

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 : Kinetic Theory of gases and Thermodynamics, Oscillations, Waves

Chemistry : Purification and Characterization of Organic Compounds, Some Basic Principles of Organic Compounds, Hydrocarbons, Environmental Chemistry

Mathematics : Sequence and Series; Cartesian Co-ordinates, Straight Lines, Pair of Straight Lines, Circle and Family of Circles, Conic Sections

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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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.

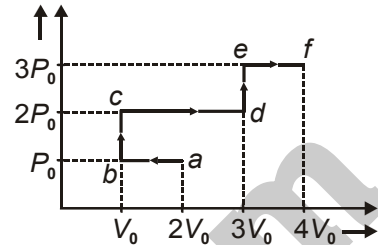
Choose the correct answer :

- For a particle executing a S.H.M., the phase of displacement is $\left(100\pi t + \frac{\pi}{4}\right)$. The phase of velocity is
 - $100\pi t + \frac{3}{4}\pi$
 - $100\pi t + \frac{5\pi}{4}$
 - $100\pi t - \frac{\pi}{4}$
 - $100\pi t + \frac{2\pi}{3}$
- The time period of oscillation of a simple pendulum suspended from a ceiling of stationary lift is T . When lift descend with an acceleration equal to $\frac{g}{4}$, then time period of oscillation is
 - $\frac{4}{\sqrt{5}}T$
 - $\frac{2}{\sqrt{5}}T$
 - $\frac{4}{\sqrt{3}}T$
 - $\frac{2}{\sqrt{3}}T$
- Coefficient of linear expansion of the string of a simple pendulum is $2 \times 10^{-5}/^{\circ}\text{C}$. When the temperature is increased by 50°C , the percentage gain in its time period will be
 - 0.5%
 - 0.05%
 - 0.25%
 - 0.01%
- Ratio of intensities of two coherent waves is 4 : 1. The ratio of maximum to the minimum intensity produced during their interference is
 - 9 : 1
 - 4 : 1
 - 16 : 1
 - 8 : 1
- $y(x, t) = \frac{5}{(2x + 4t)^2 + 100}$, represents a wave pulse, where x, y are in cm and t is time in second. The speed of wave is
 - 2 cm/s
 - 0.5 cm/s
 - 8 cm/s
 - 0.05 cm/s
- The equation of a stationary wave along a stretched string is given by

$$y = 0.2 \sin\left(\frac{\pi}{9}x\right) \cos 20\pi t$$
, where x is in cm, y is in

meter and t is in minute. The distance between two consecutive nodes is

- 9 cm
 - 18 cm
 - 9 m
 - 18 m
7. P - V diagram for an ideal gas as is shown in figure. The work done by the gas during the process $abcdef$ is



- $8 P_0 V_0$
 - $17 P_0 V_0$
 - $5 P_0 V_0$
 - $6 P_0 V_0$
8. When heat of 5×10^5 J is given to a gas at constant pressure 10^5 pascal, its volume changes from 3 m^3 to 5 m^3 . The change in internal energy is
- 300 kJ
 - 2×10^5 kJ
 - 200 J
 - 200 kJ
9. A gas expands from V_1 to V_2 individually by different processes. If W_a, W_T, W_V, W_P are work done by gas in adiabatic, isothermal, isochoric and isobaric process respectively, then which of the following is true?
- $W_a > W_T > W_P > W_V$
 - $W_P > W_a > W_T > W_V$
 - $W_P > W_T > W_a > W_V$
 - $W_T > W_a > W_P > W_V$
10. A Carnot engine works between 627°C and 27°C . If energy drawn from the source is 1500 J per cycle by the engine. The amount of useful work done by the engine per cycle is
- 33 J
 - 66 J
 - 500 J
 - 1000 J
11. The velocity of sound in a monoatomic gas is V and root mean square velocity of molecules of the gas is V_{rms} , then relation between V and V_{rms} is
- $\sqrt{3}V = V_{\text{rms}}$
 - $\sqrt{5}V = 3V_{\text{rms}}$
 - $\sqrt{3}V_{\text{rms}} = 5V$
 - $3V = \sqrt{5}V_{\text{rms}}$
12. Two springs having spring constants K_1 and K_2 are attached with equal masses m each. When they executes S.H.M., their maximum kinetic energies are

Class (XII)

equal. The ratio of their amplitudes of vibration is

(1) $\sqrt{\frac{K_2}{K_1}}$

(2) $\frac{K_1}{K_2}$

(3) $\frac{K_1^2}{K_2^2}$

(4) $\frac{K_2^2}{K_1^2}$

13. If the equation of displacement of a wave is given by $y = 5 \sin(20t - 5x)$, where x and y are in meter and t in second, then

(1) Distance travelled by wave in +ve x direction in 5 s is 1.25 m

(2) Distance travelled by wave in -ve x direction in 5 s is 1.25 m

(3) Distance travelled by wave in +ve x direction in 5 s is 20 m

(4) Distance travelled by wave in -ve x direction in 5 s is 20 m

14. Two identical vessels contains Ne and Kr at 3×10^5 Pa and 2.5×10^5 Pa respectively. If both the gases are filled in one of the vessels, then the pressure of mixture is (1 atm = 10^5 Pa)

(1) 2.5 atm

(2) 0.5 atm

(3) 5.5 atm

(4) 3 atm

15. A gas enclosed in a container exerts pressure P . If the mass of each molecule of gas becomes three times and their speeds becomes half, then the pressure becomes/remains

(1) $\frac{1}{2}P$

(2) $\frac{3}{4}P$

(3) P

(4) $\frac{1}{4}P$

16. 2 moles of He is mixed with 2 moles of hydrogen gas at room temperature. If the mixture is homogeneous,

then the value of $\frac{C_p}{C_v}$ for the mixture is

(1) 1.67

(2) 1.4

(3) 1.28

(4) 1.5

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 : Both closed and open organ pipe of same length cannot resonate at some common frequency.

and

Statement-2 : An open pipe and a closed pipe of equal length cannot have the same frequency at any harmonic.

(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 : There is no effect of change in pressure on velocity of sound in air, provided temperature remains constant.

and

Statement-2 : Change in gas pressure also causes change in gas volume in isothermal process.

(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 simple harmonic motion total mechanical energy cannot be negative.

and

Statement-2 : Gravitational potential energy is reference based.

(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

Class (XII)

20. Statement-1 : In a process if initial volume is equal to the final volume, work done by the gas is zero.

and

Statement-2 : In an isochoric process work done by the gas is zero.

- (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 : Refrigerator transfers heat from higher temperature to lower temperature.

and

Statement-2 : Heat cannot be transferred from lower temperature to higher temperature without doing any external work.

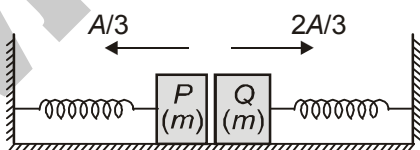
- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
- (2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
- (3) Statement-1 is True, Statement-2 is False
- (4) Statement-1 is False, Statement-2 is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

SECTION - III

Comprehension Type Questions

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

Two identical blocks P and Q have mass m each, are attached to two identical springs (of spring constant k) initially unstretched. Now the left spring (along with P) is compressed by $A/3$ and the right spring (along with Q) is compressed by $2A/3$. Both the blocks are released simultaneously, they collide perfectly inelastically.



22. The time period of oscillation of combined mass is

(1) $2\pi\sqrt{\frac{m}{2k}}$

(2) $2\pi\sqrt{\frac{m}{k}}$

(3) $\pi\sqrt{\frac{m}{k}}$

(4) $\frac{\pi}{2}\sqrt{\frac{m}{k}}$

23. The amplitude of oscillation of the combined mass is

(1) $\frac{A}{4}$

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

(3) A

(4) $\frac{A}{6}$

24. Total energy of oscillation of the combined mass is

(1) $\frac{kA^2}{36}$

(2) $\frac{kA^2}{6}$

(3) kA^2

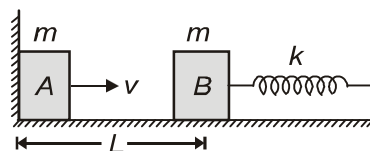
(4) $\frac{kA^2}{18}$

SECTION - IV

Straight Objective Questions

Directions : Question No. 25 to 30 are based on (Straight Single Choice - Multiple Concept Questions and/or Difficulty/Lengthy calculations & Application based questions)

25. The block A in figure shown moves at speed v towards B placed in equilibrium. All collisions to take place are elastic and surfaces are frictionless. The time period of oscillation of block A is (Neglect dimensions of the blocks)



(1) $\frac{L}{v} + \pi\sqrt{\frac{m}{K}}$

(2) $\frac{2L}{v} + \frac{\pi\sqrt{K}}{2}$

(3) $\frac{2L}{v} + \pi\sqrt{\frac{m}{K}}$

Class (XII)

$$(4) \frac{2L}{v} + \frac{2\pi\sqrt{\frac{2m}{K}}}{2}$$

26. A point source of sound is moving along y -axis with velocity $(8 \text{ m/s})\hat{j}$. An observer is located at $(-40 \text{ m}, 0)$ hears actual frequency from the source when the source is at (speed of sound in air = 320 m/s)
- (1) $(0, -1 \text{ m})$
 - (2) $(0, 1 \text{ m})$
 - (3) $(0, 0)$
 - (4) $(0, 8 \text{ m})$
27. Equation of a wave pulse at $t = 0$ and at $t = 2 \text{ s}$ are $y = \frac{3}{x^2 + 2}$ and $y = \frac{3}{x^2 - 8x + 18}$ respectively. Here x and y are in metre. Speed of the pulse is
- (1) 1 m/s
 - (2) 2 m/s
 - (3) 3 m/s
 - (4) 4 m/s
28. Three simple harmonic motions in the same direction having the same amplitude and same period are superposed. If each differ in phase from next by 45° , then the energy associated with the resulting motion is
- (1) $(1 + \sqrt{2})$ times the energy associated with any single motion
 - (2) $(2 + 3\sqrt{2})$ times the energy associated with any single motion
29. Function $x = B\cos^2\omega t - B\sin^2\omega t + 2B\sin\omega t \cdot \cos\omega t$ represents SHM. Its amplitude is
- (1) $|\sqrt{2}B|$
 - (2) $|2B|$
 - (3) $\left(\frac{B}{\sqrt{2}}\right)$
 - (4) $\left(\frac{B}{2}\right)$
30. The temperature of 100 gram of water is to be raised from 24°C to 90°C by adding steam (at 100°C) to it. The mass of the steam required for this purpose is (given specific heat of water = $1 \text{ cal/g}\cdot^\circ\text{C}$, latent heat of vaporization = 540 cal/g)
- (1) 6 g
 - (2) 8 g
 - (3) 10 g
 - (4) 12 g

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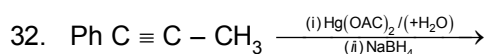
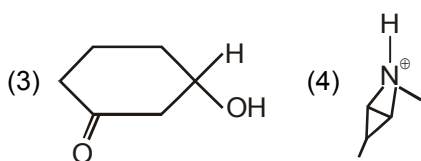
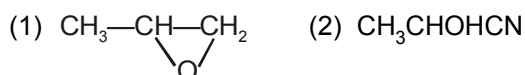
SECTION - I

Straight Single Choice Multiple Type Questions /
Application Based Single Choice Questions

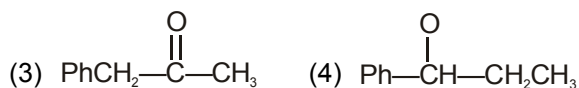
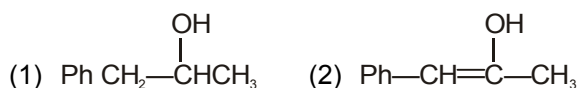
This section contains 16 multiple choice questions numbered 31 to 46. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

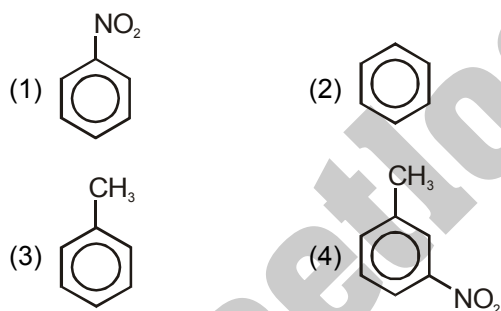
31. Which of the following compounds is achiral?



Final product is:



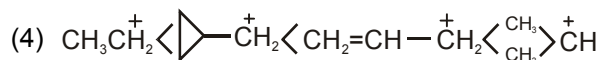
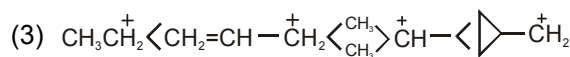
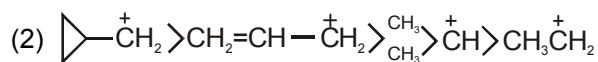
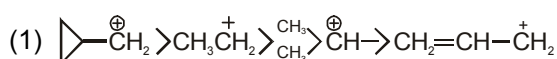
33. Most reactive towards EAS is



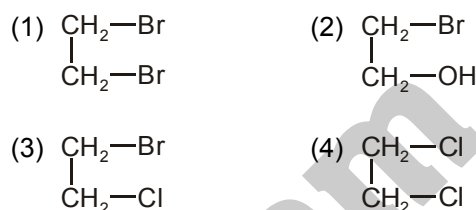
34. 3.23g of an organic compound in Duma's method gives N_2 which occupies 300ml cavity over water at 27°C , partial pressure of N_2 is 720 mm of Hg % of nitrogen in compound is:

- (1) 50
(2) 40
(3) 20
(4) 10

35. Stability of carbocation is as:



36. Ethene is shaken with aqueous solution of Br_2 and aqueous NaCl . Which of the following is not the possible product?



37. Which among the following is secondary pollutant?

- (1) CO (2) CO_2
(3) PAN (4) Aerosol

38. Eutrophication is process which involves

- (1) Depletion of ozone layer
(2) Increase in the concentration of ozone in water
(3) Decrease in the concentration of dissolved oxygen in water by algae
(4) Decrease in the level of SO_2 in air

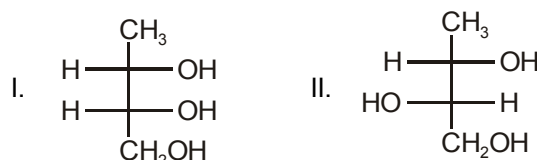
39. Which of the following is used as desiccant for absorbing water in Liebig's method for estimation of carbon and hydrogen?

- (1) $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ (2) $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$
(3) Anhydrous CaCl_2 (4) KOH

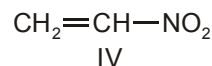
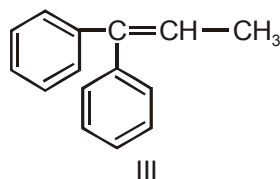
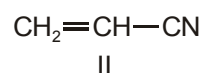
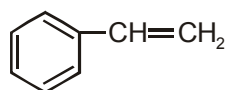
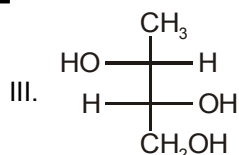
40. 0.76 g of silver salt of dibasic organic acid on ignition left 0.463 g of metallic silver. The molar mass of acid is

- (1) 70 g mol^{-1}
(2) 140.5 g mol^{-1}
(3) 60.5 g mol^{-1}
(4) 280 g mol^{-1}

41. Among the following structure which one is called Erythro isomer?



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

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

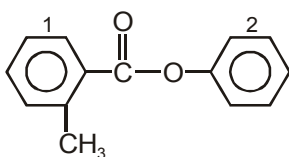
42. A compound with formula CH₃CH₂(CHOH)₂COOH can have a maximum of four stereoisomers out of which the meso structures would be

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

43. In a substitution reaction of C₆H₅Y, the major product is O/P isomer, therefore the group Y can be

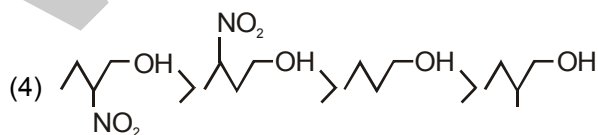
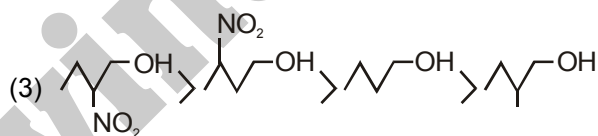
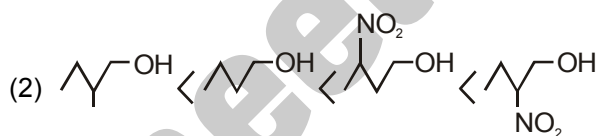
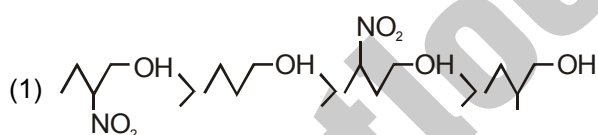
- (1) —OSO₃H (2) —NO₂
(3) —C(=O)—X (4) —NR₃⁺

44. In the compound



electrophilic attack will occur at

- (1) O/P-position in ring 1
(2) O/P-position in ring 2
(3) m-position in ring 1
(4) Only at p-position of ring 1
45. Rate of E₂ is as:



46. Correct reactivity order of given compounds in decreasing order for electrophilic addition reaction is

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 : Lactic acid and tartaric acid both exhibit optical as well as geometrical isomerism.

and

Statement-2 : Lactic acid and tartaric acid contain one and two chiral carbon respectively.

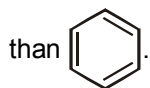
- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
(2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is True
48. Statement-1 : Methyl amine gives positive Lassaigne's test for nitrogen.

and

Statement-2 : The formation of NaCN during preparation of sodium extract will give positive Lassaigne's test for nitrogen.

- (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

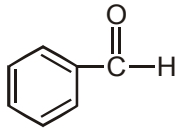
Class (XII)

49. Statement-1 :  is more reactive

and

Statement-2 : Both borazole and benzene have same structure but borazole has polar bond.

- (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 :  forms two oximes on reacting with NH_2OH .

and

Statement-2 : The two oximes are formed due to optical isomerism arisen in product.

- (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 : The pollution caused by the fine particulates are carcinogenic in nature.

and

Statement-2 : Fine particulate can penetrate into lungs.

- (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

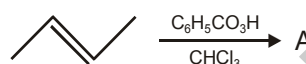
SECTION - III

Comprehension Type Questions

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

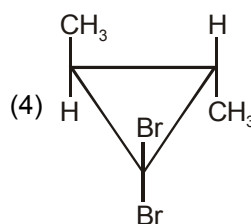
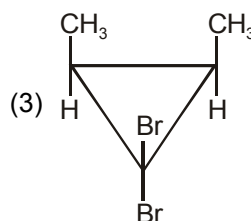
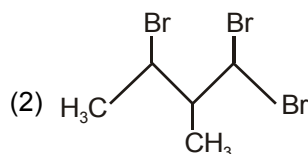
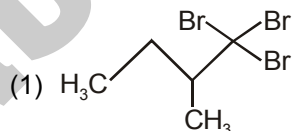
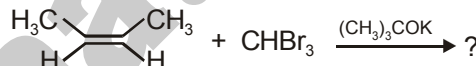
The decolorization of Br_2/water reaction shows electrophilic addition. The addition of bromine to cyclopentene provide evidence for bromonium ion intermediate in Br_2 addition. It follows ionic mechanism when cyclopentene react with Br_2 in presence of CCl_4 anti addition occurs and gives trans-isomer. So addition of halogen to an alkene is a stereospecific reaction.

52. In the reaction gives below 'A' is



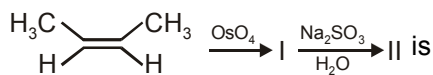
- (1) 2, 3-epoxy butane
- (2) 2, 3-butanediol
- (3) 2-butanone
- (4) Epoxy ethane

53. The product obtained in the reaction is



Class (XII)

54. The final product in



- (1) Meso-2, 3-butanediol
- (2) 2-butanol
- (3) \pm 2, 3-butanediol
- (4) 2-butanone

SECTION - IV

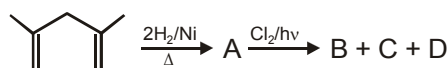
Straight Objective Question

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

55. A 0.2 M solution of an enantiomerically pure chiral compound (X) has an observed rotation 0.2° in 20 cm sample tube. The molecular mass of the compound is 150. The specific rotation of (X) is

- (1) 3.3
- (2) 0.015
- (3) 0.10
- (4) 0.15

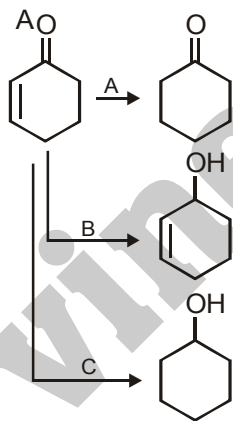
56. Given the following sequence of reaction



Identify the product 'B' which has maximum percentage in the reaction

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

57. In the given reaction, major products are given



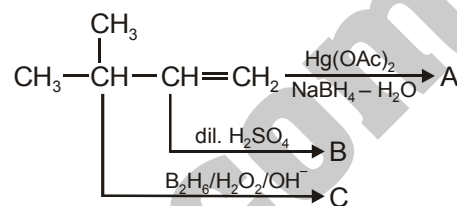
A, B & C are respectively

- (1) LAH, H_2/Ni , $\text{N}_2\text{H}_4/\text{H}_2\text{O}_2$
- (2) H_2/Ni , $\text{N}_2\text{H}_4/\text{H}_2\text{O}_2$, LAH
- (3) $\text{N}_2\text{H}_4/\text{H}_2\text{O}_2$, LAH, H_2/Ni
- (4) $\text{N}_2\text{H}_4/\text{H}_2\text{O}_2$, H_2/Ni , LAH

58. Which of the following will give blood red colour with FeCl_3 in sodium extract?

- (1) C_6H_4
- (2) $\text{H}_2\text{N}-\overset{\text{S}}{\parallel}{\text{C}}-\text{NH}_2$
- (3) $\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{NH}_2$
- (4) $\text{H}_2\text{N}-\overset{\text{O}}{\parallel}{\text{C}}-\text{NH}_2$

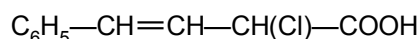
59.



The correct statements is

- (1) A & B are same alcohols, C is 1° alcohol
- (2) A, B & C are position isomers
- (3) A & C are same alcohols B is different
- (4) A, B & C are metamers

60. How many stereoisomer are possible for given compound?



- (1) 8
- (2) 2
- (3) 4
- (4) 6

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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 $\alpha \in \left(\frac{\pi}{2}, \pi\right)$, then the minimum value of

$$\sqrt{x^2 + x + 1} + \frac{\sec^2 \alpha}{\sqrt{x^2 + x + 1}}$$
 is

- (1) $2 \sec \alpha$ (2) 2
(3) $2 \tan \alpha$ (4) $-2 \sec \alpha$

62. Number of common tangents that can be drawn to the circles $x^2 + y^2 - 2x - 2y = 0$ and $x^2 + y^2 - 8x - 8y + 14 = 0$ is

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

63. The area of triangle whose vertices are $(\alpha, \beta\gamma)$, $(\beta, \alpha\gamma)$ and $(\gamma, \alpha\beta)$ is

- (1) $|\alpha + \beta + \gamma|$
(2) $\frac{1}{2} |\alpha\beta + \beta\gamma + \gamma\alpha|$
(3) $\frac{1}{2} |(\alpha - \beta)(\beta - \gamma)(\gamma - \alpha)|$
(4) 0

64. The focal chord of $y^2 = 16x$ is tangent to $(x - 2)^2 + y^2 = 1$, then the possible values of the slope of this chord are

- (1) ± 2 (2) $\pm \frac{1}{\sqrt{3}}$
(3) $\pm \sqrt{3}$ (4) $\pm \frac{1}{2}$

65. Let $a_1, a_2, a_3, \dots, a_{45}$ be in A.P. and $a_{23} = 45$. The sum $a_1 + a_2 + \dots + a_{45}$ is equal to

- (1) 625 (2) 2025
(3) 1525 (4) 1225

66. If $a_1, a_2, a_3, \dots, a_{40}$ are in A.P. and $a_1 + a_{40} = 25$ then $a_5 + a_8 + a_{11} - a_{14} - a_{27} + a_{30} + a_{33} + a_{36}$ is equal to

- (1) 25 (2) 75

- (3) 50 (4) 100

67. The abscissa of two points P, Q are the roots of the equation $x^2 + 2a_1x - a_2^2 = 0$ and their ordinates are the roots of $x^2 + 2a_3x - a_4^2 = 0$, then the distance between P and Q is equal to

- (1) $\sqrt{a_1^2 + a_2^2 + a_3^2 + a_4^2}$
(2) $\frac{1}{2} \sqrt{a_1^2 + a_2^2 + a_3^2 + a_4^2}$
(3) $\sqrt{\frac{a_1^2 + a_2^2 + a_3^2 + a_4^2}{2}}$
(4) $2\sqrt{a_1^2 + a_2^2 + a_3^2 + a_4^2}$

68. The sum of the infinite series $\frac{1}{2} + \frac{1}{2} + \frac{3}{8} + \frac{4}{16} + \dots$ is equal to

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

69. The equation of the straight line, which pass through the point $(1, 2)$ and trisect the intercept of line $2x + 5y = 40$, between axes, is

- (1) $17x - 10y - 24 = 0$ (2) $10x - 17y + 24 = 0$
(3) $17x + 10y + 24 = 0$ (4) $16x + 17y + 24 = 0$

70. A line joining two given points $A(5, 6)$ and $B(3, 8)$ is rotated about A in anticlockwise direction through an angle 15° , then the equation of line in new position is

- (1) $y - 6 = -\sqrt{3}(x - 5)$
(2) $y - 6 = \frac{1}{\sqrt{3}}(x - 5)$
(3) $y - 6 = \sqrt{3}(x - 5)$
(4) $y - 6 = -\frac{1}{\sqrt{3}}(x - 5)$

71. If a, b, c are in G.P. x and y be the A.M. between a, b and b, c respectively, then the value of

$$\left(\frac{a}{x} + \frac{c}{y}\right)\left(\frac{b}{x} + \frac{b}{y}\right)$$
 is

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

Class (XII)

72. If a, b, c are in A.P., b, c, a are in G.P., then c, a, b are in

- (1) A.P. (2) G.P.
(3) H.P. (4) A.G.P.

73. The image of $P(a, b)$ on $y = -x$ is Q and the image of Q on the line $y = x$ is R . Then the mid-point of PR is

- (1) $(a + b, b + a)$ (2) $\left(\frac{a+b}{2}, \frac{b+a}{2}\right)$
(3) $(a - b, b - a)$ (4) $(0, 0)$

74. The least distance between two points P and Q on the circles $x^2 + y^2 - 8x - 10y + 37 = 0$ and $x^2 + y^2 + 16x + 55 = 0$ respectively is

- (1) 5 units
(2) 8 units
(3) 10 units
(4) 12 units

75. The equation of the chord of the circle $x^2 + y^2 = a^2$ passing through the point $(2, 3)$ farthest from the centre is

- (1) $2x + 3y = 13$
(2) $3x - y = 3$
(3) $x - 2y + 4 = 0$
(4) $x - y + 1 = 0$

76. The minimum distance between the parabolas $y^2 - 4x - 8y + 40 = 0$ and $x^2 - 8x - 4y + 40 = 0$ is

- (1) 0
(2) $\sqrt{3}$
(3) $2\sqrt{2}$
(4) $\sqrt{2}$

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 : Lines $3x - 4y + 1 = 0$ and $4x + 3y - 3 = 0$ are perpendicular.

and

Statement-2 : If two lines are perpendicular, then product of their slopes is equal to -1 .

- (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. Consider the hyperbola $\frac{x^2}{144} - \frac{y^2}{44} = 1$

Statement-1 : From $(8, 6)$ two mutually perpendicular tangents can be drawn to given hyperbola.

and

Statement-2 : Locus of the point from which two mutually perpendicular tangent can be drawn to given hyperbola is $x^2 + y^2 = 100$.

- (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 : Angle between pair of lines represented by $x^2 + 6xy + 9y^2 + 4x + 12y - 5 = 0$ is 0° .

and

Statement-2 : Angle between pair of straight lines represented by $ax^2 + by^2 + 2hxy + 2gx + 2fy + c = 0$ is

$\tan^{-1} \left| \frac{2\sqrt{h^2 - ab}}{a + b} \right|$ provided $abc + 2fgh - af^2 - 2bg^2 - ch^2 = 0$.

- (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. Consider the ellipse $\frac{x^2}{125} + \frac{y^2}{75} = 1$.

Statement-1 : Equation of director circle of given ellipse is $x^2 + y^2 = 200$.

and

Statement-2 : Auxiliary circle of given ellipse is $x^2 + y^2 = 125$.

- (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. Consider $x + y = 18$, $x, y > 0$

Statement-1 : Maximum value of xy^2 is 864.

and

Statement-2 : xy^2 is maximum when $x = 6$

- (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.

Let us consider the circle $x^2 + y^2 = 10$ and the line $y = 1$ which cuts the circle at two points P and Q . On the basis of given information answer the following

82. The equation of parabola having PQ as latus rectum and which is concave downward, is

(1) $x^2 = 4\left(y + \frac{1}{2}\right)$ (2) $x^2 = -6\left(y + \frac{1}{2}\right)$

(3) $x^2 = -6\left(y + \frac{5}{2}\right)$ (4) $x^2 = -6\left(y - \frac{5}{2}\right)$

83. The equation of parabola having PQ as latus rectum and which is concave upward is

(1) $y^2 = 6\left(x + \frac{5}{2}\right)$ (2) $x^2 = 6\left(y + \frac{1}{2}\right)$

(3) $y^2 = 6\left(x - \frac{5}{2}\right)$ (4) $x^2 = 6\left(y - \frac{1}{2}\right)$

84. The distance between vertices of the possible parabolas is

(1) 1 unit (2) 3 units

(3) 2 units (4) 4 units

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. The mirror image of the parabola $y^2 = 4k$ with respect to the mirror as the tangent to the parabola at the point $(1, 2)$ is

(1) $(x - 1)^2 = 4(y + 1)$

(2) $(x + 1)^2 = 4(y + 1)$

(3) $(x + 1)^2 = 4(y - 1)$

(4) $(x - 1)^2 = 4(y - 1)$

86. Tangents are drawn to the ellipse $\frac{x^2}{9} + \frac{y^2}{5} = 1$ at ends of latera-recta. The area of quadrilateral so formed is

(1) 27 (2) $\frac{27}{2}$

(3) $\frac{27}{4}$ (4) $\frac{27}{55}$

Class (XII)

87. If the normal to the rectangular hyperbola $xy = c^2$ at the point $\left(ct_1, \frac{c}{t_1}\right)$ meets the curve again of

$\left(ct_2, \frac{c}{t_2}\right)$, then

- (1) $t_1^3 t_2 = 1$
 (2) $t_1^3 t_2 = -1$
 (3) $t_1 t_2 = 1$
 (4) $t_1 t_2 = -1$

88. If the circle $x^2 + y^2 = 1$ cuts the rectangular hyperbola $xy = 1$ in four points (x_i, y_i) , $i = 2, 3, 4$, then

- (1) $x_1 x_2 x_3 x_4 = -1$
 (2) $y_1 y_2 y_3 y_4 = 1$

(3) $x_1 + x_2 + x_3 + x_4 = 10$

(4) $y_1 + y_2 + y_3 + y_4 = 5$

89. If $(1+x)(1+x^2)(1+x^4) \dots (1+x^{128}) = \sum_{x=0}^n x^r$, then the value of n is

- (1) 512
 (2) 511
 (3) 255
 (4) 256

90. The vertices of a triangle are $\left(ab, \frac{1}{ab}\right)$, $\left(bc, \frac{1}{bc}\right)$,

$\left(ca, \frac{1}{ca}\right)$, where a, b, c are the roots of $x^3 - 3x^2 + 6x + 1 = 0$. Then the co-ordinates of its centroid are

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

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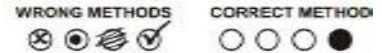
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4.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	19.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	34.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	49.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	64.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	79.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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"/>
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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"/>
8.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	23.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	38.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	53.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	68.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	83.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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"/>
11.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	26.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	41.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	56.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	71.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	86.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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"/>