



# Monthly Progressive Test

Class: XII

Subject: PCMB



Test Booklet No.: MPT05

Test Date: 

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Time: 180 mins

Full Marks: 200

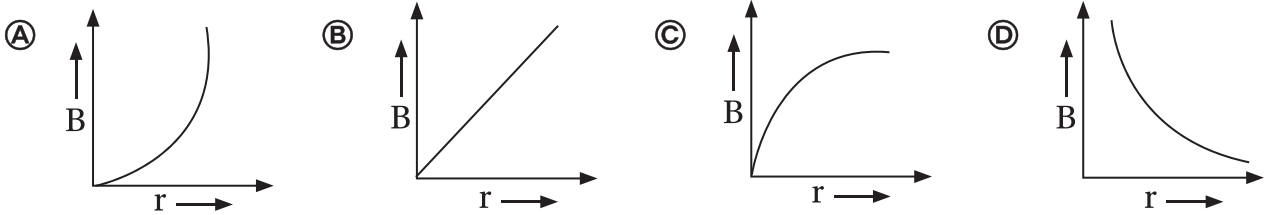
## Important Instructions :

1. The Test is of 180 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 .
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 scibble 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.

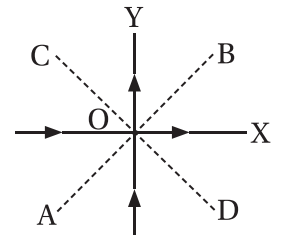
**Space For Rough Works**



1. The magnetic flux density  $B$  at a distance  $r$  from a long straight wire carrying current varies with distance  $r$  as shown in Fig.:

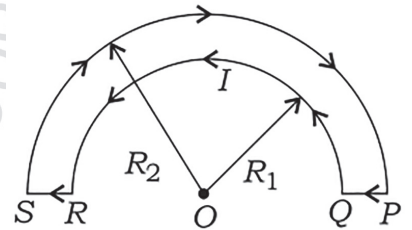


2. The figure shows two straight long wires insulated from each other along the axes  $x$  and  $y$  carrying equal current  $I$ .  $AB$  and  $CD$  are lines in the plane of the axes and at  $45^\circ$  with the axes. The magnetic field of the system is zero on the line:



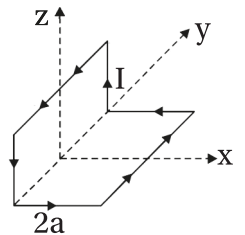
- (A)  $AB$                       (B)  $OB$  but not  $OA$   
 (C)  $CD$                       (D)  $OC$  but not  $OD$
3. The wire loop carries a current  $I$  as shown in figure. The magnetic field at the centre  $O$  is:

- (A) zero                      (B)  $\frac{\mu_0 I}{4} \left( \frac{1}{R_1} - \frac{1}{R_2} \right)$   
 (C)  $\frac{\mu_0 I}{4} \left( \frac{1}{R_1} + \frac{1}{R_2} \right)$       (D)  $\frac{\mu_0 I}{2} \left( \frac{1}{R_1} - \frac{1}{R_2} \right)$

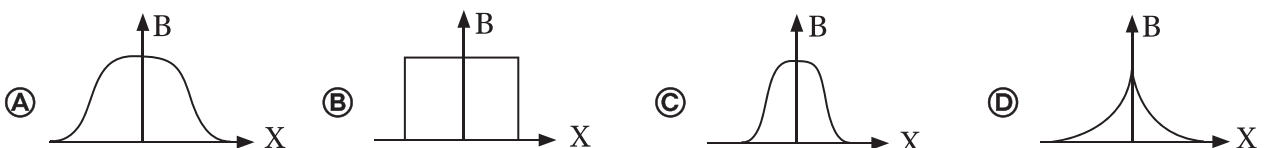


4. A non-planar loop of conducting wire carrying a current  $I$  placed as shown in the figure. Each of the straight sections of the loop is of length  $2a$ . The magnetic field due to this loop at the point  $P(a, 0, a)$  points in the direction:

- (A)  $\frac{1}{\sqrt{2}}(-\hat{j} + \hat{k})$       (B)  $\frac{1}{\sqrt{3}}(-\hat{j} + \hat{k} + \hat{i})$   
 (C)  $\frac{1}{\sqrt{3}}(\hat{i} + \hat{j} + \hat{k})$       (D)  $\frac{1}{\sqrt{2}}(\hat{i} + \hat{k})$



5.  $B$  along the axis of a solenoid is given by:



6. A wire of length  $L$  m carrying a current  $I$  ampere is bent in the form of a circle. Its magnetic moment will be:

- (A)  $\frac{IL}{4\pi}$                       (B)  $\frac{IL^2}{4\pi}$                       (C)  $\frac{I^2L^2}{4\pi}$                       (D)  $\frac{LI^2}{4\pi}$

7. A positively charged particle moving with velocity  $v$  enters a region of space having a constant magnetic induction  $\vec{B}$ . The particle will experience the largest force when the angle between vectors  $\vec{v}$  and  $\vec{B}$  is:

- (A)  $0^\circ$                       (B)  $45^\circ$                       (C)  $90^\circ$                       (D)  $180^\circ$

### Assertion Reason based Questions (8-9):

**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.

8. **Assertion:** An electron while coming vertically from another space to the earth space enters the earth's magnetic field at equator, it is deflected towards west.

**Reason:**  $F = -e(\vec{v} \times \vec{B})$ , Earth magnetic lines of forces directed from geographical south-pole to geographical north-pole

- (A) A                      (B) B                      (C) C                      (D) D

9. **Assertion:** If a charged particle moving in a circular path in a uniform magnetic field, the magnetitude of linear momentum of the particle is not changing.

**Reason:** Velocity of the particle is not changing in the magnetic field.

- (A) A                      (B) B                      (C) C                      (D) D

10. Flux  $\phi$  (in weber) in a closed-circuit of resistance 10 ohm varies with time  $t$  (in sec) according to the equation:

$$\phi = 6t^2 - 5t + 1$$

What is the magnitude of the induced current at  $t = 0.25$ s?

- (A) 1.2 A                      (B) 0.8 A                      (C) 0.6 A                      (D) 0.2 A

**Assertion Reason based Questions (11–12):**

**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.

**11. Assertion:** When a coil is rotated in a uniform magnetic field about an axis perpendicular to the field, emf is induced in it which is maximum for the orientation of the coil in which magnetic flux through the coil is zero.

**Reason:** In an electric generator, electrical energy is generated by rotating a coil in a magnetic field.

- (A) A                      (B) B                      (C) C                      (D) D

**12. Assertion:** An emf  $E$  is induced in a closed loop where magnetic flux is varied. The induced emf  $E$  produced does not come from a conservative field.

**Reason:** The line integral of  $\vec{E} \cdot d\vec{l}$  around the closed loop is non-zero.

- (A) A                      (B) B                      (C) C                      (D) D

**13.** A direct current of 5 A is superimposed on an alternating current  $I = 10 \sin \omega t$  flowing through a wire. The effective value of the resulting current will be:

- (A)  $\left(\frac{15}{2}\right)$  A                      (B)  $5\sqrt{3}$  A                      (C)  $5\sqrt{5}$  A                      (D) 15 A

**14.** The reactance of a coil when used in the domestic ac power supply (220 V – 50 Hz) is  $100 \Omega$ . The self-inductance of the coil is nearly:

- (A) 3.2 henry                      (B) 0.32 henry                      (C) 2.2 henry                      (D) 0.22 henry

**15.** A coil of resistance  $R$  and inductance  $L$  is connected to a battery of  $E$  volt emf. The final current flowing in the coil is:

- (A)  $\frac{E}{R}$                       (B)  $\frac{E}{L}$                       (C)  $E / (R^2 + \omega^2 L^2)^{1/2}$                       (D)  $EL(R^2 + L^2)^{1/2}$

**Assertion Reason based Questions (16–17):**

**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.

**16. Assertion :** A current carrying conductor is not charged.

**Reason :** At any instant, in a conductor number of proton is equal to number of electron.

- (A) A                      (B) B                      (C) C                      (D) D

**17. Assertion :** In conductor, free electrons cannot constitute a current, in absence of a field.

**Reason :** Inside conductor, free electrons move randomly.

- (A) A                      (B) B                      (C) C                      (D) D

**18. Magnetic field induction ( $B$ ) at the centre  $O$  of the circular arc of central angle  $\theta$  and radius  $R$ , carrying a current  $I$  is**

- (A)  $\left(\frac{\theta}{2\pi}\right)\left(\frac{\mu_0}{4\pi}\right)\left(\frac{2\pi I}{R}\right)$                       (B)  $\frac{\mu_0}{4\pi}\left(\frac{I}{R}\right)(\theta)$

- (C) Both (A) and (B) are correct                      (D) None of these

**19. The magnetic field lines due to straight conductor carrying current are in the form of**

- (A) Concentric ellipse                      (B) Concentric square  
 (C) Concentric circle                      (D) None of these

**20. If a charge of + one coulomb while moving at right angle to a magnetic field with a velocity of 1 m/s experiences a force of 1 newton, at that point magnetic field of induction is**

- (A) 2 tesla                      (B) 1 tesla                      (C) 1.5 tesla                      (D) 2.5 tesla

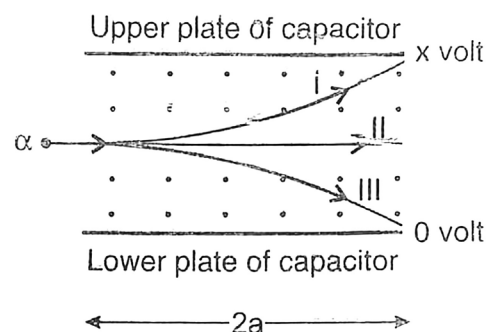
**Comprehension Type Questions**

In a beam of charged particles where the particles could be moving at different speeds, it is possible to separate charged particles moving at a definite speed with the help of an arrangement called 'Velocity Selector.' A velocity selector is an arrangement of mutually perpendicular electric and magnetic fields in a common region. A charged particle passing through such an arrangement experiences both electric and magnetic forces. Directions of

fields, which are mutually perpendicular, are so selected that electric and magnetic forces acting on the particle are in opposite directions. If a beam of charged particles, that has particles travelling at various speeds, passes through a 'velocity selector', only those charged particles pass undeviated which travel at a speed for which electric and magnetic forces are equal in magnitude, so that, their directions being opposite, net force will be zero.

Velocity selector is an important component in many experiments involving moving charged particles, e.g., a 'Mass Spectrometer'.

Suppose you have to design a velocity selector to select only those alpha particles in a beam that are moving at a speed  $3.8 \times 10^6$  m/s. You have a parallel plate capacitor having a plate separation 1.5 cm and also a power supply so that a potential difference can be applied between the plates of capacitor. Obviously, this will result in an electric field between the plates. You have also a permanent magnet using which a uniform magnetic field  $B = 0.2$  T can be applied in the region between the plates of capacitor and in a manner perpendicular to electric field. You apply magnetic field in a direction out of the paper. The arrangement is as shown in figure. [Take mass of  $\alpha$ -particle,  $m_\alpha = 4$  amu ( $1 \text{ amu} = 1.67 \times 10^{-27}$  kg) and charge on  $\alpha$ -particle =  $2e$  ( $e = 1.6 \times 10^{-19}$  C)].



Answer the following questions:

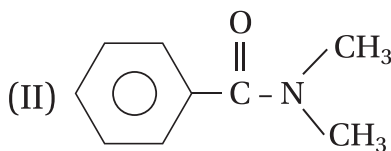
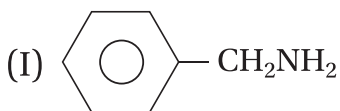
21. Direction of magnetic force acting on  $\alpha$ -particle is:
  - (A) upward
  - (B) downward
  - (C) uncertain
  - (D) along the direction of initial motion of  $\alpha$ -particle
22. In the absence of electric field and considering the action of magnetic field only, and assuming that  $\alpha$ -particle is moving in the plane of paper, path of  $\alpha$ -particle as seen from above will be:
  - (A) circular clockwise
  - (B) circular anticlockwise
  - (C) a straight line
  - (D) parabolic anticlockwise
23. Voltage that needs to be applied across the capacitor plates so that  $\alpha$ -particles of speed  $v = 3.8 \times 10^6$  m/s pass undeviated (along path II in the figure) will be such that  $x$ , referring to the given figure, is:
  - (A)  $x = -1.14 \times 10^4$
  - (B)  $x = -2.28 \times 10^5$
  - (C)  $x = -3.42 \times 10^5$
  - (D)  $x = +6.23 \times 10^4$
24. Consider an alpha particle 'A' in the beam moving at  $4.4 \times 10^6$  m/s and another beta particle 'B' moving at  $3.2 \times 10^6$  m/s. In the presence of both electric and magnetic fields and with  $x$  being the same as calculated above:
  - (A) A will move along path I while B along path III

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- Ⓑ A will move along path II while B along path I  
Ⓒ A will move along path III while B along path II  
Ⓓ A will move along path III while B along path I
25. Find the deflection suffered by an  $\alpha$ -particle moving at  $4.4 \times 10^6$  m/s when it passes through the given velocity selector which is designed to select a velocity  $3.8 \times 10^6$  m/s? You may express the answer as a function of time 't' (sec) spent inside the fields.
- Ⓐ  $6.54 \times 10^{14} t^2$  m   Ⓑ  $3.36 \times 10^{13} t^2$  m   Ⓒ  $2.87 \times 10^{12} t^2$  m   Ⓓ  $1.62 \times 10^{11} t^2$  m

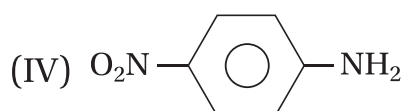
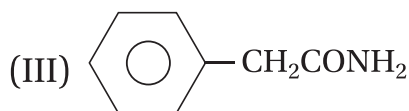
## Chemistry

26. Select the correct product when  $C_6H_5OCH_3$  reacts with excess HI ?  
Ⓐ  $C_6H_5I + CH_3OH$    Ⓑ  $C_6H_5OH + CH_3I$    Ⓒ  $C_6H_5I + CH_3I$    Ⓓ  $C_6H_5I + CH_2I_2$
27. 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 Cannizzaro's reaction  
(III) It can show both tautomerism and functional isomerism  
(IV) It cannot react with  $C_2H_5OH$
- Ⓐ I, II, III, IV   Ⓑ I, II, IV   Ⓒ II, III, IV   Ⓓ I, II, III
28. 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
29. 2 - hydroxybenzoic acid is heated with sodalime and 1.1 gm  $CO_2$  is formed. What mass of ethanoyl anhydride reacts with the acid to form aspirin [C = 12, O = 16, H = 1] ?  
Ⓐ 2.65 gm   Ⓑ 2.45 gm   Ⓒ 2.55 gm   Ⓓ 2.35 gm
30. Among the given molecules, how many will not form ammonia gas after heating with concentrated NaOH solution ?





[7]



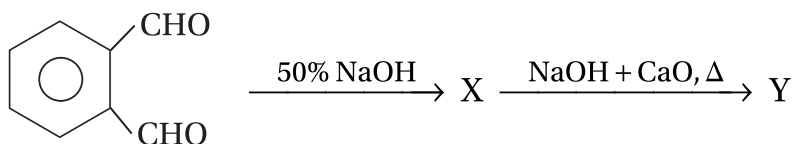
(A) I, II, III, IV

(B) I, II, IV

(C) II, III, IV

(D) I, II, III

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



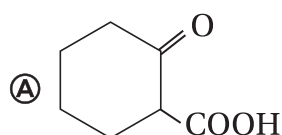
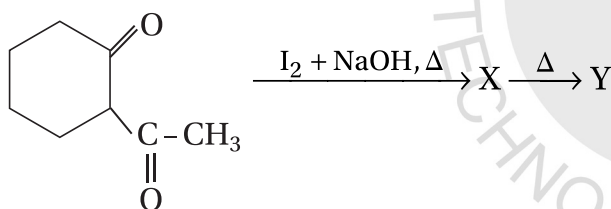
(A) On nitration it produces meta substituted product

(B) It is weaker Bronsted acid than phenol

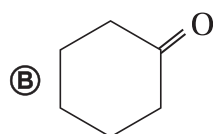
(C) It spontaneously forms white turbidity when anhydrous  $ZnCl_2$  and concentrated HCl is added to it

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

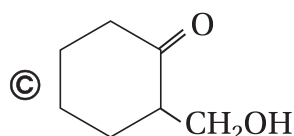
32. Consider the following road map and select the correct end product



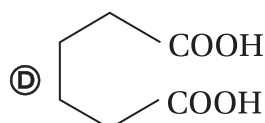
and yellow coloured  $CHI_3$



and yellow coloured  $CHI_3$



and yellow coloured  $CHI_3$



and yellow coloured  $CHI_3$

33. Correct order of Bronsted acidity of the following compounds is

- (A)  $\text{CH}_3\text{C} \equiv \text{CCOOH} \rangle \text{CH}_3\text{CH} = \text{CHCOOH} \rangle \text{CH}_3\text{CH}_2\text{CH}_2\text{COOH} \rangle \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$   
 (B)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH} \rangle \text{CH}_3\text{CH}_2\text{CH}_2\text{COOH} \rangle \text{CH}_3\text{CH} = \text{CHCOOH} \rangle \text{CH}_3\text{C} \equiv \text{CCOOH}$   
 (C)  $\text{CH}_3\text{C} \equiv \text{CCOOH} \rangle \text{CH}_3\text{CH}_2\text{CH}_2\text{COOH} \rangle \text{CH}_3\text{CH} = \text{CHCOOH} \rangle \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$   
 (D)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH} \rangle \text{CH}_3\text{C} \equiv \text{CCOOH} \rangle \text{CH}_3\text{CH} = \text{CHCOOH} \rangle \text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$

Question number 34 to 37 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  $\text{CO}_2$  and phenol in dilute acid medium at 4-6 atmosphere pressure and at  $350^\circ\text{C}$  temperature. When this compound reacts with ethanoyl chloride to form aspirin. This compound reacts with methanol in presence of  $\text{H}_2\text{SO}_4$  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.

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



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

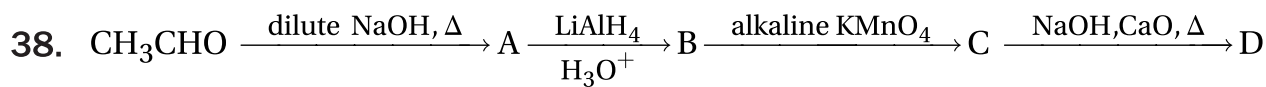
- (A) Kolbe's electrolysis (B) Fridel - Crafts reaction  
 (C) Claisen reaction (D) No option is correct

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

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

37. After reacting with which reagent, 2 - hydroxybenzoic acid produces such a compound that is an essential component of pain removing solution for external use ?

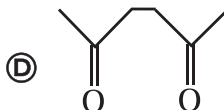
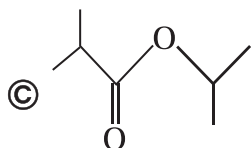
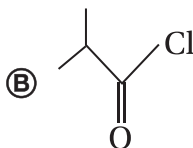
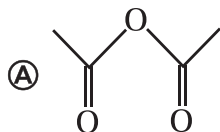
- (A) Sodalime, heat (B) Benzoyl chloride  
 (C)  $\text{CH}_3\text{OH}$ , concentrated  $\text{H}_2\text{SO}_4$  (D)  $\text{Ca}(\text{OH})_2$ , heat



Compound 'D' is

- (A) Propane                      (B) Butane                      (C) Propene                      (D) Butene

39. Which is hydrolysed to the maximum extent ?



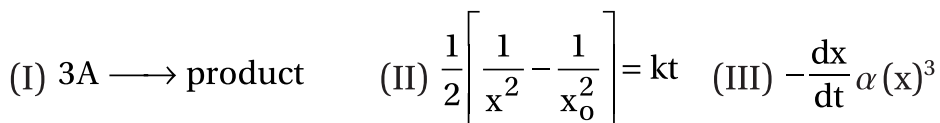
40. Which of the following reagent is used to make chemical difference between methanoic acid and ethanoic acid ?

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

41. 0.004 M  $\text{Na}_2\text{SO}_4$  solution is isotonic with 0.010 M  $\text{C}_6\text{H}_{12}\text{O}_6$  solution at 298 K. What is the apparent degree of dissociation of  $\text{Na}_2\text{SO}_4$  ?

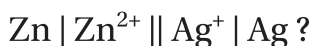
- (A) 90%                      (B) 80%                      (C) 75%                      (D) 85%

42. The correct expression of half life of a reaction is  $t_{50\%} \propto \frac{1}{x_0^2}$ . The correct equations, related to this reaction are



- (A) I, II, III                      (B) II, III                      (C) I, III                      (D) I, II

43. Which of the following conditions will increase the voltage of the cell of given representation



- (A) By increasing the dimension of zinc electrode  
(B) By increasing concentration of  $\text{Ag}^+$   
(C) By increasing the dimension of silver electrode  
(D) By increasing concentration of  $\text{Zn}^{2+}$

44. If  $E^\circ_{(A^+/A)} = -0.287 \text{ v}$ ,  $E^\circ_{(B^+/B)} = +0.106 \text{ v}$ ,  $E^\circ_{(D^+/D)} = -1.04 \text{ v}$ ,  $E^\circ_{(H^+/\frac{1}{2}H_2)} = 0.0 \text{ v}$ , then which metal cannot release  $H_2$  gas from dilute  $H_2SO_4$  solution ?
- (A) Metal A                      (B) Metal B  
 (C) Metal C                      (D) A, B, C all can release  $H_2$  gas from dilute  $H_2SO_4$  solution
45.  $C_2H_5COOH \xrightarrow[\Delta]{Ag_2O} X \xrightarrow{Br_2} Y$

Correct statement about compound Y is —

- (A) Boiling point of 'Y' is higher than its higher homolog  
 (B) Compound 'Y' always take part in  $SN^1$  reactions  
 (C) Compound 'Y' is highly soluble in water  
 (D) Compound 'Y' has only primary carbon atoms
46. Select the wrong statement
- (A) Boiling point of aldehydes and ketones are lower than those of alcohols of similar masses  
 (B) Alcohols show intermolecular hydrogen bonding where as aldehydes and ketones donot  
 (C) Lower members of aldehydes and ketones are partially soluble in water as they can form hydrogen bond with water  
 (D) Solubility of aldehydes and ketones increases rapidly on increasing the length of alkyl chain

**Question number 47 to 50 are ASSERTION - REASON TYPE. Select the correct option**

**OPTION A :** Assertion and reason both are correct and reason is the correct explanation of assertion

**OPTION B :** Assertion and reason both are correct and reason is not the correct explanation of assertion

**OPTION C :** Assertion is correct but reason is wrong

**OPTION D :** Assertion is wrong but reason is correct

47. **Assertion :** In laboratory, phenol is kept inside coloured bottle in absence of oxygen

**Reason :** In presence of sunlight and oxygen, phenol is oxidised into quinone

48. **Assertion :**  $CH_3CH_2COOH$  is stronger Bronsted acid than  $CH_2(NO_2)COOH$

**Reason :** Presence of electron withdrawing group in carboxylic acid increases the Bronsted acidity

49. **Assertion :**  $\text{CH}_3\text{CH}_2\text{CONH}_2$  is weaker Lewis base than  $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$

**Reason :** Lone pair on nitrogen in amide molecule receives resonance stability

50. **Assertion :** When phenol is shaken with bromine water then white precipitation is obtained

**Reason :** In this reaction, a mixture of 2-bromophenol and 4-bromophenol is formed

## Mathematics

51.  $\int \frac{\sqrt{\tan x}}{\sin x \cos x} dx =$

- (A)  $2\sqrt{\tan x}$       (B)  $2\sqrt{\cot x}$       (C)  $\sqrt{\cot x}$       (D)  $\sqrt{\tan x}$

52.  $\int \frac{\sin 2x dx}{a^2 \cos^2 x + b^2 \sin^2 x} =$

- (A)  $(b - a) \log(a^2 \cos^2 x + b^2 \sin^2 x)$       (B)  $\frac{1}{b^2 - a^2} \log(a^2 \cos^2 x - b^2 \sin^2 x)$   
 (C)  $\frac{1}{b^2 - a^2} \log(a^2 \cos^2 x + b^2 \sin^2 x)$       (D)  $\frac{1}{a^2 + b^2} \log(a^2 \cos^2 x + b^2 \sin^2 x)$

53.  $\int \frac{1}{x(x^4 - 1)} dx =$

- (A)  $\log\left(\frac{x^4}{x^4 - 1}\right)$       (B)  $\frac{1}{2} \log\left(\frac{x^2 - 1}{x^2 + 1}\right)$       (C)  $\frac{1}{4} \log\left(\frac{x^4 - 1}{x^4}\right)$       (D)  $\log \frac{x(x^2 - 1)}{x^2 + 1}$

54.  $\int \frac{dx}{(2+x)\sqrt{1+x}} =$

- (A)  $2 \tan^{-1} \sqrt{1+x}$       (B)  $\frac{1}{2} \tan^{-1} \sqrt{1+x}$       (C)  $\tan^{-1} \sqrt{1+x}$       (D)  $\log\{(2+x)\sqrt{1+x}\}$

55.  $\int_0^{\pi} \frac{x \sin x}{2 - \sin^2 x} dx =$

- (A)  $\frac{\pi^2}{4}$       (B)  $\frac{\pi^2}{2}$       (C)  $\frac{\pi}{2}$       (D)  $\frac{\pi}{4}$

$$56. \int_0^{\pi} \sqrt{\frac{1+\cos 2x}{2}} dx =$$

- (A) 2                      (B) 0                      (C) -1                      (D) 1

57. The area bounded by  $y^2 = 4x$  and its latus rectum is

- (A) 1 sq. unit              (B)  $\frac{8}{3}$  sq. units              (C)  $\frac{2}{3}$  sq. units              (D) None of these

### Assertion Reason based Questions (58–59):

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

- (a) Assertion is correct, Reason is correct; Reason is a correct explanation for assertion.  
 (b) Assertion is correct, Reason is correct; Reason is not a correct explanation for Assertion.  
 (c) Assertion is correct, Reason is incorrect  
 (d) Assertion is incorrect, Reason is correct.

$$58. \text{Assertion: } \int_{-2}^2 \log\left(\frac{1+x}{1-x}\right) dx = 0.$$

**Reason:** If  $f$  is an odd function, then  $\int_{-a}^a f(x) dx = 0$ .

- (A) a                      (B) b                      (C) c                      (D) d

$$59. \text{Assertion: } \int [\sin(\log x) + \cos(\log x)] dx = x \sin(\log x) + c$$

**Reason:**  $\frac{d}{dx}[x \sin(\log x)] = \sin(\log x) + \cos(\log x)$ .

- (A) a                      (B) b                      (C) c                      (D) d

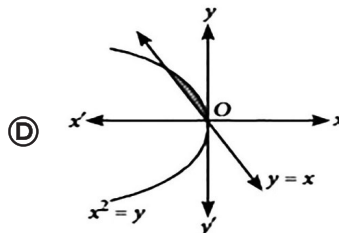
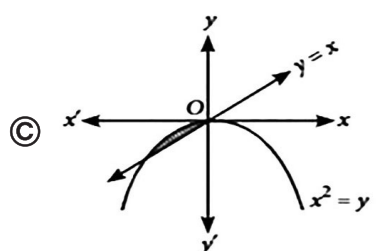
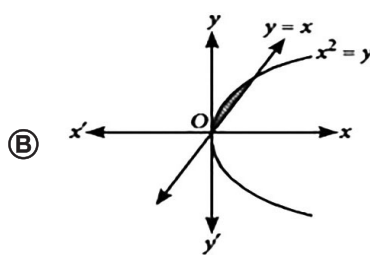
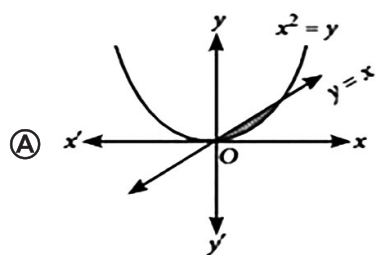
### Case Study Based Questions (60–62):

Consider the following equations of curves  $x^2 = y$  and  $y = x$ . On the basis of above information, answer the following questions.

60. The point(s) of intersection of both the curves is (are)

- (A) (0, 0), (2, 2)              (B) (0, 0), (1, 1)              (C) (0, 0), (-1, -1)              (D) (0, 0), (-2, -2)

61. Area bounded by the curves is represented by which of the following graph?



62. The value of area bounded by the curves  $x^2 = y$  and  $x = y$  is

- (A)  $\frac{1}{6}$  sq. unit      (B)  $\frac{1}{3}$  sq. unit      (C)  $\frac{1}{2}$  sq. unit      (D) 1 sq. unit

63.  $\int \sqrt{1+x^2} d(x^2) =$

- (A)  $\frac{2}{3x}(1+x^2)^{3/2}$       (B)  $\frac{2}{3}(1+x^2)^{3/2}$       (C)  $\frac{2x}{3}(1+x^2)^{3/2}$       (D)  $\frac{2x}{3}(1+x^2)$

64.  $\int_0^{\pi/2} \log(\tan x) dx =$

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

65. The area bounded by the curves  $y = \sqrt{x}$ ,  $2y + 3 = x$  and  $x$ -axis in the 1<sup>st</sup> quadrant is

- (A) 9 sq. units      (B)  $\frac{27}{4}$  sq. units      (C) 36 sq. units      (D) 18 sq. units

66. If  $y = \cos^{-1}\left(\frac{2\cos x - 3\sin x}{\sqrt{13}}\right)$ , then  $\frac{dy}{dx}$  is

- (A) Zero      (B) Constant = 1      (C) Constant  $\neq 1$       (D) None of these

67. The interval in which  $y = x^2 e^x$  is decreasing is

- (A)  $(-\infty, \infty)$       (B)  $(-\infty, -2)$       (C)  $(0, \alpha)$       (D)  $(-2, 0)$

68. If  $f(x) = \begin{cases} \frac{1 - \cos \lambda x}{x \sin x}, & x \neq 0 \\ \frac{1}{2}, & x = 0 \end{cases}$  is continuous at  $x = 0$ , then  $\lambda$  is
- (A) 0                      (B)  $\pm 1$                       (C) 1                      (D) None of these
69. The range of the function  $f(x) = \sqrt{(x-1)(3-x)}$  is
- (A)  $[1, 3]$                       (B)  $[0, 1]$                       (C)  $[-2, 2]$                       (D) None of these
70. The principal value of  $\cos^{-1}\left(-\sin \frac{7\pi}{6}\right)$
- (A)  $\frac{5\pi}{3}$                       (B)  $\frac{7\pi}{6}$                       (C)  $\frac{\pi}{3}$                       (D) None of these
71.  $\int_{\pi/8}^{7\pi/8} \frac{x dx}{\cos^2 x - \sin^2 x} =$
- (A)  $\frac{\pi}{2} \log(3 - 2\sqrt{2})$                       (B)  $\frac{\pi}{4} \log(3 - 2\sqrt{2})$                       (C)  $\pi \log(\sqrt{2} - 1)$                       (D)  $\pi \log(\sqrt{2} + 1)$
72.  $\int \frac{3^x dx}{\sqrt{1-9^x}} =$
- (A)  $\log_e 3(\sin^{-1}(3^x))$                       (B)  $\frac{1}{\log_e 3} \sin^{-1}(3^x)$
- (C)  $\log_e 3(\sin^{-1}(3^{x/2}))$                       (D)  $\frac{1}{\log_e 3} \sin^{-1}(3^{x/2})$
73. If  $\int \tan^4 x dx = a \tan^3 x + b \tan x + cx$ , then
- (A)  $a = \frac{1}{3}, b = -1, c = 1$                       (B)  $a = \frac{1}{2}, b = -1, c = 1$
- (C)  $a = \frac{1}{2}, b = -1, c = 2$                       (D)  $a = \frac{1}{2}, b = -2, c = 1$
74.  $\int \left( \frac{1}{\log x} - \frac{1}{(\log x)^2} \right) dx =$
- (A)  $x \log x$                       (B)  $\frac{x}{\log x}$                       (C)  $\log x$                       (D) None of these



75. Area bounded by the curve  $x^2 = 4y$  and the straight line  $x = 4y - 2$  is

- (A)  $\frac{8}{9}$  sq. unit      (B)  $\frac{9}{8}$  sq. units      (C)  $\frac{4}{3}$  sq. units      (D) None of these

### Biology

76. Choose the primary lymphoid organ from the list given below:

- (A) Bone marrow      (B) Spleen  
(C) Lymph nodes      (D) All

77. Colostrum is rich in which antibody?

- (A) IgA      (B) IgG      (C) IgM      (D) IgE

78. How does a restriction nuclease function?

- (A) It is used for cutting DNA at a specific location  
(B) It acts as a selective marker.  
(C) It joins the cut ends of DNA.  
(D) It is used for hydrolysing the peptidoglycan of bacterial cell wall.

79. Name a bacterium used in Recombinant DNA Technology

- (A) *Salmonella typhimurium*      (B) *Acetobacter aceti*  
(C) *Clostridium tetani*      (D) All

80. Polymerase Chain Reaction (PCR) is concerned with—

- (A) Amplification of the gene of interest      (B) Isolation of genetic material  
(C) Isolation of desired DNA fragment      (D) Ligation of DNA fragments

81. Use of bioresources by multinational companies, without proper authorisation from the countries or people concerned is called

- (A) Bioethics      (B) Biopatent      (C) Biopiracy      (D) Biological warfare

82. The Bt toxin produced by *Bacillus thuringiensis* is a/an—

- (A) Fungicide      (B) Insecticide      (C) Molluscide      (D) Rodenticide

83. How can deficiency of ADA be treated?

- (A) By gene therapy      (B) By bone marrow transplantation  
(C) By enzyme replacement therapy      (D) All

84. Crystals of Bt toxin are produced by some bacteria, but the bacteria is not harmed because

- (A) Bacteria are resistant to toxin

- Ⓑ The toxin is inactive in bacteria
- Ⓒ Bacteria enclose the toxin in a special cover
- Ⓓ The toxin is immature

### Assertion-Reason type Questions (85–87):

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

- A. Both Assertion and Reason are true and Reason is the correct explanation of the Assertion.
- B. Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.
- C. Assertion is true but Reason is false.
- D. Assertion is false but Reason is true.

**85. Assertion:**  $\text{CaCl}_2$  is used to increase the efficiency of DNA uptake while producing transformed bacterial cells.

**Reason:**  $\text{Ca}^{+2}$  ions create transient pores on the bacterial cell wall to facilitate the entry of foreign DNA.

**86. Assertion:** Plasmids are autonomously replicating linear nuclear DNA.

**Reason:** Plasmids are used as cloning vectors.

**87. Assertion:** Each restriction endonuclease recognises a specific palindromic sequence in the DNA.

**Reason:** Palindromes in the DNA are group of letters that reads the same from 5' to 3' or 3' to 5' direction.

**Read the passage and answer the following questions (Q.Nos. 88 – 90)**

**In normal cells, cell growth and differentiation is highly controlled and regulated. Cancerous cells loose this property. As a result, cells continue to divide to produce a mass of cells called tumour or neoplasm. So there is a breakdown of the regulatory mechanism in cancer cells.**

**88.** Which type of tumour shows metastasis?

- Ⓐ Benign tumour
- Ⓑ Malignant tumour
- Ⓒ Both A and B
- Ⓓ None

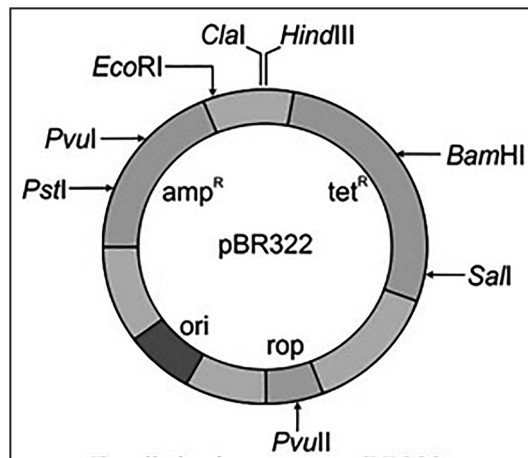
**89.** Which of the following is a method used for cancer detection?

- Ⓐ Computed Tomography
- Ⓑ Resonance Imaging
- Ⓒ Radiography
- Ⓓ All

90. Alpha Interferons are used in which type of treatment of cancer?  
 (A) Radiotherapy (B) Chemotherapy  
 (C) Immunotherapy (D) None
91. In most angiosperms, pollen grains are shed at the \_\_\_\_  
 (A) 4-celled stage (B) 2-celled stage (C) 6-celled stage (D) 5-celled stage
92. Delivery of the baby during child birth is called  
 (A) Gestation (B) Implantation (C) Parturition (D) Insemination
93. Which of the following should be banned to minimise female foeticide?  
 (A) Amniocentesis (B) IUDs (C) IVF (D) All of the above
94. Biogas plants are mostly functional in rural areas because—  
 (A) Cattle dung is readily available  
 (B) It is an easy and cheap process  
 (C) The spent slurry of the biogas plant is used as a fertilizer  
 (D) All of the above
95. Analogous structures are a result of  
 (A) Divergent evolution (B) Convergent evolution  
 (C) Shared Ancestry (D) Stabilising selection
96. The mature infective stage of mosquito is called -----  
 (A) Gametocyte (B) Gametophyte (C) Sporophyte (D) Sporozoite

**Study the diagram given below and answer the following questions : (97 - 99)**

97. The diagram represents



- (A) Eco RI (B) Bacteriophage  
 (C) A restriction enzyme (D) E.coli cloning vector

98. Ori stands for
- Ⓐ The sequence from where replication starts
  - Ⓑ Selectable marker
  - Ⓒ Cloning site
  - Ⓓ Restriction site
99. ----- is a procedure through which a piece of DNA is introduced in a host bacterium.
- Ⓐ Replication
  - Ⓑ Amplification
  - Ⓒ Transformation
  - Ⓓ Cloning

**Assertion-Reason type Questions (100):**

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

- A. Both Assertion and Reason are true and Reason is the correct explanation of the Assertion.
  - B. Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.
  - C. Assertion is true but Reason is false.
  - D. Assertion is false but Reason is true.
100. **Assertion:** Tobacco smoking leads to oxygen deficiency in the human body.  
**Reason:** Smoking leads to an increase in the carbon monoxide content in blood, which reduces the oxygen carrying capacity of haemoglobin.

## **Space For Rough Works**

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