2 & 3 & b+y \\ -3 & 1 & c+z \end{bmatrix}$

Assertion (A) : det A + det B = det C.

Reason (R) : A + B = C.

Ⓐ a Ⓑ b Ⓒ c Ⓓ d

64. **Assertion (A) :** If $2(\sin^{-1}x)^2 - 5(\sin^{-1}x) + 2 = 0$, then x has 2 solutions.

Reason (R) : $\sin^{-1}(\sin x) = x$ if $x \in R$

Ⓐ a Ⓑ b Ⓒ c Ⓓ d

65. **Assertion (A) :** The domain of definition of the function

$$f(x) = e^{2x} + \cos^{-1}\left(\frac{x}{2} - 1\right), \text{ is } (0,1) \cup (1,2) \cup (2,3) \cup (3,4)$$

Reason (R) : The domain of $\cos^{-1}\left(\frac{x}{2} - 1\right)$ is $[0, 4]$.

Ⓐ a Ⓑ b Ⓒ c Ⓓ d

66. A function f is such that f(xy) = f(x + y) for all real values of x and y, and f(5) = 10. What is f(20) + f(–20) equal to?

Ⓐ 10 Ⓑ 20 Ⓒ 0 Ⓓ 40

67. The range of the function $f(x)=\frac{x^2+x+2}{x^2+x+1}, x\in R$ is

Ⓐ $(1,\infty)$ Ⓑ $\left(1,\frac{11}{7}\right]$ Ⓒ $\left(1,\frac{7}{3}\right]$ Ⓓ $\left(1,\frac{7}{5}\right]$

68. The value of f (0), so that the function $f(x)=\frac{\sqrt{a^2-ax+x^2}-\sqrt{a^2+ax+x^2}}{\sqrt{a+x}-\sqrt{a-x}}(a>0)$ becomes continuous at x = 0 is

Ⓐ $\sqrt{a}$ Ⓑ $-\sqrt{a}$ Ⓒ –a Ⓓ a

69. If $f(x)=\begin{pmatrix} x & \text{if x is rational} \\ -x & \text{if x is irrational}\end{pmatrix}$, then

Ⓐ f(x) is an even function Ⓑ f(x) is continuous at $x=\frac{1}{2}$

Ⓒ f(x) is continuous at x = 0 Ⓓ f(x) is a periodic function

70. The function $f(x)=\frac{x^2-8x+18}{x^2+4x+30}$ is

Ⓐ one-one Ⓑ bijective Ⓒ not one-one Ⓓ none of these

71. The value of $\tan^{-1}\left[2\cos\left(2\sin^{-1}\frac{1}{2}\right)\right]$ is

Ⓐ $\frac{-\pi}{4}$ Ⓑ $\frac{\pi}{4}$ Ⓒ $\frac{\pi}{2}$ Ⓓ none of these

72. If $A=\begin{bmatrix}0 & 2b & c\\ a & b & -c\\ a & -b & c\end{bmatrix}$ is orthogonal matrix, then |abc| = ?

Ⓐ $\frac{1}{2}$ Ⓑ $\frac{1}{3}$ Ⓒ $\frac{1}{6}$ Ⓓ 1

73. Let $A=\begin{bmatrix}1 & -1 & 1\\ 2 & 1 & -3\\ 1 & 1 & 1\end{bmatrix}$ and $10\,B=\begin{bmatrix}4 & 2 & 2\\ -5 & 0 & \alpha\\ 1 & -2 & 3\end{bmatrix}$. If B is the inverse of matrix A, then α is

Ⓐ 2 Ⓑ –1 Ⓒ 3 Ⓓ 5

74. If A, B and C are n x n matrices and det(A) = 2, det(B) = 3 and det(C) = 5, then the value of the $\det(A^2BC^{-1})$ is equal to

Ⓐ $\frac{6}{5}$ Ⓑ $\frac{12}{5}$ Ⓒ $\frac{18}{5}$ Ⓓ $\frac{24}{5}$

75. If $A=\begin{bmatrix}4 & k & k\\ 0 & k & k\\ 0 & 0 & k\end{bmatrix}$ and det(A) = 256, then |k| equals

Ⓐ 4 Ⓑ 5 Ⓒ 6 Ⓓ 8

Biology

76. Inbreeding depression and lack of genetic variation occurs in :

Ⓐ Cleistogamous flowers Ⓑ Chasmogamous flowers Ⓒ Unisexual flowers Ⓓ Geitonogamous flowers

77. How can a pollen tube germinate inspite of the presence of sporopollenin on its external surface?

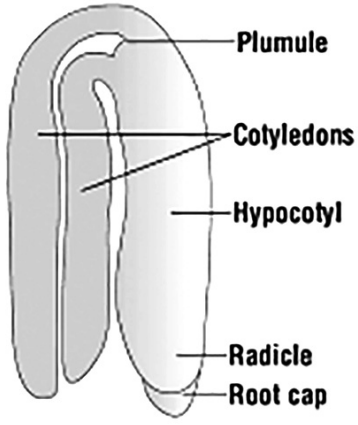
Ⓐ Due to the presence of cellulose and pectin in the inner layer.

Ⓑ Due to the presence of pectin on the sporopollenin covering.

Ⓒ Due to the lack of sporopollenin in the germ pores of exine.

Ⓓ Due to lack of sporopollenin in the intine

78. The given diagram is that of a dicot seed. Apart from the two cotyledons, what is the other characteristic feature of a dicot seed which differentiates it from a monocot seed?



Ⓐ Presence of root cap. Ⓑ Presence of hypocotyl

Ⓒ Absence of epicotyl Ⓓ Absence of coleoptile and coleorhiza

79. In 60% of angiosperms, the pollen grains, at the time of liberation from the anther contains:

Ⓐ One vegetative cell and one generative cell Ⓑ Two vegetative cells and one generative cell

Ⓒ One vegetative and two generative cells Ⓓ One vegetative and three generative cells

80. During which phase of the menstrual cycle does ovulation occur?

Ⓐ Menstrual phase Ⓑ Ovulatory phase Ⓒ Secretory phase Ⓓ Follicular phase

81. Secretion of which of the following glands provides fructose to the sperms?

Ⓐ Prostate gland Ⓑ Seminal vesicles Ⓒ Cowper's gland Ⓓ All of the above

82. The birth canal is:

Ⓐ Cervical canal Ⓑ Vagina

Ⓒ Both A and B Ⓓ Uterus, cervical canal and vagina

83. What are the number of chromosomes in the secondary spermatocyte and spermatozoa?

Ⓐ 46 and 23, respectively Ⓑ 23 and 46, respectively Ⓒ 23 and 23, respectively Ⓓ 46 and 46, respectively

84. Lactational amenorrhea is a

Ⓐ Natural method of birth control
Ⓑ ART method
Ⓒ Barrier method of contraception
Ⓓ None of the above

85. MTP is safe upto

Ⓐ first month of pregnancy
Ⓑ second month of pregnancy
Ⓒ third month of pregnancy
Ⓓ fourth month of pregnancy

86. The persistent remnant of the nucellus in the seed is called_____

Ⓐ Endosperm Ⓑ Cotyledon Ⓒ Perisperm Ⓓ Tapetum

87. Name the form of asexual reproduction that mimics sexual reproduction, but produce seeds without fertilisation.

Ⓐ Polyembryony Ⓑ Parthenocarpy Ⓒ Apomixis Ⓓ None of the above

88. Name the hormone released by the pituitary, which causes parturition?

Ⓐ Vasopressin Ⓑ Oxytocin Ⓒ Somatostatin Ⓓ hCG

89. At which stage, can the sex of a child be determined?

Ⓐ By the end of first trimester
Ⓑ By the middle of second trimester
Ⓒ By the end of second trimester
Ⓓ By the middle of third trimester

90. Rise in level of which hormone stimulates the release of milk during lactation?

Ⓐ Oxytocin Ⓑ Oestrogen Ⓒ Prolactin Ⓓ Progesterone

Assertion and Reason :

Directions: The questions 91 to 94 have two statements – Assertion (A) and Reason (R). Of the two statements, mark the correct answer from the options given below:

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true but R is not the correct explanation of A.

C. A is true but R is false.

D. A is false but R is true.

91. **Assertion:** The pollen grains are the male gametes of plants.

Reason : Pollen grains are rich in nutrients.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

92. **Assertion :** The embryo sac represents the female gametophyte.

Reason : The embryo sac turns into a fruit after fertilization.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

93. **Assertion :** The trophoblast cells of the blastocyst gets attached to the endometrium.

Reason : The inner mass cells of the blastocyst transforms into the embryo.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

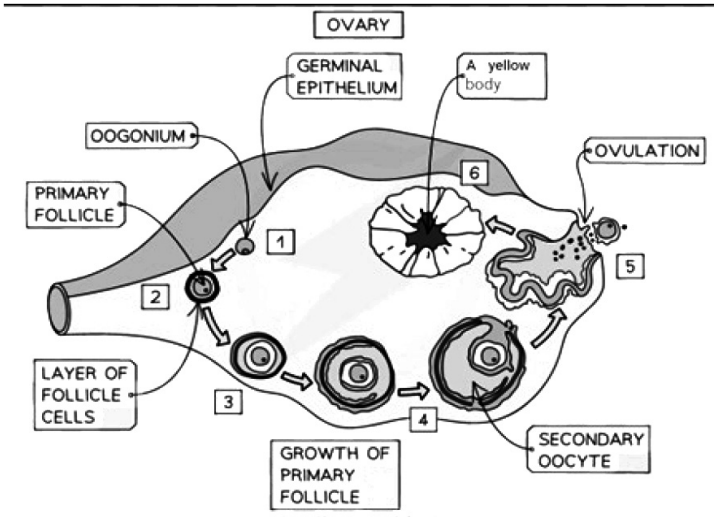
94. **Assertion :** Sharing of infected needles or surgical instruments can cause transmission of Hepatitis B from one person to another.

Reason : Ectopic pregnancy is a type of STD.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

Case Base Question

Study the diagram of oogenesis given below and answer the following questions: (95–97)



95. What is oogonia?

Ⓐ Gamete mother cells Ⓑ Cells which give rise to primary oocyte

Ⓒ Diploid cells Ⓓ All of the above

96. What is the ploidy of primary oocyte in humans?

Ⓐ 23 Ⓑ 46 Ⓒ 2 Ⓓ 69

97. When each primary oocyte gets surrounded by a layer of granulosa cells, the resulting structure is called:

Ⓐ Primary follicle Ⓑ Secondary follicle Ⓒ Graafian follicle Ⓓ Corpus luteum

Read the given passage and answer the following questions : (98 – 100)

The transfer of pollen grains from anther and their deposition over stigma of the pistil is termed as pollination. Depending upon sources of pollen grains, pollination is of three types.

Pollination

	Autogamy		Geitonogamy		Xenogamy/Allogamy
1.	The transfer of pollen grains is from anther to stigma of the same flower. e.g.. pea, rice, weat etc. It is self-pollination	1.	The transfer of pollen grains is from anther of one flower to the stigma of another flower of same plant. e.g., cucurbita.	1.	The transfer of pollen grains is from anther of one flower to the stigma of another flower of different plant. e.g., Papaya, maize.
2.	Brings pollen with similar genetic constitution on stigma.	2.	It is functionally cross-pollination but genetically similar to autogamy.	2.	Brings genetically different types of pollen grains to stigma.

98. Which of the following plants are aquatic but do not show hydrophily?

Ⓐ *Vallisneria* Ⓑ Lotus Ⓒ *Hydrilla* Ⓓ None of the above

99. In some insect pollinated plant species, floral rewards include a safe place to lay eggs. Name one such plant.

Ⓐ *Amorphophallus* Ⓑ *Pinus* Ⓒ *Hydrilla* Ⓓ *Zostera*

100. What is the name of the phenomenon in which the stamens and stigma of a bisexual flower mature at different times?

Ⓐ Dicliny Ⓑ Homogamy Ⓒ Cleistogamy Ⓓ Dichogamy