Monthly Progressive Test

Class: XII

Subject: PCMB

Academic Excellence Programme
TECHNO ACE

Test Booklet No.: MPT08 **Test Date:** 2 0 1 2 2 0 2 4

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 MPT0820122024.
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. A point charge situated at a distance 'r' from a short electric dipole on its axis, experiences a force $\vec{F}$. If the distance of the charge is '2r', the force on the charge will be

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

2. A charge particle is placed between the plates of a charged parallel plate capacitor. It experiences a force F. If one of the plates is removed, the force on the charge particle becomes

   Ⓐ F Ⓑ 2F Ⓒ F/2 Ⓓ Zero

3. The resistance of a metal wire increases with increasing temperature on account of

   Ⓐ decrease in free electron density Ⓑ decrease in relaxation time

   Ⓒ increase in mean free path Ⓓ increase in the mass of electron

4. Five identical cells, each of emf 2V and internal resistance 0.1 Ω are connected in parallel. This combination in turn is connected to an external resistor of 9.98 Ω. The current following through the resistor is

   Ⓐ 0.05 A Ⓑ 0.1 A Ⓒ 0.15 A Ⓓ 0.2 A

5. A charge particle after being accelerated through a potential difference 'V' enters in a uniform magnetic field and moves in a circle of radius r. If V is doubled, the radius of the circle will become

   Ⓐ 2r Ⓑ $\sqrt{2}$ r Ⓒ 4 r Ⓓ $\frac{r}{\sqrt{2}}$

6. A straight conducting rod of length l and mass m is suspended in a horizontal plane by a pair of flexible strings in a magnetic field of magnitude B. To remove the tension in the supporting strings, the magnitude of the current in the wire is

   Ⓐ $\frac{mgB}{l}$ Ⓑ $\frac{mgl}{B}$ Ⓒ $\frac{mg}{lB}$ Ⓓ $\frac{lB}{mg}$

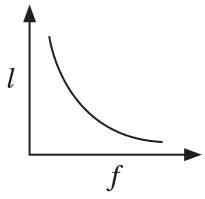
7. A magnet of magnetic moment of $50\hat{i}\ A\ m^2$ is placed along the x-axis in magnetic field $\vec{B} = (0.5\hat{i} + 3.0\hat{j})T$. The torque acting on the magnet is

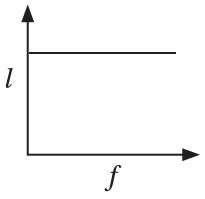
   Ⓐ $175\hat{k}$ Nm Ⓑ $75\hat{i}$ Nm Ⓒ $150\hat{k}$ Nm Ⓓ $25\sqrt{37}\hat{k}$ Nm

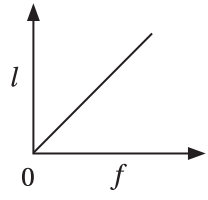
8. A circular coil of radius 10 cm is placed in a magnetic field $\vec{B} = (1.0\hat{i} + 0.5\hat{j})$ mT such that the outward unit vector normal to the surface of the coil is $(0.6\hat{i} + 0.8\hat{j})$. The magnetic flux linked with the coil is

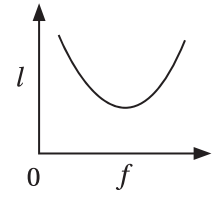
   Ⓐ 0.314 μWb Ⓑ 3.14 μWb Ⓒ 31.4 μWb Ⓓ 1.256 μWb

9. Which of the following graphs represent the variation of current (l) with frequency (f) in an AC circuit containing a pure capacitor?

   Ⓐ 

   Ⓑ 

   Ⓒ 

   Ⓓ 

10. The electromagnetic waves used to purify water are

    Ⓐ Infrared rays Ⓑ Ultraviolet rays Ⓒ X-rays Ⓓ Gamma rays

11. A plane wave is incident on a concave mirror of radius of curvature R. The reflected wave is a spherical wave of radius

Ⓐ $\frac{R}{4}$ Ⓑ $\frac{R}{2}$ Ⓒ R Ⓓ 2R

12. A biconcave lens of power P vertically splits into two identical Plano concave parts. The power of each part will be

Ⓐ 2P Ⓑ P/2 Ⓒ P Ⓓ $P/\sqrt{2}$

13. In Young's double-slit experiment, the intensity on the screen is I_0 at a point where path difference is λ. The intensity at the point where path difference is $\frac{\lambda}{4}$ is

Ⓐ $\frac{I_0}{4}$ Ⓑ $\frac{I_0}{2}$ Ⓒ I_0 Ⓓ zero

14. The work function for a photosensitive surface is 3.315 eV. The cut-off wavelength for photoemission of electron from this surface is

Ⓐ 150 nm Ⓑ 200 nm Ⓒ 375 nm Ⓓ 500 nm

■ **Assertion-Reason type Questions (15):**

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

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

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

C. If Assertion is true but the Reason is false.

D. If Assertion is false but Reason is true.

15. **Assertion:** Photoelectric current increases with an increase in intensity of incident radiation, for a given frequency of incident radiation and the accelerating potential.

Reason: Increase in the intensity of incident radiation results in an increase in the number of photoelectrons emitted per second and hence an increase in the photocurrent.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

16. An alpha particle approaches a gold nucleus in Geiger-Marsden experiment with kinetic energy K. It momentarily stops at a distance d from the nucleus and reverses its direction. Then d is proportional to

Ⓐ $\frac{1}{\sqrt{K}}$ Ⓑ $\sqrt{K}$ Ⓒ $\frac{1}{K}$ Ⓓ K

17. A hydrogen atom makes a transition from n = 5 to n = 1 orbit. The wavelength of photon emitted is λ. The wavelength of photon emitted when it makes a transition from n = 5 to n = 2 orbit is

Ⓐ $\frac{8}{7}\lambda$ Ⓑ $\frac{16}{7}\lambda$ Ⓒ $\frac{24}{7}\lambda$ Ⓓ $\frac{32}{7}\lambda$

18. Two nuclei have their mass numbers in the ratio of 1 : 27. What is the ratio of their nuclear densities?

Ⓐ 1 : 27 Ⓑ 1 : 1 Ⓒ 1 : 9 Ⓓ 1 : 3

19. The binding energy per nucleon of ${}_8O^{16}$ is 7.97 MeV and that of ${}_8O^{17}$ is 7.75 MeV. The energy (in MeV) required to remove a neutron from ${}_8O^{17}$ is

Ⓐ 0.42 MeV Ⓑ 7.86 MeV Ⓒ 4.23 MeV Ⓓ 3.64 MeV

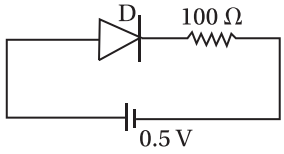
20. The threshold voltage for a p-n junction diode used in the circuit is 0.7 V. The type of biasing and current in the circuit are

Ⓐ Forward biasing, 0 A

Ⓑ Reverse biasing, 0 A

Ⓒ Forward biasing, 5 mA

Ⓓ Reverse biasing, 2 mA



21. A small bar, when placed near a magnet is repelled by it. This is because the bar is made of

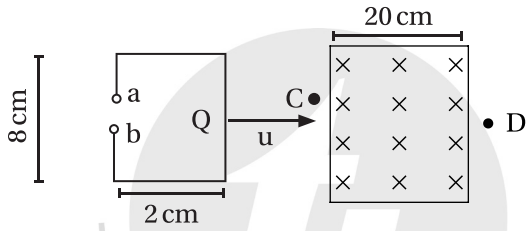
Ⓐ iron Ⓑ copper Ⓒ aluminium Ⓓ nickel

22. A current of 2.5 A flows through a coil of inductance 5 H. The magnetic flux linked with the coil is

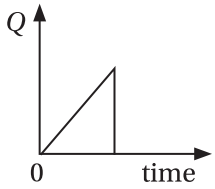
Ⓐ 0.5 Wb Ⓑ 12.5 Wb Ⓒ zero Ⓓ 2 Wb

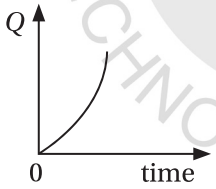
■ **Case Based Questions (23–25):**

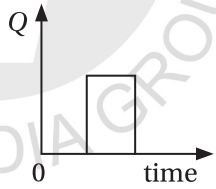
A rectangular coil Q is moved from a point C to another point D with uniform velocity u through a region of uniform magnetic field acting normally inward as shown in the figure below.

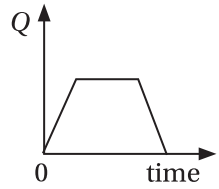


23. Select the correct graph of magnetic flux linked with it (along Y axis) and time (along X axis)

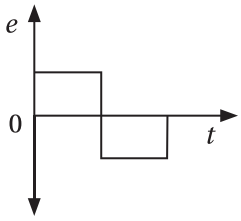
Ⓐ 

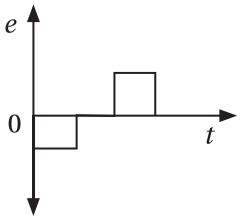
Ⓑ 

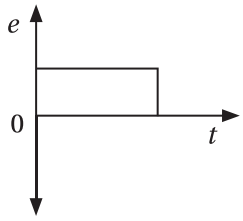
Ⓒ 

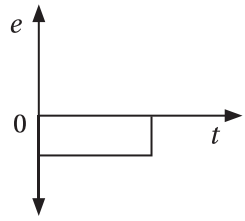
Ⓓ 

24. Select the correct graph between emf induce (e) along y-axis and time (t) along x-axis

Ⓐ 

Ⓑ 

Ⓒ 

Ⓓ 

25. If u = 1 cm/s (uniform speed), then total duration for which emf lasts is

Ⓐ 1 s Ⓑ 3 s Ⓒ 4 s Ⓓ 2 s

Chemistry

26. Which of the following pairs of ions are isoelectronic and isostructural?

Ⓐ CO_3^{2-} , $NO_3^{\ominus}$ Ⓑ ClO_3^- , CO_3^{2-} Ⓒ SO_3^{2-} , NO_3^- Ⓓ ClO_3^- , SO_3^{2-}

27. In a cyclotrimetaphosphoric acid molecule, how many single and double bonds are present?

Ⓐ 3 double bonds; 9 single bonds
Ⓑ 6 double bonds; 6 single bonds
Ⓒ 3 double bonds; 12 single bonds
Ⓓ zero double bonds; 12 single bonds

28. In qualitative analysis when H_2S is passed through an aqueous solution of salt acidified with dil. HCl, a black precipitate is obtained. On boiling the precipitate with dil. HNO_3, it forms a solution of blue colour. Addition of excess of aqueous solution of ammonia to this solution gives _____.

Ⓐ deep blue precipitate of $Cu(OH)_2$
Ⓑ deep blue solution of $[Cu(NH_3)_4]^{2+}$
Ⓒ deep blue solution of $Cu(NO_3)_2$
Ⓓ deep blue solution of $Cu(OH)_2 . Cu(NO_3)_2$

29. On heating lead nitrate forms oxides of nitrogen and lead. The oxides formed are _____.

Ⓐ N_2O, PbO Ⓑ NO_2, PbO Ⓒ NO, PbO Ⓓ NO, PbO_2

30. Which of the following are peroxoacids of sulphur?

Ⓐ H_2SO_5 and $H_2S_2O_8$ Ⓑ H_2SO_5 and $H_2S_2O_7$ Ⓒ $H_2S_2O_7$ and $H_2S_2O_8$ Ⓓ $H_2S_2O_6$ and $H_2S_2O_7$

31. In solid state PCl_5 is a _____

Ⓐ Covalent solid
Ⓑ Octahedral structure
Ⓒ Ionic solid with $[PCl_6]^+$ octahedral and $[PCl_4]^-$ tetrahedral
Ⓓ Ionic solid with $[PCl_4]^+$ tetrahedral and $[PCl_6]^-$ octahedral

32. The magnetic nature of elements depends on the presence of unpaired electrons. Identity the configuration of transition element, which shows highest magnetic moment.

Ⓐ $3d^7$ Ⓑ $3d^5$ Ⓒ $3d^8$ Ⓓ $3d^2$

33. When $KMnO_4$ solution is added to oxalic acid solution, the decolourisation is slow in the beginning but becomes instantaneous after some time because

Ⓐ CO_2 is formed as the product
Ⓑ Reaction is exothermic
Ⓒ MnO_4^- catalyses the reaction
Ⓓ Mn^{2+} acts as autocatalyst

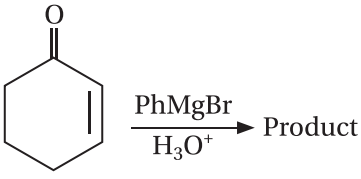
34. There are 14 elements in actionid series which of the following elements does not belong to this series?

Ⓐ U Ⓑ N_p Ⓒ T_m Ⓓ F_m

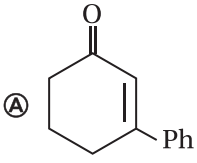
35. The C.F.S.E for octahedral $[CoCl_6]^{4-}$ is 18,000 cm^{-1}. The C.F.S.E for tetrahedral $[CoCl_4]^{2-}$ will be:

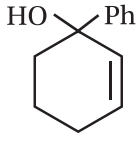
Ⓐ 18,000 cm^{-1} Ⓑ 16,000 cm^{-1} Ⓒ 8,000 cm^{-1} Ⓓ 20,000 cm^{-1}

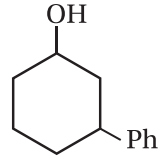
36.

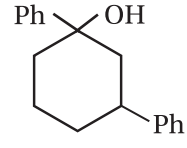


Identify the structure of product:

Ⓐ 

Ⓑ 

Ⓒ 

Ⓓ 

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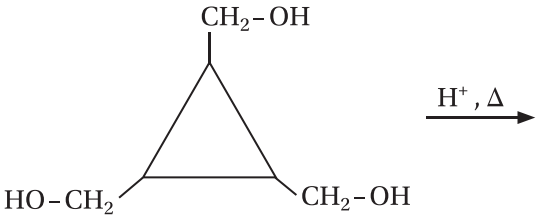
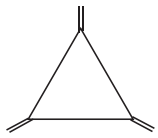
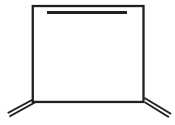
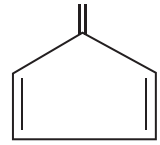
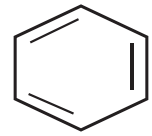


Ⓐ 

Ⓑ 

Ⓒ 

Ⓓ 

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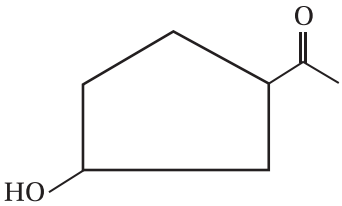
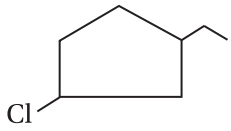
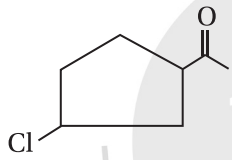
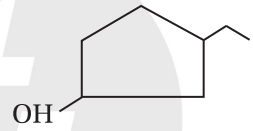
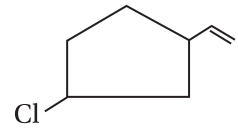


Ⓐ 

Ⓑ 

Ⓒ 

Ⓓ 

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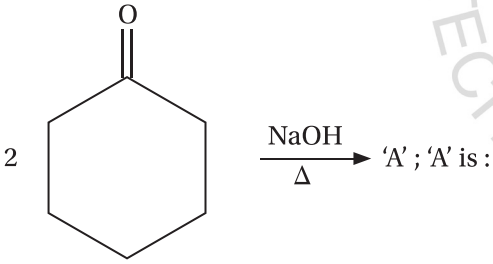
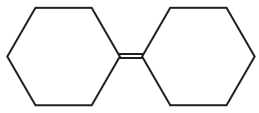
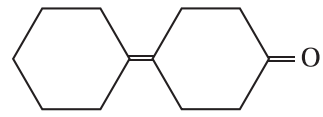
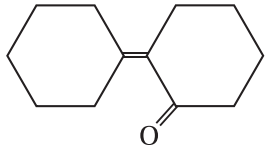
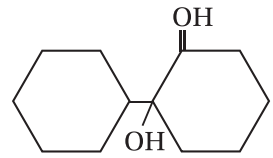


Ⓐ 

Ⓑ 

Ⓒ 

Ⓓ 

40. During mutarotation of β–D–glucose in aqueous solution angle of optical rotation

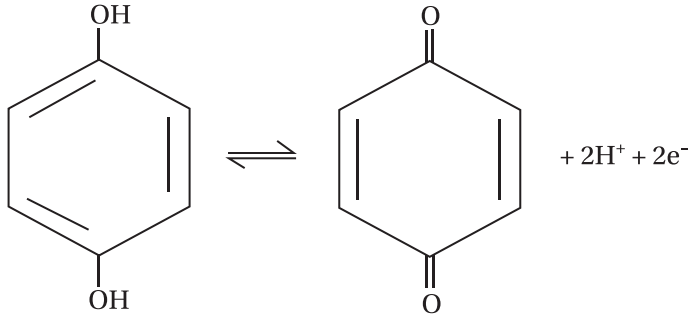
Ⓐ Remains constant value of + 111°

Ⓑ Remains constant value of + 19.2°

Ⓒ Changes from an angle of + 112° to a constant value of + 52.5°

Ⓓ Changes from an angle of + 19.2° to a constant value of + 52.5°

41. For the reduction half reaction $E^{\circ}_{quinhydron} = 1.30$ V



At pH = 3 at 293 K, electrode reduction potential is (considered quinone and hydroquinone have identical concentration)

Ⓐ 1.48 V Ⓑ 1.42 V Ⓒ 1.36 V Ⓓ 1.3 V

■ **Assertion Reason Type Question (42–44):**

Read the two statements carefully and select the correct option given below.

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

42. **Assertion (A):** The molar conductivity of strong electrolyte decreases with increase in concentration.

Reason (R): At high concentration, migration ion is slow.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

43. **Assertion (A):** Electrolysis of molten $PbBr_2$ using Pt electrodes produces Br_2 at anode.

Reason (R): Br_2 is obtained in gaseous state at room temperature.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

44. **Assertion (A):** If activation energy is zero then temperature will hence no effect on rate constant.

Reason (R): Lower the activation energy faster is the reaction.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

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

46. 2 millimolar solution of sodium ferrocyamide is 60% dissociated at 27°C. Osmotic pressure of the solution is:

Ⓐ 2.14 atm Ⓑ 1.02 atm Ⓒ 0.167 atm Ⓓ 0.0234 atm

47. The equivalent conductance of CH_3COONa, HCl and NaCl at infinite dilution are 91, 426 and 126 S cm^2. eq^{-1} respectively at 25°C. The equivalent conductance of 1(M) CH_3COOH solution is 19.55 S.cm^2 eq^{-1}. The pH of the solution is: [Given: $\log_{10}5 = 0.7$]

Ⓐ 5.3 Ⓑ 4.3 Ⓒ 2.3 Ⓓ 1.3

■ **Case Based Questions (48–49):**

According to collision theory, products are formed only when the reactant molecules comes close and colliode together at one and the same time. During the collision, atomic rearrangement takes place which leads to the formation of products. Atomic rearrangement involves breaking and formation of bonds. It takes place only when coillioding molecules have energy equal greater than minimum energy required for the reaction, called activation energy (E_a) i.e. energy of reactant molecule in addition to that energy which it possesses already, to bring about a chemical change is called activation energy. The rate of the reaction is concerned with decrease in concentration or increase in the concentration of products per unit time. Rate = $K[A]^x[B]^y$; x and y indicate how sensitive the rate is to change in concentration of A and B. Sum of x + y gives the overall order of a reaction.

48. For the following reaction:

$A(g) \longrightarrow B(g) + C(g)$

The initial pressure was P_0 while pressure after 't' time was P_t. The rate constant K will be given by:

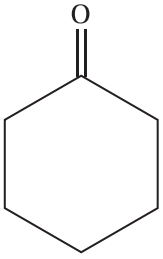
Ⓐ $K = \frac{2.303}{t}\log_{10}\frac{P_0}{P_t}$ Ⓑ $K = \frac{2.303}{t}\log_{10}\frac{P_0}{P_0 - P_t}$

Ⓒ $K = \frac{2.303}{t}\log_{10}\frac{P_0}{2P_0 - P_t}$ Ⓓ $K = \frac{2.303}{t}\log_{10}\frac{P_0}{3P_0 - P_t}$

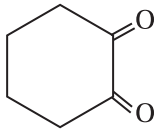
49. For a reaction $2N_2O_5(g) \longrightarrow 4NO_2(g) + O_2(g)$ the rate and rate constant are 1.02×10^{-4} mol $(L)^{-1}$ $(S)^{-1}$ and 3.4×10^{-5} $(S)^{-1}$ respectively. The concentration of N_2O_5 at this time will be:

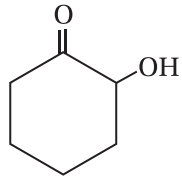
Ⓐ 1.732 mol/L Ⓑ 3 mol/L Ⓒ 1.02×10^{-4} mol/L Ⓓ 3.2×10^5 mol/L

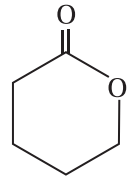
50.

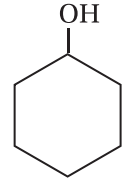


$\xrightarrow{SeO_2}$ 'P' ; 'P' is :

Ⓐ 

Ⓑ 

Ⓒ 

Ⓓ 

Mathematics

51. If $\begin{bmatrix} x+y \\ x-y \end{bmatrix} = \begin{bmatrix} 2 & 1 \\ 4 & 3 \end{bmatrix}\begin{bmatrix} 1 \\ -2 \end{bmatrix}$, then (x, y) is

Ⓐ (1, 1) Ⓑ (1, –1) Ⓒ (–1, 1) Ⓓ (–1, –1)

52. The area of the triangle with vertices (–2, 4), (2, k) and (5, 4) is 35 sq. units. The value of k is

Ⓐ 4 Ⓑ –2 Ⓒ 6 Ⓓ –6

53. The line y = x + 1 is a tangent to the curve $y^2 = 4x$ at the point.

Ⓐ (1, 2) Ⓑ (2, 1) Ⓒ (1, –2) Ⓓ (–1, 2)

54. If $\sin^{-1} : [-1, 1] \to \left[\frac{-\pi}{2}, \frac{\pi}{2}\right]$ is a function, then value of $\sin^{-1}\left(-\frac{1}{2}\right)$ is

Ⓐ $-\frac{\pi}{6}$ Ⓑ $\frac{\pi}{6}$ Ⓒ $\frac{5\pi}{6}$ Ⓓ $\frac{\pi}{3}$

55. If A is a square matrix of order 3 and $|A| = 5$, then what is the value of $|\text{Adj.A}|$?

Ⓐ 15 Ⓑ 5 Ⓒ 25 Ⓓ 9

56. The degree of the differential equation $\left[1+\left(\frac{dy}{dx}\right)^3\right] = \left(\frac{d^2y}{dx^2}\right)^2$ is

Ⓐ 3 Ⓑ 2 Ⓒ 4 Ⓓ 7

57. The integrating factor for solving the linear differential equation $x\frac{dy}{dx} - y = x^2$ is

Ⓐ –x Ⓑ $-x^{-1}$ Ⓒ x^2 Ⓓ $\frac{1}{x}$

58. The value of $\left|\hat{i} - \hat{j}\right|^2$ is

Ⓐ 0 Ⓑ 2 Ⓒ 1 Ⓓ none of these

59. What is the point of intersection of the lines ?

$L_1 = \frac{x}{1} = \frac{y-2}{-1} = \frac{z-3}{2}$

$L_2 : \frac{x-3}{-1} = \frac{y-0}{2} = \frac{z-1}{0}$

Ⓐ (0, –1, 2) Ⓑ (–2, 2, 1) Ⓒ (0, 0, 0) Ⓓ none of these

60. $\int \frac{\sin x + \cos x}{\sqrt{1+\sin 2x}}\,dx. = ?$

Ⓐ x + c Ⓑ –x + c Ⓒ $\log^x{}_e$ Ⓓ $-\log^x{}_e + c$

61. Find the value of derivative of $\tan^{-1}(e^x)$ w. r. t x at the point x = 0.

Ⓐ $-\frac{1}{2}$ Ⓑ 0 Ⓒ $\frac{1}{4}$ Ⓓ $\frac{1}{2}$

62. The cartesian equation of a line are $\frac{x-3}{2} = \frac{y+2}{-5} = \frac{z-6}{3}$

Find the vector equation of the line.

Ⓐ $\vec{r} = (3\hat{i} - 2\hat{j} + 6\hat{k}) + \lambda(2\hat{i} - 5\hat{j} + 3\hat{k})$ Ⓑ $\vec{r} = (3\hat{i} - 2\hat{j} + 6\hat{k}) + \lambda i$

Ⓒ $\vec{i} = \lambda(2\hat{i} - 5\hat{j} + 3\hat{k})$ Ⓓ none of these

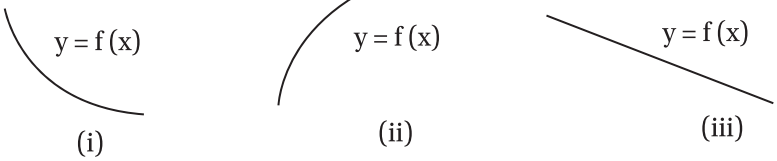
63. Evaluate : $\int_{-\pi}^{\pi} \left(\sin^{2023} x + x^{1023}\right) dx.$

Ⓐ –1 Ⓑ 2023 Ⓒ 0 Ⓓ 1023

64. Given $\int_1^2 e^{x^2} dx = a$ then the value of $\int_e^{e^4} \sqrt{\log_e^x} \, dx$ is

Ⓐ $e^4 - e$ Ⓑ $e^4 - a$ Ⓒ $2e^4 - a$ Ⓓ none of these

65.



(i) (ii) (iii)

Choose the correct option.

Ⓐ For fig (i) $f''(x) > 0$ Ⓑ For fig (ii) $f''(x) > 0$ Ⓒ For fig (iii) $f''(x) < 0$ Ⓓ For fig (i) & (iii) $f''(x) < 0$

66. Let $P = \{(x, y) : x^2 + y^2 = 1, x, y \in R\}$. Then, P is

Ⓐ Reflexive Ⓑ Symmetric Ⓒ Transitive Ⓓ Anti-Symmetric

67. Let $f : R \to R$ be a function defined by $f(x) = x^3 + 4$, then f is

Ⓐ injective Ⓑ surjective Ⓒ bijective Ⓓ none of these

68. The set of points where the function f given by $f(x) = |x - \pi| \sin x$ is differentiable is

Ⓐ R Ⓑ $R - \{\pi\}$ Ⓒ $(0, \infty)$ Ⓓ none of these.

69. Choose the incorrect option.

Ⓐ Differentiability of a function at a point implies continuity at that point.

Ⓑ Continuity of a function at a point implies differentiability at that point.

Ⓒ non continuity of a function at a point implies non differentiability at that point

Ⓓ If f (x) and g (x) are differentiable then their composition fog (x) and gof (x) both are differentiable functions.

70. Function $f(x) = \frac{\lambda.\sin x + 6\cos x}{2\sin x + 3\cos x}$ is increasing if

Ⓐ $\lambda > 1$ Ⓑ $\lambda < 1$ Ⓒ $\lambda < 4$ Ⓓ $\lambda > 4$

■ **Assertion Reason based Questions (71-72):**

Directions: In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

71. Consider the system of equations

$a_1x + b_1y = 0$

$a_2x + b_2y = 0$

where $a_1, a_2, b_1, b_2 \in \{0, 1\}$

Assertion (A) : The probability that the system of equation has a unique solution is $\frac{3}{8}$

Reason (R) : The probability that the system of equation has a solution is 1.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

72. **Assertion (A) :** Two cards from an ordinary deck of 52 cards are missing. Then the probability that a random card drawn from this desk is a spade is a

Reason (R) : If A and B are two events associated with a sample space S. Then $P(A \cap B) = P(A) \cdot P(B)$.

Ⓐ A Ⓑ B Ⓒ C Ⓓ D

■ **Case Study Based Questions (73–75):**

Suppose a man wishes to buy two types of machines. He has only ₹ 2880 to invest and space for at most ₹20 items. Machine A costs him ₹180 and Machine B costs him ₹120. The profit that he gets by selling machine A is ₹11 and by selling machine B is ₹9.

Let x and y denote the number of machines of type A and B respectively. On the basis of this answer the following questions.

73. What is the objective function of the given problem ?

Ⓐ maximize $Z = 11x + 9y$ Ⓑ Minimize $Z = 11x + 9y$ Ⓒ Maximize $Z = 9x + 11y$ Ⓓ Minimize $Z = 9x + 11y$.

74. Choose the correct relation.

Ⓐ $x + y \leq 20$ Ⓑ $x + y < 20$ Ⓒ $x + y > 20$ Ⓓ none of these

75. Feasible region lies in

Ⓐ 1^{st} quadrant Ⓑ 2^{nd} quadrant Ⓒ 3^{rd} quadrant Ⓓ 4^{th} quadrant

Biology

76. Name the component cells in the egg apparatus of an embryo sac.

Ⓐ Two synergids and an egg Ⓑ Three synergids and two female gametes

Ⓒ Three antipodals and two synergids Ⓓ Three antipodals and an egg

77. Which of the following will not result in variations among siblings?

Ⓐ Independent assortment of genes Ⓑ Crossing over

Ⓒ Linkage Ⓓ Mutation

78. _____ is a codon with dual functions – it acts as an initiation codon and also codes for methionine.

Ⓐ GUA Ⓑ AUG Ⓒ AUU Ⓓ All

79. Identify the examples of convergent evolution from the following:

Ⓐ Brains of vertebrates Ⓑ Thorns of *Bougainvillea* and tendrils of *Cucurbita*

Ⓒ Vertebrate hearts Ⓓ Flippers of penguins and dolphins

80. In malignant tumours, the cells proliferate, grow rapidly and move to other parts of the body to form new tumours. This stage of disease is called _____ .

Ⓐ Metagenesis Ⓑ Teratogenesis Ⓒ Metastasis Ⓓ Amitosis

81. Swiss cheese bears large holes due to the production of CO_2 by which microbe?

Ⓐ *Lactobacillus* Ⓑ *Sachharomyces cerevisiae*

Ⓒ *Propionibacterium shermanii* Ⓓ *Aspergillus niger*

82. Name the interaction between a whale and the barnacles growing on its back.

Ⓐ Parasitism Ⓑ Commensalism Ⓒ Amensalism Ⓓ Symbiosis

83. An inverted pyramid of biomass is seen in which ecosystem?

Ⓐ Forest Ⓑ Marine Ⓒ Grassland Ⓓ Tundra

■ **Question No. 84 to 88 consist of two statements–Assertion(A) and Reason(R). Answer these questions selecting the appropriate option 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.

84. **Assertion :** Morphine is used to treat patients of depression.

Reason : Morphine is a sedative painkiller.

85. **Assertion :** Activated sludge should have the ability to settle quickly.

Assertion: It needs to be rapidly pumped back from sedimentation tank to aeration tank.

86. **Assertion :** Both bacteria and yeast are used extensively in recombinant DNA technology.

Assertion: Bacteria and yeast multiply very fast and form a huge population, which express the desired gene.

87. **Assertion :** A temperature control system is an important requirement for a bioreactor.

Assertion: Every microorganism or enzyme is functional only at optimum temperature conditions.

88. **Assertion :** PCR makes the use of a thermostable DNA polymerase.

Assertion: PCR is used to detect HIV in suspected AIDS patients.

■ **Case Based Question (89–92):**

Read the given passage and answer the following questions: (89-92)
First cellular forms of life appeared around 2000 million years ago (mya). Some of these cells are said to release oxygen by splitting water with the help of solar energy captured by light harvesting pigments . Single – celled organisms eventually became multicellular. Plants invaded land before animals.

89. Select the correct statement:

Ⓐ Pteridophytes appeared earlier than bryophytes and gymnosperms

Ⓑ Bryophytes appeared earlier than pteridophytes and gymnosperms

Ⓒ Gymnosperms appeared earlier than bryophytes and pteridophytes

Ⓓ Angiosperms were the first plants to have originated on earth

90. The first amphibians and the ancestors of modern day frogs are:

Ⓐ Lobefins Ⓑ Ichthyosaurs Ⓒ Seals Ⓓ None

91. Name the immediate ancestor of modern man.

Ⓐ *Ramapithecus* Ⓑ *Homo erectus*

Ⓒ *Homo sapiens neanderthalensis* Ⓓ *Homo habilis*

92. The phenomenon of 'Industrial melanism' demonstrates –

Ⓐ Natural selection Ⓑ Induced mutation Ⓒ Genetic drift Ⓓ Geographical isolation

■ **Read the given passage and answer the following questions (93-96):**

Mendelian disorders are caused due to alteration or mutation in a single gene. These follow Mendel's principles of inheritance. On the other hand, chromosomal disorders are caused due to excess, absence or abnormal arrangement of one or more chromosomes. Sometimes, the chromatids fail to segregate during cell division, resulting in gain or loss of a chromosome.

93. A sex linked recessive disorder in which the patient suffers from defect in blood coagulation. More males suffer from the disease than females. Females suffer from this disease only in the homozygous condition, X^hX^h. Identify the disease.

Ⓐ Haemophilia Ⓑ Sickle cell anaemia Ⓒ Thalassemia Ⓓ None

94. Trisomy is additional copy of a chromosome in an individual. It is represented as-

Ⓐ (3n+1) Ⓑ (3n-1) Ⓒ (2n+1) Ⓓ (2n-1)

95. Name the disease in which females are sterile with rudimentary ovaries and have a karyotype 44+XO.

Ⓐ Down's syndrome Ⓑ Klinefelter's syndrome Ⓒ Turner's syndrome Ⓓ Colour blindness

96. Colour blindness is a

Ⓐ Chromosomal disorder caused due to polyploidy Ⓑ Autosome linked recessive disease

Ⓒ Sex linked recessive disorder Ⓓ Result of monosomy

Study the picture given below and answer the following questions: (97-100)

97. Identify the figure that illustrates ovulation and match it correctly with the stage of oogenesis it represents.

Ⓐ f; secondary oocyte Ⓑ e; secondary oocyte Ⓒ g; corpus luteum Ⓓ d; primary oocyte

98. Name the ovarian hormone and the pituitary hormone, respectively, which has caused the above mentioned event.

Ⓐ Oestrogen and LH Ⓑ Oestrogen and FSH Ⓒ Progesteron and LH Ⓓ Progesteron and FSH

99. When does oogenesis initiate in human females?

Ⓐ At foetal stage Ⓑ At menarche

Ⓒ At blastula stage Ⓓ After the first menstrual cycle

100. During pregnancy, the hormone human chorionic gonadotropin is produced by _____ .

Ⓐ Ovary Ⓑ Uterus Ⓒ Corpus luteum Ⓓ Placenta