

Sankalp IIT

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IN JEE MAIN AND ADVANCED

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Time : 3 hrs.

Max. Marks: 360

Topics covered in various subjects :

Physics : Ray Optics and Optical Instruments, Wave optics, Dual Nature of Matter and Radiation, Atoms and Nuclei, Electronic Devices, Communication System and Experimental Physics

Chemistry : Organic Compounds Containing Oxygen, Nitrogen, Polymers, Biomolecules, Chemistry in Everyday life, Principles related to Practical Chemistry

Mathematics : Indefinite Integrals, Definite Integrals and their Applications, Differential Equations

Instructions:

- (i) Duration of Test is 3 hrs.
- (ii) The Test booklet consists of 90 questions. The maximum marks are 360.
- (iii) There are **three** parts in the question paper. Distribution of marks subjectwise in each part is as under for each correct response.
 - Part A – PHYSICS (120 marks)** – Questions No.1 to 30 consist **FOUR (4)** marks each for each correct response.
 - Part B – CHEMISTRY (120 marks)** – Questions No.31 to 60 consist **FOUR (4)** marks each for each correct response.
 - Part C – MATHEMATICS (120 marks)** – Questions No.61 to 90 consist **FOUR (4)** marks each for each correct response.
- (iv) One fourth ($\frac{1}{4}$) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
- (v) **Pattern of the Question: Section – I : Multiple Type Objective Questions** (Straight Single Choice Multiple Type Questions); **Section – II: Assertion – Reason Type Questions**; **Section – III: Comprehension Type Questions** : (One Comprehension Type Question should have 3 questions - Multiple Concept Questions); **Section – IV: Straight Objective Questions**: (Straight Single Choice - Multiple Concept Questions and/or Difficulty/Lengthy calculations & Application based questions)

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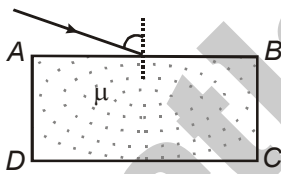
Discuss among yourself or with your teachers in case of doubts. You can post your doubts on website comment section too and We will try to answer as early as possible.

PHYSICS**SECTION - I****Straight Single Choice Multiple Type Questions / Application Based Single Choice Questions**

This section contains 16 multiple choice questions numbered 1 to 16. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

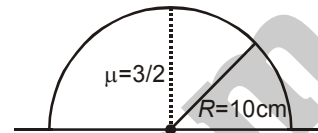
- Image formed by plane mirror is
 - Only real
 - Only virtual
 - Both real and virtual
 - Enlarged for virtual object
- The angle between two plane mirrors is 72° , then the number of images observed by these two mirrors for a point object placed between them is
 - 2
 - 5
 - 4
 - 4 or 5
- A converging beam is incident on a concave mirror of focal length 20 cm at a distance of 20 cm from pole of mirror. The image is formed at a distance of
 - 10 cm from the mirror
 - Infinity
 - 20 cm from the mirror
 - 15 cm from the mirror
- A beam of white light is incident on a plane glass slab as shown in figure. If it emerges from the face BC, then



- Only refraction occurs
 - Only dispersion occurs
 - Both refraction and dispersion occurs
 - Only reflection from face AB
- Angle of deviation in the case of refraction is
 - Always greater than 90°
 - Always less than 90°
 - Between 90° and 180°
 - Always zero
 - If ${}_1\mu_2 = \frac{3}{2}$ and ${}_3\mu_2 = \frac{4}{3}$, then the value of ${}_1\mu_3$
 - $\frac{4}{3}$
 - 2

$$(3) \frac{9}{8} \qquad (4) \frac{8}{9}$$

- Shining of air bubble inside the water is due to
 - Refraction from denser to rarer medium
 - Refraction
 - Total internal reflection
 - Dispersion
- Hemispherical glass ($\mu = \frac{3}{2}$) is kept on a table with ink mark as in figure. If ink mark is observed from the top of curved surface, then it is observed at



- 10 cm from the top surface
 - $\frac{20}{3}$ cm from the top surface
 - 5 cm from the top surface
 - At the top surface
- Light ray is incident at an angle of incidence 60° on one face of a rectangular prism of refracting angle 90° . If light ray grazes the second face, then the refractive index of material of prism is
 - $\sqrt{\frac{3}{2}}$
 - $\frac{\sqrt{7}}{2}$
 - 2
 - $\frac{2}{\sqrt{3}}$
 - If an object is at a distance of 10 cm from the concave lens of focal length 10 cm, then image is at
 - Infinity
 - At 10 cm
 - At 5 cm from the lens
 - At 20 cm from the lens
 - Slope of stopping potential versus frequency graph gives the value of
 - h
 - $\frac{h}{e}$
 - hc
 - hc
 - A transistor is connected in common emitter configuration. The collector supply is 4 V and the voltage drop across a resistor of 100Ω in the collector circuit is 0.1 V. If the current gain factor α is 0.96, then the base current is approximately
 - $42 \mu\text{A}$
 - $21 \mu\text{A}$
 - $14 \mu\text{A}$
 - $84 \mu\text{A}$
 - In hydrogen atom electron jump from fifth excited state

Class (XII)

- to first excited state then wavelength of radiation lie in
- (1) Lyman series (2) Balmer series
(3) Paschan series (4) Brackett series
14. The ground wave propagation is suitable for radiowaves of frequency
- (1) Upto 2 MHz
(2) From 2 MHz to 20 MHz
(3) From 2 MHz to 30 MHz
(4) None of these
15. Current produced due to motion of electron in circular n^{th} orbit is proportional to
- (1) n^{-1} (2) n^{-2}
(3) n^{-3} (4) n^1
16. A nucleus X undergoes following transformation
 ${}_A X^B \xrightarrow{2\alpha} Y \xrightarrow{4\beta^-} Z \xrightarrow{4\gamma} T$, then
- (1) X , Z and T are isotopes
(2) Y and Z are isotopes
(3) X , Y and T are isotopes
(4) X and Y are isotopes

SECTION - II

Assertion – Reason Type Questions

Directions : Questions number 17 to 21 are Assertion-Reason type questions. Each of these questions contains two statements. Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select the correct choice.

17. Statement-1 : All the electrons emitted in photoelectric effect do not have the same kinetic energy.
- and**
- Statement-2 : The kinetic energy of an emitted electron will depend on the total energy lost in collisions with the atoms of the metal.
- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
(2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is True
18. Statement-1 : If YDSE is performed in water instead of air then the fringe width remains same.
- and**
- Statement-2 : The wavelength of light in water is less than the wavelength in air.
- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

- (2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1

- (3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is True

19. Statement-1 : In single slit diffraction the angular width of central maxima decrease with increasing the slit width.

and

Statement-2 : Single slit diffraction, the width of central maxima is inversely proportional to slit width.

- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

- (2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1

- (3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is True

20. Statement-1 : Characteristic X-rays are independent of the nature of the target from which they are emitted.

and

Statement-2 : Characteristic X-rays are emitted where the bombarding electrons knock out electrons from the inner shells of the target atoms and the outer electrons fall into these vacancies.

- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

- (2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1

- (3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is True

21. Statement-1 : The rate of activity of a radioactive substance decreases with time.

and

Statement-2 : In radioactive decay, the amount of radioactive substance decreases with time.

- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

- (2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1

- (3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is True

SECTION - III

Class (XII)

Comprehension Type Questions

Directions : Question No. 22 to 24 are based on the following paragraph.

A double slit experiment is immersed in transparent liquid of refractive index 1.5. The slit separation is 0.5 mm and the distance between the plane of the slits and screen is 1.5 m. The slits are illuminated by the parallel beam of light whose wavelength in air 6400 Å.

22. If the intensity of the central bright fringe is I_0 , then the intensity of light coming from one of the slit is

(1) I_0

(2) $\frac{I_0}{2}$

(3) $\frac{I_0}{4}$

(4) $4I_0$

23. The fringe width is

(1) 0.32 m

(2) 0.64 mm

(3) 1.28 mm

(4) 2.5 mm

24. One of the slits of the apparatus is covered by a thin glass sheet of refractive index 1.60. The smallest thickness of the sheet to bring the minima at the centre is

(1) $6.4 \mu\text{m}$

(2) $1.6 \mu\text{m}$

(3) $3.2 \mu\text{m}$

(4) $1.28 \mu\text{m}$

SECTION - IV

Straight Objective Questions

Directions : Question No. 25 to 30 are based on the following Multiple concept questions and/or difficulty/lengthy calculations & application based questions.

25. Magnifying power of a telescope is maximum

(1) When final image is at least distance of distinct vision

(2) When final image is at infinity

(3) When final image is in between 25 and infinity

(4) Magnifying power depend only on the length of tube

26. A radioactive isotope x has a half life of 0.231 second. Initially a given sample of this isotope contains 16000 atoms. The time after which 1000 atoms of the isotope x remain in the sample is

(1) 0.693 s

(2) 0.231 s

(3) 0.924 s

(4) 2.772 s

27. In lens displacement method, size of images produced are 4 mm and 9 mm. The size of object is

(1) 6.5 mm

(2) 6 mm

(3) 7 mm

(4) 10 mm

28. When a beam of 10.6 eV photons of intensity 2.0 W/m^2 falls on a platinum surface of area $1.0 \times 10^{-4} \text{ m}^2$, 0.53% of the incident photons eject photo electron. The number of photoelectrons emitted per second is (Take $1\text{eV} = 1.6 \times 10^{-19}\text{J}$)

(1) 2.56×10^{11}

(2) 6.25×10^{11}

(3) 5.02×10^{11}

(4) 9.17×10^{11}

29. An object is placed at a distance x from the convex lens of focal length (f). Real and magnified image of magnification 2 is obtained. The value of x is

(1) $2f$

(2) $\frac{3f}{2}$

(3) $\frac{f}{2}$

(4) $\frac{5f}{2}$

30. Length of tube of astronomical telescope is 105 cm for normal adjustment. Magnifying power of telescope for normal adjustment is 20. The powers of objective and eyepiece respectively

(1) 1 D, 20 D

(2) 20 D, 1 D

(3) 10 D, 10 D

(4) 2 D, 19 D

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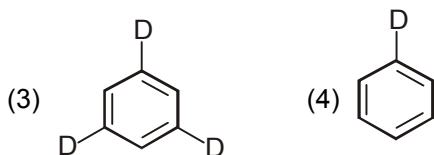
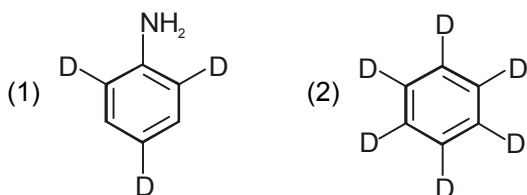
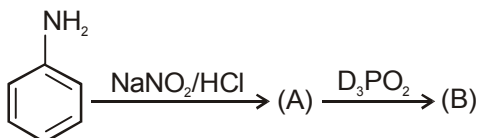
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CHEMISTRY**SECTION - I****Straight Single Choice Multiple Type Questions /
Application Based Single Choice Questions**

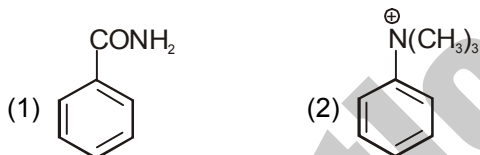
This section contains 16 multiple choice questions numbered 31 to 46. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

31. The product (B) in the reaction is



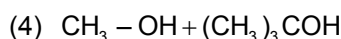
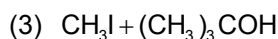
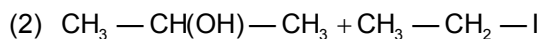
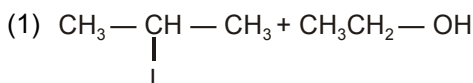
32. Which of the following will have electrophilic aromatic substitution at ortho or para position?



33. Thermal decomposition of acetone gives

- (1) $\text{CH}_2\text{CO} + \text{CH}_4$
 (2) $\text{CO}_2 + \text{H}_2\text{O}$
 (3) CH_3COOH
 (4) $\text{CH}_3\text{CHO} + \text{CO}_2$

34. 2-ethoxy propane on heating with HI of one molar concentration gives

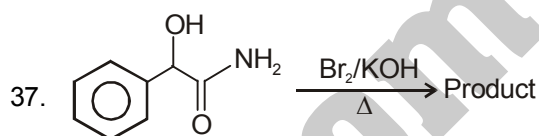


35. Which of the following is responsible for maintaining blood sugar level in human body?

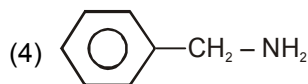
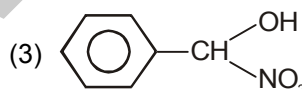
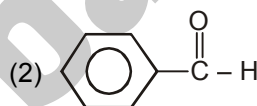
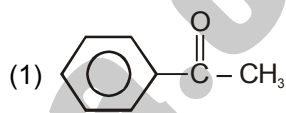
- (1) Resoflavin (2) Insulin
 (3) Fats (4) Hormones

36. Which of the following biomolecules contains a non-transition metal ion?

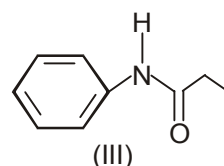
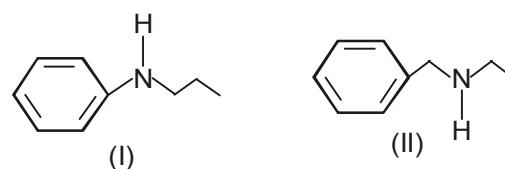
- (1) Haemoglobin (2) Chlorophyll
 (3) Insulin (4) Vitamin B₁₂



Product of this Hofmann bromamide reaction is



38. The correct order of basicity of compound I, II and III varies in the order

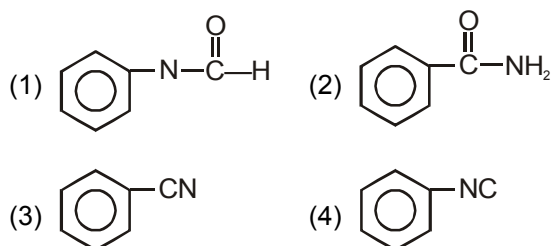
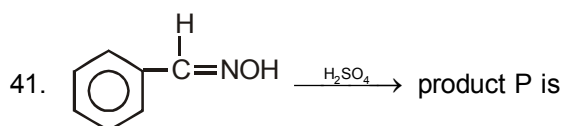
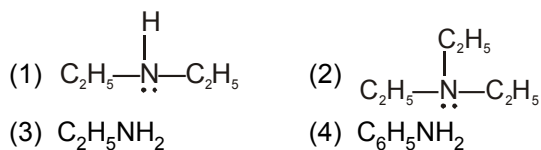


- (1) I > II > III (2) II > I > III
 (3) II > III > I (4) III > II > I

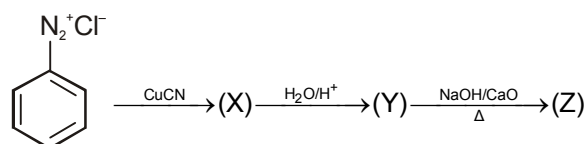
39. On hydrolysis of starch, we bring get

Class (XII)

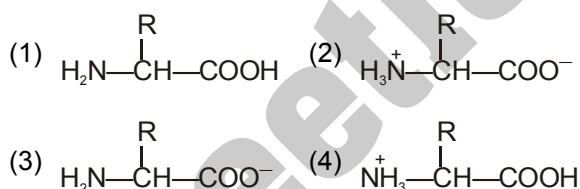
- (1) Glucose (2) Fructose
 (3) Both (1) and (2) (4) Sucrose
40. An amine is treated with $\text{H}_5\text{SO}_2\text{Cl}$, and the product obtained is insoluble in KOH . Identify the amine



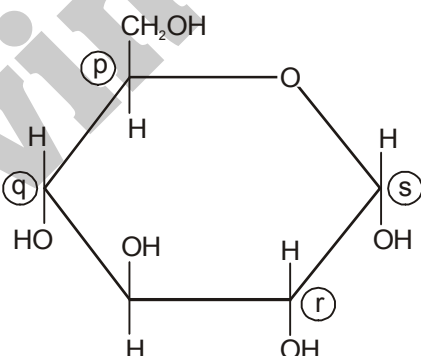
42. The end product (Z) in the given reaction



- (1) A cyanide
 (2) An amine
 (3) A carboxylic acid
 (4) An aromatic hydrocarbon
43. Which of the following structure represents the zwitter ion



44. The structure of α -D glucose is shown below

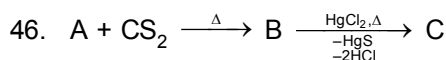


Which of the following is called the anomeric carbon?

- (1) C—(p) (2) C—(q)
 (3) C—(r) (4) C—(s)

45. In Nylon-66 interparticle force acts between molecules are

- (1) Hydrogen bonds (2) Covalent bonds
 (3) Ionic bonds (4) Co-ordinate bonds



The product 'C' smells like mustard oil, so identify the compound 'A'.

- (1) $\text{CH}_3\text{CH}_2\text{NH}_2$
 (2) $\text{CH}_3\text{CH}_2-\text{NH}-\text{CH}_2-\text{CH}_3$
 (3) $\text{C}_6\text{H}_5-\text{NH}-\text{CH}_3$
 (4) $(\text{CH}_3)_3\ddot{\text{N}}$

SECTION - II

Assertion – Reason Type Questions

Directions : Questions number 47 to 51 are Assertion-Reason type questions. Each of these questions contains two statements. Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select the correct choice.

47. Statement-1 : Acid amides are nearly neutral while amines are base in nature.

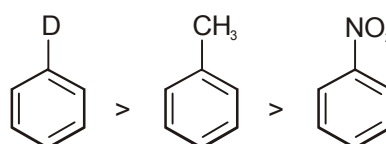
and

Statement-2 : The resonance hybrid of acid amide can

be represented as $\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{NH}_2$ which implies that the

lone pair of 'N' is delocalised.

- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
 (2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
 (3) Statement-1 is True, Statement-2 is False
 (4) Statement-1 is False, Statement-2 is True
48. Statement-1 : The rate of nitration for the given compounds is in the order



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and

Statement-2 : $-\text{CH}_3$ group activates the benzene ring towards nitration while $-\text{NO}_2$ group deactivates it.

- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
- (2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
- (3) Statement-1 is True, Statement-2 is False
- (4) Statement-1 is False, Statement-2 is True
49. Statement-1 : Aniline does not couple at $\text{p}^{\text{H}} < 4$

and

Statement-2 : Aniline converts into $\text{C}_6\text{H}_5\text{NH}_3^+\text{Cl}^-$, which cannot couple

- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
- (2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
- (3) Statement-1 is True, Statement-2 is False
- (4) Statement-1 is False, Statement-2 is True
50. Statement-1 : Fructose is tautomeric product of glucose in alkaline medium.

and

Statement-2 : Fructose and glucose are interconvertible into each other in alkaline medium.

- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
- (2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
- (3) Statement-1 is True, Statement-2 is False
- (4) Statement-1 is False, Statement-2 is True
51. Statement-1 : Teflon has high thermal stability and chemical inertness.

and

Statement-2 : Teflon is a thermoplastic.

- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
- (2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
- (3) Statement-1 is True, Statement-2 is False
- (4) Statement-1 is False, Statement-2 is True

SECTION - III

Comprehension Type Questions

Directions : Question No. 52 to 54 are based on the following paragraph.

Polymerisation involves various mechanism depending upon the initiator if initiator generates free radical addition polymerisation takes place through free radical mechanism. If H^+ is initiator and electron releasing group is present, cationic polymerisation takes place. If electron withdrawing group is present and KNH_2 is initiator, anionic polymerisation takes place.

52. Which of the following will induce anionic polymerisation?

- (1) KNH_2 (2) n-Butyl lithium
(3) KOH (4) All of these

53. Cationic polymerisation involves in presence of H^+

- (1) $\text{CH}_2=\underset{\text{Cl}}{\text{CH}}$
- (2) $\text{CH}_2=\underset{\text{CN}}{\text{CH}}$
- (3) $\text{CH}_2=\underset{\text{C}_6\text{H}_5}{\text{CH}}$
- (4) $\text{CH}_2=\underset{\text{CH}_3}{\text{CH}}$

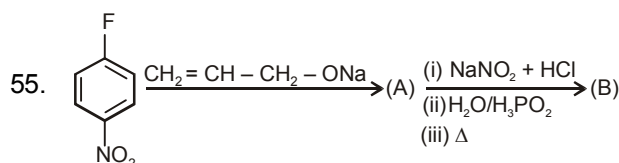
54. Which of the following will undergo anionic polymerisation in presence of KNH_2 ?

- (1) $\text{CH}_2=\underset{\text{C}_6\text{H}_5}{\text{CH}}$ (2) $\text{CH}_2=\underset{\text{CH}_3}{\text{CH}}$
- (3) $\text{CH}_2=\text{C} \begin{matrix} \diagup \text{CH}_3 \\ \diagdown \text{CH}_3 \end{matrix}$ (4) $\text{CH}_2 = \text{CH}_2$

SECTION - IV

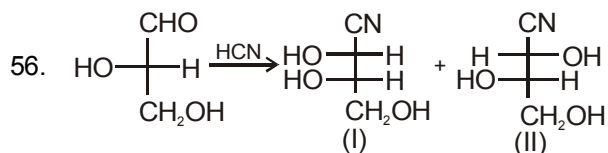
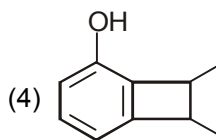
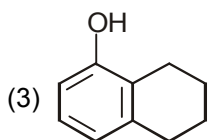
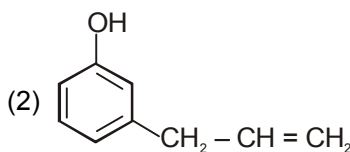
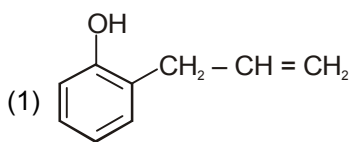
Straight Objective Question

Directions : Question No. 55 to 60 are based on (Straight Single Choice - Multiple Concept Questions and/or Difficulty/Lengthy calculations & Application based questions)



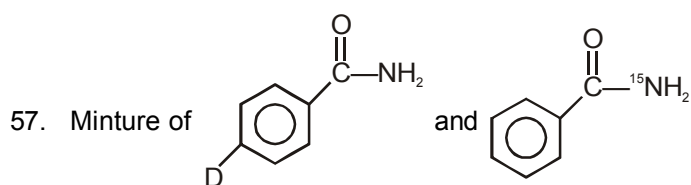
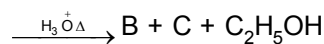
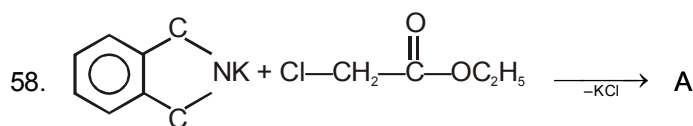
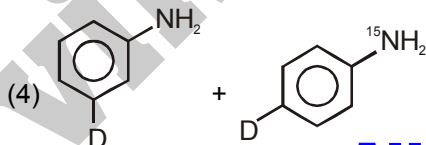
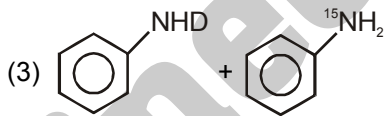
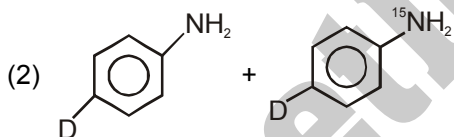
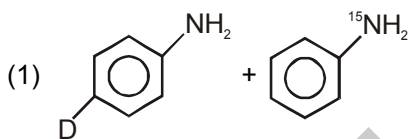
The compound (B) is

Class (XII)

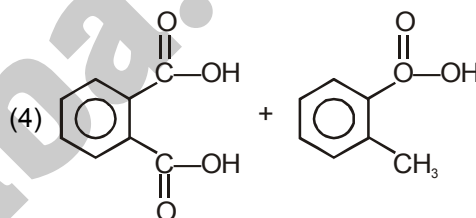
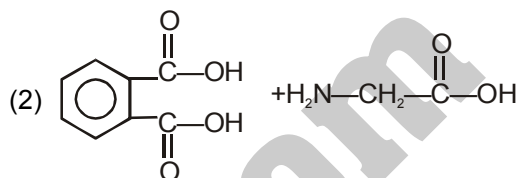
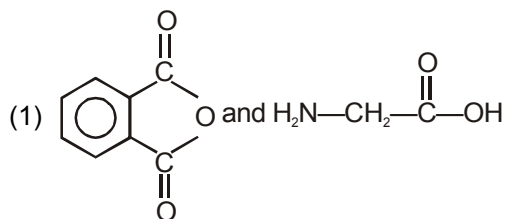


Compound (I) and (II) are not

- (1) Diastereomers (2) Epimers
(3) C - 2 epimers (4) Enantiomers

is treated with Br_2 and NaOH , the products obtained are

The product B and C are



59. Regarding paper chromatography correct among the following is

- (1) component of greater adsorption tendency moves upto lower height
(2) component of greater adsorption tendency shows lower ' R_f ' value
(3) liquid is the mobile-phase
(4) All of the above

60. Kjeldahl's method is not applicable is

- (1) pyridine (2) aniline
(3) aldoximes (4) ketoximes

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MATHEMATICS**SECTION - I****Straight Single Choice Multiple Type Questions /
Application Based Single Choice Questions**

This section contains 16 multiple choice questions numbered 61 to 76. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

61. If $f : R \rightarrow R$, $g : R \rightarrow R$ & $h : R \rightarrow R$ are continuous functions, then the value of the integral

$$\int_{-\pi/6}^{\pi/6} \{f(x) + f(-x)\}\{g(x) + g(-x)\}\{h(x) - h(-x)\} dx$$

is equal to

- (1) $\frac{\pi}{6}$ (2) $\frac{\pi}{3}$
(3) 0 (4) -1

62. The value of $\int_0^{\pi/2} \frac{dx}{1 + \tan^{2010} x}$ is equal to

- (1) $\frac{\pi}{2}$ (2) $\frac{\pi}{4}$
(3) $\frac{\pi}{3}$ (4) $\frac{\pi}{6}$

63. The value of $\int_{-\pi/4}^{\pi/4} (x^3 - x \cos x + \tan^{11} x + 5) dx$ is equal to

- (1) $\frac{5\pi}{2}$ (2) 2π
(3) 3π (4) 0

64. The solution of the differential equation $\frac{dy}{dx} = -4xy^2$ given that $y(0) = 1$ is

- (1) $y = \frac{2}{x^2 + 2}$ (2) $y = \frac{1}{x^2 + 1}$
(3) $y = \frac{1}{3x^2 + 1}$ (4) $y = \frac{1}{2x^2 + 1}$

65. The differential equation of all parabolas whose axes are parallel to y-axis is

- (1) $y''' = 0$
(2) $y'' = c$
(3) $y''' + y' = 0$
(4) $y'' + 2y' = c$

66. $\int_0^{\pi} \sqrt{\frac{1 + \cos 2x}{2}} dx$ is equal to

- (1) 0 (2) 1
(3) 2 (4) 3

67. $\lim_{n \rightarrow \infty} \frac{1^{99} + 2^{99} + \dots + n^{99}}{n^{100}}$ is equal to

- (1) $\frac{99}{100}$
(2) $\frac{1}{100}$
(3) $\frac{1}{99}$
(4) $\frac{1}{101}$

68. $\int \frac{dx}{5 + 4 \cos x}$ equals

- (1) $\frac{3}{2} \tan^{-1} \left(\frac{1}{3} \tan \frac{x}{2} \right) + c$ (2) $\frac{1}{3} \tan^{-1} \left(\frac{1}{3} \tan \frac{x}{2} \right) + c$
(3) $\frac{2}{3} \tan^{-1} \left(\frac{1}{3} \tan \frac{x}{2} \right) + c$ (4) $\frac{1}{9} \tan^{-1} \left(\frac{1}{3} \tan \frac{x}{2} \right) + c$

69. The value of $\int_0^{2010} e^{x-[x]} dx$ is equal to

- (1) $2010(e - 2)$ (2) $2010e$
(3) $2010(e - 1)$ (4) $e - 1$

70. $\int \frac{(x^4 - x)^{1/4}}{x^5} dx$ equals

- (1) $\frac{1}{15} \left(1 - \frac{1}{x^3} \right)^{5/4} + c$ (2) $\frac{4}{15} \left(1 - \frac{1}{x^3} \right)^{5/4} + c$
(3) $\frac{1}{4} \left(1 - \frac{1}{x^3} \right)^{5/4} + c$ (4) $\frac{4}{15} \left(1 - \frac{1}{x^3} \right)^{-5/4} + c$

71. If $\int \sqrt{1 + \operatorname{cosec} x} dx = \sin^{-1}(k \sin x - 1) + c$, then the value of $k + 2011$ is

- (1) 2010 (2) 2011
(3) 2009 (4) 2013

72. If $\int \frac{\sqrt[2]{x}}{1 + \sqrt[4]{x^3}} dx = k[1 + x^{3/4} - \log(1 + x^{3/4})] + c$, then the

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value of $\frac{3}{4}k + 9$ is

- (1) 0
 (2) 10
 (3) 1
 (4) -1

73. The value of the integral $\int_3^4 \frac{[x^2]}{[x^2 - 14x + 49] + [x^2]} dx$ is $\frac{m}{n}$, where $[\] =$ G.I.F, then the value of $m^3 + n^3$ is

- (1) 2
 (2) 5
 (3) 9
 (4) 10

74. The value of the integral $\int_0^{2011} \frac{2^x}{2^{[x]}} dx$ is

- (1) $\frac{2011}{\log 2}$ (2) $\frac{2010}{\log 2}$
 (3) $\frac{2012}{\log 2}$ (4) 0

75. The order and degree of the differential equation

 $x = \left(\frac{dy}{dx}\right) - \frac{1}{3!} \left(\frac{dy}{dx}\right)^3 + \frac{1}{5!} \left(\frac{dy}{dx}\right)^5 - \dots$ to ∞ is

- (1) 1, 2 (2) 1, 1
 (3) 1, 5 (4) 1, ∞

76. Let $f(x) = \min\{|x - 1|, |x|, |x + 1|\}$. Then the value of $\int_{-1}^1 f(x) dx$ is

- (1) 1 sq. unit (2) $\frac{1}{2}$ sq. unit
 (3) 2 sq. units (4) 4 sq. units

SECTION - II**Assertion – Reason Type Questions**

Directions : Questions number 77 to 81 are Assertion-Reason type questions. Each of these questions contains two statements. Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select the correct choice.

77. Statement-1 : Area of the region bounded by the curve

 $y = x^3 + 1$, the x-axis and $x = 2$ and $x = 3$ is $\frac{69}{4}$.**and**

Statement-2 : The area enclosed by the curve

 $y = f(x)$ and x-axis between $x = a$ and $x = b$ is $\int_a^b y dx$.

- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
 (2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
 (3) Statement-1 is True, Statement-2 is False
 (4) Statement-1 is False, Statement-2 is True

78. Statement-1 : $\int_0^{2010\pi} |\sin x| dx = 4020$.**and**Statement-2 : $\int_0^{n\pi} |\sin x| dx = n \int_0^{\pi} |\sin x| dx, n \in N$

- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
 (2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
 (3) Statement-1 is True, Statement-2 is False
 (4) Statement-1 is False, Statement-2 is True

79. Statement-1 : $\int_5^7 \frac{\sqrt{x} dx}{\sqrt{12-x} + \sqrt{x}} = 1$.**and**Statement-2 : $\int_a^b f(x) dx = \int_a^b f(a+b-x) dx$.

- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
 (2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
 (3) Statement-1 is True, Statement-2 is False
 (4) Statement-1 is False, Statement-2 is True
80. Statement-1 : The orthogonal trajectory of family of circles $x^2 + y^2 = 2010$ is a family of lines passing through centre of the family of circles.

and

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Statement-2 : The differential equation $\frac{dy}{dx} = \frac{x^2 + y^2}{2xy}$ can be solved by putting $y = vx$.

- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
 (2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
 (3) Statement-1 is True, Statement-2 is False
 (4) Statement-1 is False, Statement-2 is True

81. Statement-1 : The solution of differential equation

$$\frac{dy}{dx} + \frac{y}{x} = x^2 \text{ is } xy = \frac{x^4}{4} + C.$$

and

Statement-2 : The solution of the differential equation of the form $\frac{dy}{dx} + Py = Q$ where P and Q are functions of x alone or constant can be solved by

multiplying the equation by $e^{\int P dx}$.

- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
 (2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
 (3) Statement-1 is True, Statement-2 is False
 (4) Statement-1 is False, Statement-2 is True

SECTION - III

Comprehension Type Questions

Directions : Question No. 82 to 84 are based on the following paragraph.

If the equation of the curve remains unchanged by substituting $-x$ for x , it is symmetrical about y -axis. An odd function is symmetrical about origin. The equation of the tangent to the curve at (x_1, y_1) may be written as

$$y - y_1 = \left(\frac{dy}{dx}\right)_{(x_1, y_1)} (x - x_1). \text{ Consider the curve}$$

$y = xe^{-\frac{x^2}{2}}$. With the above information answer the following questions

82. The curve is symmetrical about
 (1) x -axis (2) y -axis
 (3) $y = x$ (4) The origin
83. Which of the following line touches the curve at

infinity?

- (1) $x = 0$ (2) $y = 0$
 (3) $x = -\frac{1}{2}$ (4) $y = -\frac{1}{2}$
84. The area of the curve lying in the first quadrant is
 (1) $\frac{1}{2}$ sq. unit (2) 1 sq. unit
 (3) 2 sq. unit (4) 4 sq. unit

SECTION - IV

Straight Objective Question

Directions : Question No. 85 to 90 are based on (Straight Single Choice - Multiple Concept Questions and/or Difficulty/Lengthy calculations & Application based questions)

85. For $x > 0$, let $f(x) = \int_1^x \frac{\log_e t}{t+1} dt$. Then the value of

$$2\left(f(e) + f\left(\frac{1}{e}\right)\right) + 2010 \text{ is}$$

- (1) 2012 (2) 2011
 (3) 2010 (4) 2009

86. Let $f(x) = \log\left(\frac{1+x}{1-x}\right) + \log(x + \sqrt{x^2+1}) + x^2 \sin x$.

Then the value of integral $\int_{-2011}^{2011} f(x) dx$ is

- (1) $\frac{2011}{2}$ (2) 2011
 (3) 4022 (4) 0

87. The area of the region bounded by the curves

$$f(x, y) = \{(x, y) : x^2 + y^2 \leq 1 \leq x + y\} \text{ is}$$

- (1) $\left(\frac{\pi}{4} - \frac{1}{2}\right)$ sq. units
 (2) $\frac{\pi}{4} - \frac{1}{2} + \sin^{-1}\left(\frac{3}{4}\right)$ sq. units
 (3) $\left(\frac{\pi}{4} + \frac{1}{2}\right)$ sq. units
 (4) $\frac{\pi}{4} + \frac{1}{2} + \sin^{-1}\left(\frac{3}{4}\right)$ sq. units

88. Let $T > 0$ be a fixed real number. Suppose $f(x)$ is a continuous function such that for all $x \in R$,

$$f(x + T) = f(x). \text{ If } I = \int_0^T f(x) dx, \text{ then the value}$$

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of $\int_3^{3+3\pi} f(2x)dx$ is

(1) $\frac{3}{2}l$

(2) $2l$

(3) $3l$

(4) $6l$

89. Area of the triangle formed by the x-axis and tangent and normal drawn to the curve $y = x^2$ at (1, 1) is equal to

(1) 3 sq. unit

(2) $\frac{5}{4}$ sq. unit

(3) 4 sq. unit

(4) 2 sq. unit

90. Area bounded by the curves $y = \sqrt{5-x^2}$ and $y = |x-1|$ is

(1) $\frac{5\pi-2}{3}$ sq. unit

(2) $\frac{5\pi-2}{4}$ sq. unit

(3) $\frac{5\pi}{4}$ sq. unit

(4) $\frac{5\pi-1}{4}$ sq. unit

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4. Use of pencil is strictly prohibited.
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WRONG METHODS



CORRECT METHOD



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5.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	20.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	35.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	50.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	65.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	80.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	21.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	36.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	51.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	66.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	81.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	22.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	37.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	52.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	67.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	82.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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9.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	24.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	39.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	54.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	69.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	84.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	25.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	40.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	55.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	70.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	85.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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12.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	27.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	42.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	57.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	72.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	87.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	28.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	43.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	58.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	73.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	88.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	29.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	44.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	59.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	74.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	89.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	30.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	45.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	60.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	75.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	90.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>