Monthly Progressive Test

Class: XII

Subject: PCMB

Academic Excellence Programme
TECHNO ACE

Test Booklet No.: MPT-05 **Test Date:** 1 2 1 2 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 MPT05 12122025.
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 scrible 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

Topic : Dual Nature of Particle, Atoms and Nuclei

1. In a double-silt experiment, the slits are separated by a distance d and the screen is at a distance D from the slits. If a maximum is formed just opposite to each of the slits, then what is the order of the fringe so formed?

Ⓐ $\frac{d^2}{2\lambda D}$ Ⓑ $\frac{2d^2}{\lambda D}$ Ⓒ $\frac{d^2}{\lambda D}$ Ⓓ $\frac{d^2}{4\lambda D}$

2. White light incidents normally on a slit of width d. The first minimum for red light ($\lambda = 6500$ Å) is produced at an angle 30° with the incident light. Then d will be

Ⓐ 3250 Å Ⓑ 6.5×10^{-4} cm Ⓒ 1.3 μm Ⓓ 2.6×10^{-4} cm

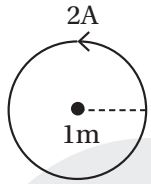
3. 2A current circulates in a circular loop of radius 1m. The magnetic field produced at the centre of the loop is

Ⓐ μ_0 tesla

Ⓑ $\frac{\mu_0}{2}$ tesla

Ⓒ 2π tesla

Ⓓ $\frac{\mu_0}{\pi}$ tesla



4. A solenoid of length 2 m and radius 1 cm has 500 turns. If 3 A current flows in the solenoid then magnetic field produced at the centre of solenoid is

Ⓐ 750 μ_0 tesla Ⓑ 3000 m_0 tesla Ⓒ $3\mu_0$ tesla Ⓓ $\frac{3\mu_0}{4\pi}$ tesla

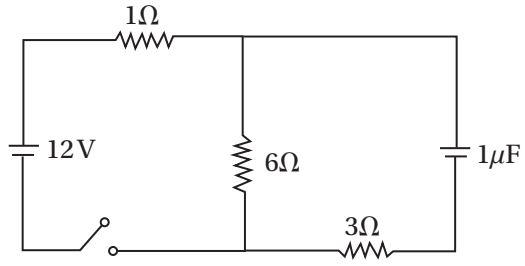
5. A charged particle moving in a crossed electric and magnetic fields E and B respectively, moves undeviated. The speed of the charted particle is

Ⓐ $\frac{E}{B}$ Ⓑ $\frac{B}{E}$ Ⓒ $\sqrt{E^2 + B^2}$ Ⓓ $(E + B)$

6. When a current I is set up in a wire of radius r, the drift velocity is v_d. If the same current is set up through a wire of radius 2r, the drift velocity will be

Ⓐ $4\,v_d$ Ⓑ $2\,v_d$ Ⓒ $v_d/2$ Ⓓ $v_d/4$

7. When the switch is closed, then the initial current through 1 Ω resistor is



Ⓐ 12 A Ⓑ 4 A Ⓒ $\frac{10}{7}$ A Ⓓ 3 A

8. Two electric bulbs A and B are rated 60 W and 100 W, respectively. If they are connected in parallel to the same source, then

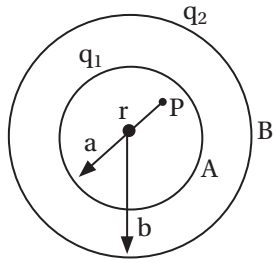
Ⓐ both the bulbs draw the same current

Ⓑ bulb A draws more current than bulb B

Ⓒ bulb B draws more current than bulb A

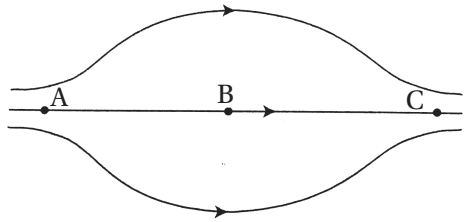
Ⓓ currents drawn in the bulbs are in the ratio of their resistances

9. There are two concentric shells A and B. A carries charge q_1 and B carries q_2 as shown in figure. A has radius a and B has radius b. The potential at point P is



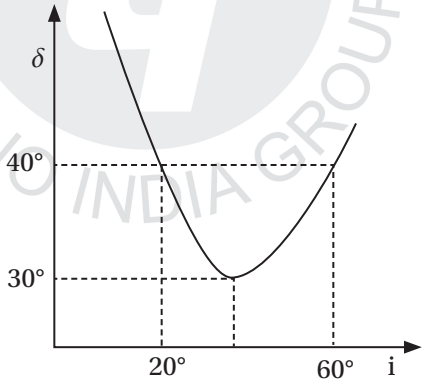
Ⓐ $\frac{q_1 + q_2}{4\pi\varepsilon_0 r}$ Ⓑ $\frac{q_1}{4\pi\varepsilon_0 a} + \frac{q_2}{4\pi\varepsilon_0 b}$ Ⓒ $\frac{q_1 + q_2}{4\pi\varepsilon_0 b}$ Ⓓ $\frac{q_1 + q_2}{4\pi\varepsilon_0 a}$

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



Ⓐ $E_A > E_B > E_C$ Ⓑ $E_A = E_B = E_C$ Ⓒ $E_A = E_C = E_B$ Ⓓ $E_A > E_C > E_B$

11. Graphical representation for the variations of angle of deviations with angle of incidence is as shown alongside. Find the angle of incidence corresponding to minimum deviation?



Ⓐ 25° Ⓑ 35° Ⓒ 45° Ⓓ 55°

12. The refractive index of a thin equi-convex lens is 1.5 and the radius of curvatures is 5 cm. The focal length of the lens inside water (refractive index = $\frac{4}{3}$)

Ⓐ + 10 cm Ⓑ + 20 cm Ⓒ – 10 cm Ⓓ – 20 cm

13. **Statement I:** For glass lens in air and real object, if the rays are diverging after emerging from a lens, the lens must be concave.

Statement II: The convex lens can give only converging rays.

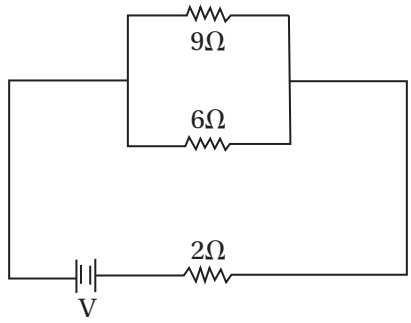
Ⓐ Statement I and Statement II both are correct Ⓑ Statement I is correct but Statement II is incorrect

Ⓒ Statement I is incorrect but Statement II is correct Ⓓ Statement I and Statement II both are incorrect

14. Two bulbs of wattage 40 W and 100 W rated at 220 V are connected in series across a 330 V. What will happen?

Ⓐ 40 W bulb will fuse Ⓑ 100 W bulb will fuse Ⓒ Both bulbs will fuse Ⓓ No bulb will fuse

15. If the power dissipated in the 9 Ω resistor in the circuit shown in 36 W, then the potential difference across the 2 Ω resistor is



Ⓐ 8 V Ⓑ 10 V Ⓒ 2 V Ⓓ 4 V

ASSERTION AND REASON (16–19):

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.

16. **Assertion (A) :** It is not possible to have interference between the waves produced by two violins.
Reason (R) : For interference of two waves the phase difference between the waves must remain constant.
(a) A (b) B (c) C (d) D

17. **Assertion (A) :** Photoelectric effect demonstrates the particle mature of light.
Reason (R) : Photoelectric current is proportional to frequency of incident radiation
(a) A (b) B (c) C (d) D

18. **Assertion (A) :** Total energy of an electron in a hydrogen atom is negative.
Reason (R) : Electron is bounded to the nucleus
(a) A (b) B (c) C (d) D

19. **Assertion (A) :** The nucleus X^{7}_{3} is more stable than the nucleus X_{3}^{6}
Reason (R) : Contains more number of protons.
(a) A (b) B (c) C (d) D

Case Study-I

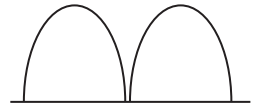
The focal length of a lens determined by the radii of curvature of its two surfaces and the refractive index of its medium with respect to that of the surrounding medium. The power of a lens is reciprocal of its focal length. If a number of lenses are kept in contact, the power of the combination is the algebric sum of the powers of the individual lenses.

20. A double convex lens, with each face having same radius of curvature R is made of refractive index n. It's power is—
(a) $\frac{2(n-1)}{R}$ (b) $\frac{(2n-1)}{R}$ (c) $\frac{(n-1)}{2R}$ (d) $\frac{(2n-1)}{2R}$

21. If the above lens has power P and if it cut into two equal parts perpendicular to its principle axis, the power of one part of the lens will be—

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

22. If the above lens cut along its principal, the two part are arranged as shown the figure.



The power of the combination will be

(a) Zero (b) P

(c) 2P (d) $\frac{P}{2}$

Case Study-II

A smart home uses sensors at the main door.

(i) The motion sensor(M) outputs 1 when movement is detected

(ii) The door sensor (D) out puts 1 when the door is opened

(iii) The alarms (A) should turn one only when both sensors detect smoking

(iv) The engineer designs the alarm circuit using logic gates

23. Which logic gate should be used so that the alarm turns on lonely when both M and D are 1.

(a) OR gate (b) AND gate (c) NOT gate (d) X OR gate

24. If M = 1; and D = What will be the alarm output using the choses deter—

(a) 0 (b) 1 (c) 0.707c (d) Can't be determined

25. If the engineer wants the alarm to turn on when either M or D is I, the gate used should be—

(a) AND gate (b) NOR gate (c) Or gate (d) NAND gate

Chemistry

26. The first order reaction has $k = 4.9 \times 10^{-3}\ S^{-1}$. How long will it take 4 g of this reactant to reduce to 3 g? ($\log_{10}4 = 0.6021$, $\log_{10}3 = 0.4771$)

Ⓐ 60 s Ⓑ 58.75 s

Ⓒ 62 s Ⓓ 50 s

27. The standard reduction potential for Fe^{2+}/Fe and Sn^{2+}/Sn electrodes are –0.44 V and –0.14 V respectively. For the cell reaction, $Fe^{2+} + Sn \rightarrow Fe + Sn^{2+}$, the standard emf is

Ⓐ +0.30 V Ⓑ –0.58

Ⓒ +0.58 V Ⓓ –0.30 V

28. Grignard's reagent on reaction with acetone forms

Ⓐ Tertiary alcohol Ⓑ Secondary alcohol

Ⓒ Acetic acid Ⓓ aldehyde

29. Select the correct product when $C_6H_5OCH_3$ reacts with excess HI.

Ⓐ $C_6H_5I + CH_3OH$ Ⓑ $C_6H_5OH + CH_3I$

Ⓒ $C_6H_5I + CH_3I$ Ⓓ $C_6H_5I + CH_2I_2$

30. Correct order of Bronsted acidity is

Ⓐ 4-nitrophenol > 2-nitrophenol > 3-nitrophenol > phenol

Ⓑ 4-nitrophenol > 3-nitrophenol > 2-nitrophenol > phenol

Ⓒ 2-nitrophenol > 4-nitrophenol > 3-nitrophenol > phenol

Ⓓ 2-nitrophenol > 3-nitrophenol > 4-nitrophenol > phenol

31. Correct statements about the by product obtained when phenol is prepared from cumene

(I) It takes part in haloform reaction

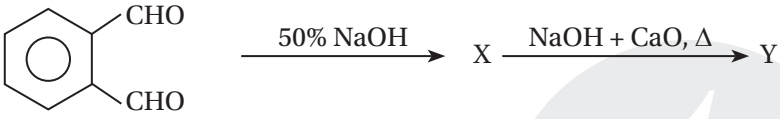
(II) It takes part in aldol condensation reaction but does not take part in cannizaro's reaction.

(III) It can show both tantomerism and functional isomerism.

(IV) It can not react with C_2H_5OH

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

32. Consider the following road map and select the correct statement about compound 'Y'



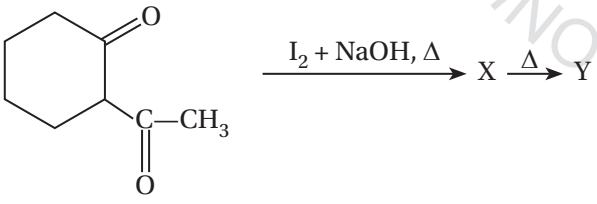
Ⓐ On nitration it produces meta substituted product

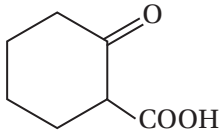
Ⓑ It is weaker Bronsted acid than phenol

Ⓒ It spontaneously forms white turbidity when anhydrous $ZnCl_2$ and concentrated HCl is added to it.

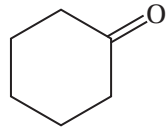
Ⓓ It can be produced after the reaction between benzaldehyde and methyl magnesium bromide with H_3O^+

33. Consider the following road map and select the correct end product.

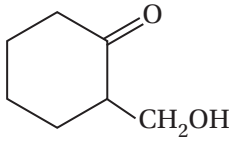


Ⓐ 

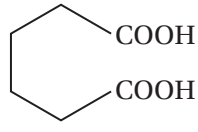
and yellow coloured CHI_3

Ⓑ 

and yellow coloured CHI_3

Ⓒ 

and yellow coloured CHI_3

Ⓓ 

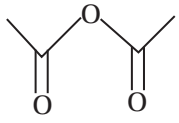
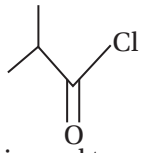
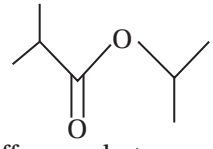
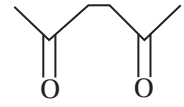
and yellow coloured CHI_3

34. $CH_3CHO \xrightarrow{\text{dilute NaOH, }\Delta} A \xrightarrow[H_3O^+]{LiAlH_4} B \xrightarrow{\text{alkaline } KMnO_4} \xrightarrow{NaOH,CaO,\Delta} D$

Compound 'D' is

Ⓐ Propane Ⓑ Butane Ⓒ Propene Ⓓ Butene

35. Which is hydrolysed to the maximum extent?

Ⓐ  Ⓑ  Ⓒ  Ⓓ 

36. Which of the following reagent is used to make chemical difference between methanoic acid and ethanoic acid?

Ⓐ Sodalime, heat
Ⓑ Fehling solutions, heat in water bath
Ⓒ Zinc dust, heat
Ⓓ $Ca(OH)_2$

37. Which of the following has the highest boiling point?

Ⓐ propane 1,2,3-triol Ⓑ propane 1,2-diol Ⓒ propanol Ⓓ propan-2-ol

Case Study Based Questions:

SN^2 reaction becomes favourable when the alkyl group is small or less crowded. In this mechanism, inversion of configuration occurs. In this reaction, the solvents are acetone, dimethyl sulphoxide (DMSO), dimethyl formamide (DMF).

38. Among the given compounds, which takes part in SN^2 reaction most spontaneously?

Ⓐ C_6H_5Br Ⓑ CH_3Br Ⓒ $(CH_3)_3Cl$ Ⓓ $CH_3CH(Br)CH_2CH_3$

39. (1R)-$CH_3CH(D)(Br)$ reacts with KOH in acetone medium. The correct product will be

Ⓐ (1R)-$CH_3CH(D)()OH$ only
Ⓑ (1S)-$CH_3CH(D)(OH)$ only
Ⓒ (a) major, (b) minor
Ⓓ (b) major, (a) minor

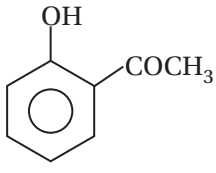
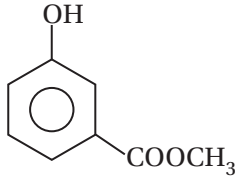
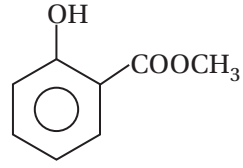
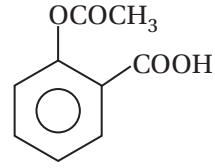
40. Which of the following molecule reacts with NaOH in DMF at the fastest rate?

Ⓐ $H_2C = CHBr$ Ⓑ $C_6H_5CH_2Br$ Ⓒ $H_2C = CH—CH_2Br$ Ⓓ $H_3CCH_2CH_2CH_2Br$

Question number 41 to 43 are based on the following passage, read the passage and select the correct answer.

2-hydroxybenzoic acid is prepared by the Kolbe-Schmidt reaction by using CO_2 and phenol in dilute acid medium at 4–6 atmosphere pressure and at 350°C temperature. When this compound reacts with ethanoyl chloride to form aspirin. This compound reacts with methanol in presence of H_2SO_4 to form methyl salicylate and after reaction with benzoyl chloride, salol is formed. When 2-hydroxybenzoic acid is heated with sodalime then phenol is formed.

41. Which of the following is formed when 2-dydroxybenzoic acid reacts with ethanoyl chloride?

Ⓐ  Ⓑ  Ⓒ  Ⓓ 

42. Which reaction is associated to produce 2-hydroxybenzoic acid?

Ⓐ Kolbe's electrolysis
Ⓑ Fridel-Crafts reaction
Ⓒ Claisen reaction
Ⓓ No option is correct

43. When benzoyl chloride reacts with 2-hydroxybenzoic acid then the correct product is

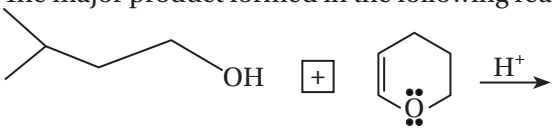
Ⓐ Benzyl benzoate
Ⓑ 2-hydroxybenzophenone
Ⓒ 3-hydroxybenzophenone
Ⓓ Benzoyl salicylate

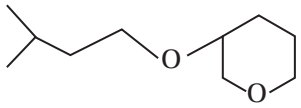
44. 0.004 M Na_2SO_4 solution is isotonic with 0.010 M $C_6H_{12}O_6$ solution at 298 K. What is the apparent degree of

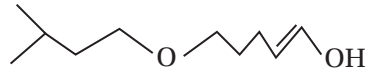
dissociation of Na_2SO_4?

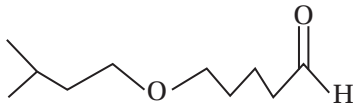
Ⓐ 90% Ⓑ 80% Ⓒ 75% Ⓓ 85%

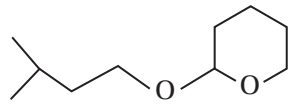
45. The major product formed in the following reaction is :



Ⓐ 

Ⓑ 

Ⓒ 

Ⓓ 

Assertion and Reason (Q.46–47) :

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.

46. **Assertion (A) :** Synthesis of ethyl phenyl ether may be achieved by williamson.

Reason (R) : Reaction of bromobenzene with sodium ethoxide yields phenyl ether.

Ⓐ a Ⓑ b Ⓒ c Ⓓ d

47. **Assertion (A) :** Zeise's saltt contain C_2H_4 molecule as one of the ligands.

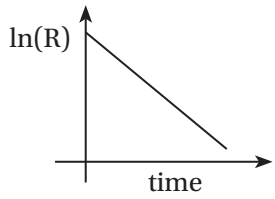
Reason (R) : Zeise's salt is an organometallic compound.

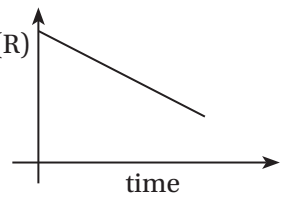
Ⓐ a Ⓑ b Ⓒ c Ⓓ d

48. The density of a solution prepared by dissolving 120 g of urea [mol. mass = 60 u] in 1000 g water is 1.15 g/mL. The molarity of this solution is :

Ⓐ 0.50 M Ⓑ 1.78 M Ⓒ 1.02 M Ⓓ 2.05 M

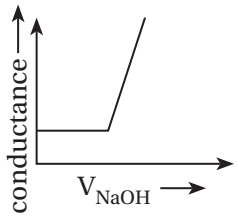
49. The given plots represents the variation of concentration of a reactant, R with time for two different reactions (i) and (ii). The respective orders of the reactions are :

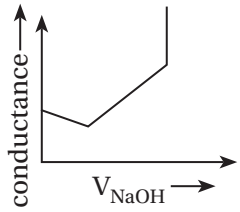
(i) 

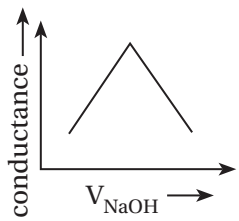
(ii) 

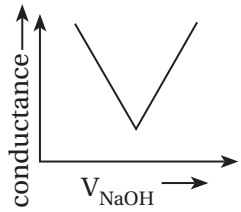
Ⓐ 1, 0 Ⓑ 1, 1 Ⓒ 0, 1 Ⓓ 0, 2

50. Choose the correct representation of conductometric titration of benzoic acid vs sodium hydroxide.

Ⓐ 

Ⓑ 

Ⓒ 

Ⓓ 

Mathematics

51. The vector equation of the line $6x - 2 = 3y + 1 = 2z - 2$ is

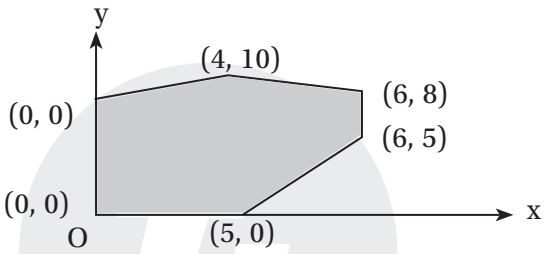
Ⓐ $\vec{r} = \left(\frac{1}{3}\hat{i} - \frac{1}{3}\hat{j} + \hat{k}\right) + \lambda(\hat{i} + 2\hat{j} + 3\hat{k})$ Ⓑ $\vec{r} = \left(\frac{1}{3}\hat{i} - \frac{1}{3}\hat{j} + \hat{k}\right) + \lambda(\hat{i} - 2\hat{j} + 3\hat{k})$

Ⓒ $\vec{r} = \left(\frac{1}{3}\hat{i} - \frac{1}{3}\hat{j} + \hat{k}\right) + \lambda(\hat{i} + 2\hat{j} - 3\hat{k})$ Ⓓ None of these

52. Let X and Y be two events such that $P(X) = \frac{1}{3}, P(X|Y) = \frac{1}{2}$ and $P(Y|X) = \frac{2}{5}$, Then

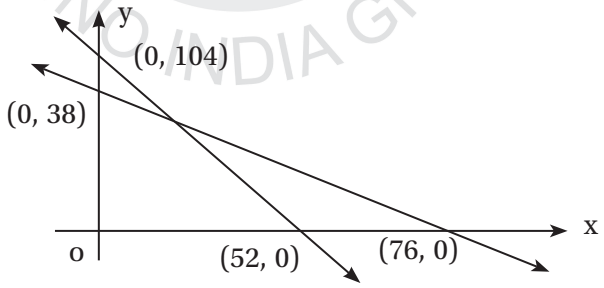
Ⓐ $P(Y) = \frac{3}{5}$ Ⓑ $P(X'|Y) = \frac{1}{2}$ Ⓒ $P(X \cup Y) = \frac{2}{5}$ Ⓓ $P(X \cap Y) = \frac{1}{5}$

53. The feasible region for an LPP is shown below : Let $z = 3x - 4y$ be the objective functiion. Minimum of z occurs at



Ⓐ (0, 0) Ⓑ (0, 8) Ⓒ (5, 0) Ⓓ (4, 10)

54. The feasible region of an LPP is given in the following figure.



Then, the constraints of the LPP are $x \geq 0$, $y \geq 0$ and

Ⓐ $2x + y \leq 52$ and $x + 2y \leq 76$ Ⓑ $2x + y \leq 104$ and $x + 2y \leq 76$

Ⓒ $x + 2y \leq 104$ and $2x + y \leq 76$ Ⓓ $x + 2y \leq 104$ and $2x + y \leq 38$

55. Let A = {3, 5}. Then number of reflexive relations on A is.

Ⓐ 2 Ⓑ 4 Ⓒ 0 Ⓓ 8

Case Study Based Question – I (Q. 56 to Q. 58) :

A cricket match is organised between the clubs A and B for which a team from each club is chosen. Remaining players of club A and club B are respectively sitting on the lines represented by the equations

$\frac{x-3}{1} = \frac{y-2}{2} = \frac{z+4}{2}$ and $\frac{x-5}{3} = \frac{y+2}{2} = \frac{z}{6}$ and to cheer the team of their own clubs.

On basis of this information given in passage answer following questions.

56. Find the vector equation of the line on which players of club A can be seated.

Ⓐ $\vec{r}=(3\hat{i}+2\hat{j}-4\hat{k})+\lambda(\hat{i}+2\hat{j}+2\hat{k})$ Ⓑ $\vec{r}=(3\hat{i}+2\hat{j}+4\hat{k})+\lambda(\hat{i}+2\hat{j}+2\hat{k})$

Ⓒ $\vec{r}=(3\hat{i}+2\hat{j}+4\hat{k})+\lambda(\hat{i}-2\hat{j}+2\hat{k})$ Ⓓ $\vec{r}=(3\hat{i}+2\hat{j}+4\hat{k})+\lambda(\hat{i}+2\hat{j}-2\hat{k})$

57. Write the direction cosines of the line on which players of club B are seated.

Ⓐ $\frac{3}{7},\frac{2}{7},\frac{4}{7}$ Ⓑ $\frac{3}{7},\frac{2}{7},\frac{5}{7}$ Ⓒ $-\frac{3}{7},\frac{2}{7},\frac{4}{7}$ Ⓓ $\frac{3}{7},\frac{2}{7},\frac{6}{7}$

58. Find the angle between the lines on which players of clubs A and B are seated.

Ⓐ $\cos^{-1}\left(\frac{17}{21}\right)$ Ⓑ $\cos^{-1}\left(\frac{19}{21}\right)$ Ⓒ $\sin^{-1}\left(\frac{17}{21}\right)$ Ⓓ $\cos^{-1}\left(\frac{17}{22}\right)$

Case Study Based Question–II (Q.59 to Q.61) :

A factory has three machines A, B and C to manufacture bolts. Machine A manufacture 30%, machine B manufacture 20% and machine C manufacture 50% of the bolts respectively. Out of their respective outputs 5%, 2% and 4% are defective. A bolt is drawn at random from total production and it is found to be defective.

On basis of the above information answer the following questions.

59. Probability that defective bolt drawn is manufactured by machine B, is

Ⓐ 0.3 Ⓑ 0.1 Ⓒ 0.2 Ⓓ 0.4

60. Probability that defective bolt drawn is manufactured by machine C, is

Ⓐ $\frac{16}{39}$ Ⓑ $\frac{17}{39}$ Ⓒ $\frac{20}{39}$ Ⓓ $\frac{15}{39}$

61. Probability that defective bolt is not manufactured by machine B, is

Ⓐ $\frac{35}{39}$ Ⓑ $\frac{61}{39}$ Ⓒ $\frac{41}{39}$ Ⓓ None of these

Assertion–Reason Based Questions (Q. 62 – Q. 65) :

Directions: In each of the questions given below, there are two statements marked as Assertion (A) and Reason (R). Mark your answer as per the codes provided below :

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

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

c. A is true but R is false.

d. A is false but R is true.

62. **Assertion (A) :** The vector equation of the line passing through the points (6, –4, 5) and (3, 4, 1) is $\vec{r} = (6\hat{i} - 4\hat{j} + 5\hat{k}) + \lambda(-3\hat{i} + 8\hat{j} + 4\hat{k})$

Reason (R) : The vector equation of the line passing through the points $\vec{a}$ and $\vec{b}$ is $\vec{r} = \vec{a} + \lambda(\vec{b} - \vec{a})$

Ⓐ a Ⓑ b Ⓒ c Ⓓ d

63. **Assertion (A) :** If A and B are two mutually exclusive events with $P(\bar{A}) = \frac{5}{6}$ and $P(B) = \frac{1}{3}$. Then $P(A|B)$ is equal to $\frac{1}{4}$.

Reason (R) : If A and B are two events such that P(A) = 0.2, P(B) = 0.6 and $P(A|B) = 0.2$ then the value of $P(A|\bar{B})$ is 0.2.

Ⓐ a Ⓑ b Ⓒ c Ⓓ d

64. **Assertion (A) :** Maximum value of Z = 3x + 2y, subject to the constraints $x + 2y \le 2$; $x \ge 0$; $y \ge 0$ will be obtained at point (2, 0).

Reason (R) : In a bounded feasible region, it always exist a maximum and minimum value.

Ⓐ a Ⓑ b Ⓒ c Ⓓ d

65. **Assertion (A) :** The solution of differential equation $\frac{dy}{dx} = \frac{x}{y}$ with initial condition x = 1 and y = 1 is x = y .

Reason (R) : Separation of variable method can be used to solve the differential equation.

Ⓐ a Ⓑ b Ⓒ c Ⓓ d

66. The solution set of the equation $\begin{vmatrix} x & 3 & 7 \\ 2 & x & 2 \\ 7 & 6 & x \end{vmatrix} = 0$ is

Ⓐ {2, –3, 7} Ⓑ {2, 7, –9} Ⓒ {–2, 3, 7} Ⓓ None of these

67. If $y = \sin^{-1}\left(\frac{x}{\sqrt{1+x^2}}\right) + \cos^{-1}\left(\frac{x}{\sqrt{1+x^2}}\right)$, then the value of $\frac{dy}{dx}$ is

Ⓐ 0 Ⓑ 1 Ⓒ $\frac{2}{1+x^2}$ Ⓓ $\frac{4}{1+x^2}$

68. $f(x) = 2|x - 2| + 3|x - 4|$ is _____ in (2, 4) .

Ⓐ decreasing Ⓑ increasing Ⓒ constant Ⓓ cannot be decided

69. Let [.] be the greatest integer function. Then $\int_0^{\frac{5}{2}} [x]dx =$

Ⓐ 2 Ⓑ 1 Ⓒ 0 Ⓓ None of these

70. $\int \frac{dx}{x(x^2+1)}$ is equal to

Ⓐ $\log|x| - \frac{1}{2}\log\left(x^2+1\right) + c$ Ⓑ $\frac{1}{2}\log|x| + \frac{1}{2}\log\left(x^2+1\right) + c$

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

71. Using integration, find the area of the region bounded by the line 2y + x = 8, the x-axis and the lines x = 2 and x = 4.

Ⓐ 5 sq. units Ⓑ 15 sq. units Ⓒ 25 sq. units Ⓓ 10 sq. units

72. A function f : R+ → R (where R+ is the set of all non-negative real numbers) defined by f(x) = 4x + 3 is

Ⓐ one-one but not onto Ⓑ onto but not one-one Ⓒ both one-one and onto Ⓓ neither one-one nor onto

73. The number of equivalence relations in the set {1, 2, 3} containing the elements (1, 2) and (2, 1) is

Ⓐ 0 Ⓑ 1 Ⓒ 2 Ⓓ 3

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

Ⓐ 1 Ⓑ $\frac{1}{2}$ Ⓒ $\frac{1}{3}$ Ⓓ $\frac{1}{4}$

75. If $A = \begin{bmatrix} 1 & 2 \\ -3 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & 0 \\ 2 & 3 \end{bmatrix}$, then

Ⓐ $A^2 = A$ Ⓑ $B^2 = B$ Ⓒ $AB \neq BA$ Ⓓ $AB = BA$

Biology

76. Which one of the following statements is correct?

Ⓐ Tapetum nourishes the developing pollen Ⓑ Hard outer layer of pollen is called intine

Ⓒ Sporogenous tissue is haploid Ⓓ Endothecium produces the microspores

77. Which is the correct pair in terms of edible parts?

Ⓐ Tomato—Thalamus Ⓑ Maize—Cotyledons Ⓒ Guava—Mesocarp Ⓓ Date palm—Pericarp

78. Gonads develop from embryonic :

Ⓐ Ectoderm Ⓑ Mesoderm

Ⓒ Endoderm Ⓓ Mesoderm and endoderm

79. Egg is liberated from ovary in:

Ⓐ Primary oocyte stage Ⓑ Secondary oocyte stage

Ⓒ Oogonial stage Ⓓ Mature ovum stage

80. Which two of the following statements are correct?

I. MTP during the first trimester, is generally safe

II. Chances of conception are nil until mother breast feeds the infant, upto two years

III. IUDs, like Copper-T, are effective contraceptives

IV. Contraceptive pills may be taken upto one week after coitus to prevent conception

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

81. Which one of the following is not an IUD?

Ⓐ CuT Ⓑ Progestasert

Ⓒ Multiload 375 Ⓓ Vaults

82. *Salmonella* is related with:

Ⓐ T.B Ⓑ Typhoid Ⓒ Tetanus Ⓓ Pneumonia

83. Which of the following is an opiate narcotic?

Ⓐ Amphetamines Ⓑ LSD Ⓒ Barbiturates Ⓓ Morphine

84. Biological control of agricultural pests, unlike chemical control, is

Ⓐ Self perpetuating Ⓑ Polluting Ⓒ Very expensive Ⓓ Toxic

85. Which one is wrongly matched?

Ⓐ Yeast – Ethanol Ⓑ Coliforms – Vinegar

Ⓒ *Streptomyces* – Antibiotics Ⓓ Methanogens – Gobar gas

86. A diploid organism is heterozygous for 4 loci, how many types of gametes can be produced?

Ⓐ 4 Ⓑ 8 Ⓒ 16 Ⓓ 32

87. Write the percentage of F2 homozygous and heterozygous populations in a typical monohybrid cross.

Ⓐ 25 % and 75 % Ⓑ 75 % and 25 %

Ⓒ 50 % each Ⓓ 65 % and 35 %

88. The number of linkage group in an organism is _____ the number of haploid chromosomes in the organism.

Ⓐ greater than Ⓑ equal to Ⓒ lesser than Ⓓ has no relation with

89. What is the criterion for DNA fragments movement on agarose during during gel electrophoresis?

Ⓐ The larger the fragment size, the farther it moves

Ⓑ The smaller the fragment size, the farther it moves

Ⓒ Positively charged fragments move to the farther end.

Ⓓ Negatively charged fragments do not move

90. Which of the following restriction enzymes produces blunt ends?

Ⓐ Xho I Ⓑ Hind III Ⓒ Sal I Ⓓ Eco RV

The questions 16 to 19 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. A—In recombinant DNA technology, human genes are often transferred into bacteria (prokaryotes) or yeast (eukaryotes).

R—Both bacteria and yeast multiply very fast to form a huge population which express the desired gene.

Ⓐ a Ⓑ b Ⓒ c Ⓓ d

92. A—It is not possible for an alien DNA to become part of a chromosome anywhere along its length and replicate normally.

R—Alien DNA must be linked to *ori* or origin of replication site to start replication.

Ⓐ a Ⓑ b Ⓒ c Ⓓ d

93. A—Small sized animals are rarely found in the polar regions.

R—Small sized animals have larger surface area relative to their volume and have to spend considerable amount of energy to generate body heat.

Ⓐ a Ⓑ b Ⓒ c Ⓓ d

94. A—Pyramid of energy is always upright.

R—When energy flows from a particular trophic level to the next trophic level, some energy is always lost as heat at each step.

Ⓐ a Ⓑ b Ⓒ c Ⓓ d

Case based Question (20–22)

Read the given passage and answer the following questions:

Life on earth appeared 500 million years ago after its formation about 4 billion years ago. In order to explain the origin of life on earth, different scientists and thinkers proposed several theories.

95. Which theory states that God has created life by his divine act of creation?

Ⓐ Theory of special creation Ⓑ Theory of spontaneous generation

Ⓒ Theory of chemical evolution Ⓓ Theory of Panspermia

96. The concept of chemical evolution is based on

Ⓐ Interaction of water, air and clay under intense heat

Ⓑ Effect of solar radiations on chemicals

Ⓒ Possible origin of life by combination of chemicals under suitable environmental conditions

Ⓓ Crystallization of chemicals

97. Name the scientist who rejected the theory of spontaneous generation and demonstrated that life came from pre existing life.

Ⓐ Louis Pasteur Ⓑ Charles Darwin Ⓒ Lamarck Ⓓ Abbe Lemiatre

Case based Question (23–25)

Read the given passage and answer the following questions:

DNA replication was proven to be semi conservative in nature. When Watson and Crick proposed the scheme for DNA replication, they said that the two strands of the double helix would separate and act as a template for the synthesis of the new complementary strand. After completion of replication, each DNA would have one parental strand and one newly synthesised strand.

98. What role does the enzyme topoisomerase play in DNA replication?

Ⓐ It unwinds the DNA strand.

Ⓑ It facilitates the joining of the two DNA strands together

Ⓒ It catalyses the polymerisation of nucleotides

Ⓓ It releases the tension in the DNA strand.

99. Identify the incorrect statement regarding DNA replication.

Ⓐ The DNA polymerase can initiate DNA replication process on its own randomly.

Ⓑ In case of eukaryotes, there are five different DNA polymerases that have been identified to catalyse the polymerisation of nucleotides.

Ⓒ Origin of replication also provides the site for attachment of RNA primer.

Ⓓ All of the above

100. How many types of DNA polymerase are responsible for the polymerization of deoxynucleotides in case of prokaryotes?

Ⓐ 2 Ⓑ 3 Ⓒ 4 Ⓓ 5