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JEE-MAIN
Batch - Growth (June) | Minor Test – 12

Time: 3:00 **Test Date: 02nd February 2025** **Maximum Marks: 300**

Name of the Candidate: _____Roll No._____

Centre of Examination (in Capitals):_____

Candidate's Signature: _____Invigilator's Signature:_____

READ THE INSTRUCTIONS CAREFULLY

1. The candidates should not write their Roll Number anywhere else (except in the specified space) on the Test Booklet/Answer Sheet.
2. This Test Booklet consists of 75 questions.
3. This question paper is divided into three parts **PART A - MATHEMATICS, PART B - PHYSICS** and **PART C - CHEMISTRY** having 25 questions each and every **PART** has two sections.
   (i) **Section-I** contains 20 multiple choice questions with only one correct option. **Marking scheme:** +4 for correct answer, 0 if not attempted and –1 in all other cases.
   (ii) **Section-II** contains 5 questions, is an INTEGERAL VALUE.
   Marking scheme: +4 for correct answer, 0 if not attempted and –1 in all other cases.
4. No candidate is allowed to carry any textual material, printed or written, bits of papers, mobile phone any electronic device etc., except the Identity Card inside the examination hall/room.
5. Rough work is to be done on the space provided for this purpose in the Test Booklet only.
6. On completion of the test, the candidate must hand over the Answer Sheet to the invigilator on duty in the Room/Hall. However, the candidate is allowed to take away this Test Booklet with them.
7. **For integer-based questions, the answer should be in decimals only not in fraction.**
8. **If learners fill the OMR with incorrect syntax (say 24.5. instead of 24.5), their answer will be marked wrong.**

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TEST SYLLABUS

BATCH – Growth (JUNE)) | Minor Test - 12

02nd February 2025

Mathematics	:	Ellipse
Physics	:	Fluid Mechanics
Chemistry	:	Isomerism

Useful Data Chemistry:

Gas Constant	R	$= 8.314\,JK^{-1}mol^{-1}$
		$= 0.0821$ Lit atm $K^{-1}mol^{-1}$
		$= 1.987 \approx 2$ Cal $K^{-1}mol^{-1}$
Avogadro's Number	N_a	$= 6.023 \times 10^{23}$
Planck's Constant	h	$= 6.626 \times 10^{-34}$ Js
		$= 6.25 \times 10^{-27}$ erg.s
1 Faraday		= 96500 Coulomb
1 calorie		= 4.2 Joule
1 amu		$= 1.66 \times 10^{-27}$ kg
1 eV		$= 1.6 \times 10^{-19}$ J

Atomic No:

H = 1, D = 1, Li = 3, Na = 11, K = 19, Rb = 37, Cs = 55, F = 9, Ca = 20, He = 2, O = 8, Au = 79.

Atomic Masses:

He = 4, Mg = 24, C = 12, O = 16, N = 14, P = 31, Br = 80, Cu = 63.5, Fe = 56, Mn = 55, Pb = 207, Au = 197, Ag = 108, F = 19, H = 2, Cl = 35.5, Sn = 118.6

Useful Data Physics:

Acceleration due to gravity $g = 10\ m/s^2$

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PART – A: MATHEMATICS

SECTION-I

1. If the distance between the foci of an ellipse is half the length of its latus rectum, then the eccentricity of the ellipse is:

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

2. The equation of the circle drawn with the two foci of $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ as the end-points of a diameter, is

(A) $x^2+y^2=a^2+b^2$ (B) $x^2+y^2=a^2$

(C) $x^2+y^2=2a^2$ (D) $x^2+y^2=a^2-b^2$

3. The number of real tangents that can be drawn to the ellipse $3x^2+5y^2=32$ passing throygh $(3,5)$ is

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

4. The tangent and normal to the ellipse $3x^2+5y^2=32$ at the point $P(2,2)$ meet the x-axis at Q and R, respectively. Then the area (in sq. units) of the triangle PQR is :

(A) $\frac{34}{15}$ (B) $\frac{14}{3}$ (C) $\frac{16}{3}$ (D) $\frac{68}{15}$

5. In an ellipse, with centre at the origin, if the difference of the lengths of major axis and minor axis is 10 and one of the foci is at $(0,5\sqrt{3})$, then the length of its latus rectum is:

(A) 10 (B) 5 (C) 8 (D) 6

6. Let S and S' be the foci of an ellipse and B be any one of the extremities of its minor axis. If $\Delta S'BS$ is a right angled triangle with right angle at B and area $(\Delta S'BS)=8$ sq. units, then the length of a latus rectum of the ellipse is :

(A) 4 (B) $2\sqrt{2}$ (C) $4\sqrt{2}$ (D) 2

7. If tangents are drawn to the ellipse $x^2+2y^2=2$ at all points on the ellipse other than its four vertices then the mid points of the tangents intercepted between the coordinate axes lie on the curve:

(A) $\frac{1}{4x^2}+\frac{1}{2y^2}=1$ (B) $\frac{x^2}{4}+\frac{y^2}{2}=1$ (C) $\frac{1}{2x^2}+\frac{1}{4y^2}=1$ (D) $\frac{x^2}{2}+\frac{y^2}{4}=1$

8. If m is the slope of a common tangent to the curves $\frac{x^2}{16}+\frac{y^2}{9}=1$ and $x^2+y^2=12$, then $12m^2$ is. equal to:

(A) 6 (B) 9 (C) 10 (D) 12

9. The eccentricity of the curve $2x^2+y^2-8x-2y+1=0$ is :

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

10. Find the equation of the ellipse whose vertices are (± 13, 0) and foci are (± 5, 0).

(A) $\frac{x^2}{13}+\frac{y^2}{12}=1$ (B) $\frac{x^2}{169}+\frac{y^2}{144}=1$ (C) $\frac{x^2}{144}+\frac{y^2}{169}=1$ (D) $\frac{x^2}{12}+\frac{y^2}{13}=1$

11. The equation of the ellipse whose centre is at the origin and the x-axis, the major axis, which passes through the points (−6, 1) and (4, −4) is

(A) $3x^2 - 4y^2 = 32$ (B) $3x^2 + 4y^2 = 112$

(C) $4x^2 - 3y^2 = 112$ (D) $4x^2 + 3y^2 = 112$

12. A man running a race course notes that sum of its distance from two flag posts from him is always 10m and the distance between the flag posts is 8m. Then, the equation of the posts traced by the man is

(A) $\frac{x^2}{25}+\frac{y^2}{9}=1$ (B) $x^2 + y^2 = 25$ (C) $x^2 + y^2 = 9$ (D) $\frac{x^2}{9}+\frac{y^2}{25}=1$

13. The curve represented by $x = 2(\cos t + \sin t)$, $y = 5(\cos t - \sin t)$, is

(A) a circle (B) a parabola

(C) an ellipse (D) a hyperbola

14. The foci of the conic $25x^2 + 16y^2 - 150x = 175$ are:

(A) $(0, \pm 3)$ (B) $(0, \pm 2)$ (C) $(3, \pm 3)$ (D) $(0, \pm 1)$

15. The equation of the ellipse, with axes parallel to the coordinate axes, whose eccentricity is $\frac{1}{3}$ and foci are at $(2, -2)$ and $(2,4)$, is

(A) $\frac{(x-1)^2}{8}+\frac{(y-2)^2}{9}=9$ (B) $\frac{(x-2)^2}{8}+\frac{(y-1)^2}{9}=9$

(C) $\frac{(x-1)^2}{9}+\frac{(y-2)^2}{8}=9$ (D) $\frac{(x-2)^2}{9}+\frac{(y-1)^2}{8}=9$

16. If α and β are eccentric angles of the ends of a focal chord of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, then $\tan\frac{\alpha}{2}\tan\frac{\beta}{2}$ is equal to.

(A) $\frac{1-e}{1+e}$ (B) $\frac{e-1}{e+1}$ (C) $\frac{e+1}{e-1}$ (D) none of these

17. If the line $lx + my + n = 0$ to touches the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, then

(A) $a^2l^2 + b^2m^2 = n^2$ (B) $a^2m^2 + b^2l^2 = n^2$

(C) $a^2n^2 + b^2m^2 = l^2$ (D) none of these

18. The locus of mid-points of a focal chord of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is

(A) $\frac{x^2}{a^2}+\frac{y^2}{b^2}=\frac{ex}{a}$ (B) $\frac{x^2}{a^2}-\frac{y^2}{b^2}=\frac{ex}{a}$

(C) $x^2 + y^2 = a^2 + b^2$ (D) none of these

19. The equation of the ellipse with its centre at $(1, 2)$, one focus at $(6, 2)$ and passing through $(4, 6)$ is.

(A) $\frac{(x-1)^2}{45}+\frac{(y-2)^2}{20}=1$ (B) $\frac{(x-1)^2}{20}+\frac{(y-2)^2}{45}=1$

(C) $\frac{(x+1)^2}{45}+\frac{(y+2)^2}{20}=1$ (D) None of these

20. The eccentricity of a ellipse with centre at the origin and axes along the coordinate axes, is $1/2$. If one of the directrices is $x = 4$, then the equation of the ellipse is

(A) $4x^2 + 3y^2 = 1$ (B) $3x^2 + 4y^2 = 12$

(C) $4x^2 + 3y^2 = 12$ (D) $3x^2 + 4y^2 = 1$

SECTION-II

21. If the length of the latus rectum of the ellipse $x^2 + 4y^2 + 2x\ 8y - \lambda = 0$ is 4, and l is the length of its major axis, then $\lambda + l$ is equal to.

22. The area of the quadrilateral formed by the tangents at the end-points of latusrecta to the ellipse $\frac{x^2}{9} + \frac{y^2}{5} = 1$, is

23. If the eccentricities of the two ellipse $\frac{x^2}{169} + \frac{y^2}{25} = 1$ and $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ are equal, then the value of $\frac{5a}{b}$, is.

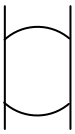
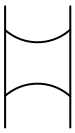
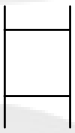
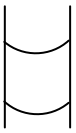
24. If the distance between the foci of an ellipse is 6 and the distance between its directrices is 12, then square of length of its latus rectum is:

25. If the co-ordinates of two points A and B are $(\sqrt{7}, 0)$ and $(-\sqrt{7}, 0)$ respectively and P is any point on the conic, $9x^2 + 16y^2 = 144$, then $PA + PB$ is equal to:

PART – B: PHYSICS

SECTION-I

26. A vertical glass capillary tube open at both ends contains some water. Which of following shapes may be taken by the water?

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

27. A raft of wood (density 600 kg/m^3) of mass 120 kg floats in water. How much weight can be put on the raft to make it just sink?

(A) 120 kg (B) 200 kg (C) 40 kg (D) 80 kg

28. When a capillary tube is dipped in a liquid, the capillary rise is h_1, when the inner surface is coated with wax, the capillary rise is h_2, then

(A) $h_1 = h_2$ (B) $h_1 < h_2$ (C) $h_1 > h_2$ (D) none of these

29. A beaker is filled with a liquid of density *d* up to a height *h*. If the beaker is at rest, then the mean pressure on any of the wall is

(A) zero (B) *hdg* (C) $\frac{h}{2}dg$ (D) 2 *hdg*

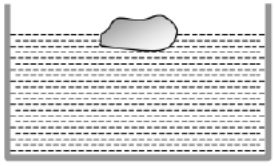
30. An open vessel containing water is given a constant acceleration a in the horizontal direction. Then the free surface of water gets sloped with the horizontal at an angle θ given by

(A) $\theta = \tan^{-1}\left(\frac{a}{g}\right)$ (B) $\theta = \tan^{-1}\left(\frac{g}{a}\right)$ (C) $\theta = \sin^{-1}\left(\frac{a}{g}\right)$ (D) $\theta = \cos^{-1}\left(\frac{g}{a}\right)$

31. A beaker containing a liquid of density ρ moves up with an acceleration a. The pressure due to the liquid at a depth h below the free surface of the liquid is

(A) $h\rho g$ (B) $h\rho(g+a)$ (C) $h\rho(g-a)$ (D) $2h\rho g\left(\frac{g-a}{g+a}\right)$

32. A body floats in a liquid contained in a beaker. The whole system as shown falls freely under gravity. The upthrust on the body due to the liquid is

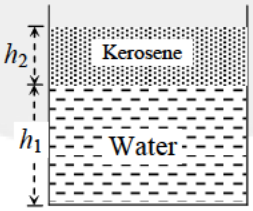


(A) Zero
(B) Equal to the weight of the liquid displaced
(C) Equal to the weight of the body in air
(D) Equal to the weight of the immersed position of the body

33. The ratio of excess pressure in two soap bubbles is 3 : 1. The ratio of their volumes will be

(A) $\frac{1}{3}$ (B) $\frac{1}{9}$ (C) $\frac{27}{1}$ (D) $\frac{1}{27}$

34. A wide vessel which is filled with water of density ρ_1 and kerosene of density ρ_2. The thickness of water layer is h_1 and that of kerosene layer is h_2. The gauge pressure at the bottom of the vessel will be



(A) $h_1\rho_1 g$ (B) $h_2\rho_2 g$ (C) $h_1\rho_1 g + h_2\rho_2 g$ (D) $h_1\rho_2 g + h_2\rho_1 g$

35. Work done in splitting a drop of water of 1 mm radius into 64 droplets is (Surface tension of water is 72×10^{-3} J/m^2)

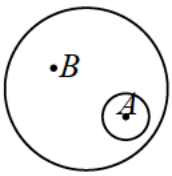
(A) 2.0×10^{-6} J (B) 2.7×10^{-6} J (C) 4×10^{-6} J (D) 5.4×10^{-6} J

36. Two water pipes of diameters 2 cm and 4 cm are connected with the main supply line. The velocity of flow of water in the pipe of 2 cm diameter is

(A) 4 times that in the other pipe (B) $\frac{1}{4}$ times that in the other pipe

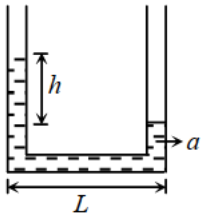
(C) 2 times that in the other pipe (D) $\frac{1}{2}$ times that in the other pipe

37. There is an air bubble of radius R inside a drop of water of radius $3R$. Find the ratio of gauge pressure at point B to that at point A.



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

38. At rest, a liquid stands at the same level in the tubes. As the system is given an acceleration a towards the right, a height difference *h* occurs as shown in the figure. The value of *h* is:

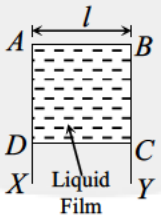


(A) $\frac{aL}{2g}$ (B) $\frac{gL}{2a}$ (C) $\frac{gL}{a}$ (D) $\frac{aL}{g}$

39. A large open tank has two holes in the wall. One is a square hole of side *L* at a depth *y* from the top and the other is a circular hole of radius *R* at a depth 4*y* from the top. When the tank is completely filled with water, the quantities of water flowing out per second from both the holes are the same. Then, *R* is equal to

(A) $\frac{L}{\sqrt{2\pi}}$ (B) 2 πL (C) *L* (D) $\frac{L}{2\pi}$

40. A liquid film is formed over a frame *ABCD* as shown in figure. Wire *CD* (massless) can slide without friction. The mass to be hung from *CD* to keep it in equilibrium is (Surface tension of liquid is *T*)



(A) $\frac{T}{g}$ (B) $\frac{2Tl}{g}$ (C) $\frac{g}{2Tl}$ (D) $T \times l$

41. If two soap bubbles of different radii are in communication with each other

(A) air flows from larger bubble into the smaller one until the two bubbles are of equal size.

(B) the size of the bubbles remains the same

(C) air flows from the smaller bubble into the larger one and larger bubble grows at the expense of the smaller one

(D) the air flows from the larger bubble into the smaller bubble until the radius of the smaller one becomes equal to that of the larger one, and of the larger one equal to that of the smaller one.

42. A ball of mass *m* and radius *r* is released in viscous liquid. The value of its terminal velocity is proportional to

(A) 1/*r* only (B) *m*/*r* (C) $(m/r)^{1/2}$ (D) *m* only

43. Two soap bubbles with radii r_1 and r_2 ($r_1 > r_2$) come in contact. Their common surface has a radius of curvature

(A) $\frac{r_1 + r_2}{2}$ (B) $\frac{r_1 r_2}{r_1 - r_2}$ (C) $\frac{r_1 r_2}{r_1 + r_2}$ (D) $\sqrt{r_1 r_2}$

44. A liquid drop at temperature T, isolated from its surroundings, breaks into a number of droplets. The temperature of the droplets will be
(A) equal to T
(B) greater than T
(C) less than T
(D) either (A), (B) or (C) depending on the surface tension of the liquid

45. An incompressible liquid is continuously flowing through a cylindrical pipe whose radius is $2R$ at point A. The radius at point B, in the direction of flow, is R. If the velocity of liquid at point A is v then its velocity at point B will be
(A) v (B) $4v$ (C) $2v$ (D) $v/2$

SECTION-II

46. A mercury drop of radius 1 cm is sprayed into 10^6 droplets of equal size. The energy expended (if surface tension of mercury is 35×10^{-3} N/m) is given as $\Delta U = \frac{4.35}{10^N}$ J Find N. (change in surface tension is neglected)

47. Two separate air bubbles (radii 0.002 m and 0.004 m) formed of the same liquid (surface tension 0.07 N/m) come together to form a double bubble. The radius R (in meter) of curvature of the internal film surface common to both the bubbles is $R = \frac{N}{1000}$. Find N.

48. A glass rod of diameter d_1 = 1.5 mm is inserted symmetrically into a glass capillary of inside diameter d_2 = 2 mm. Then the whole arrangement is vertically oriented and brought in contact with the surface of water. To what height (in mm) will the water rise in the capillary? (Density of water = 1 gm/cc, surface tension = 0.07 N/m, angle of contact = 0^0, g = 10 m/s^2)

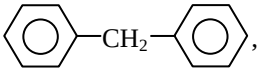
49. Two solids A and B float in water. It is observed that A floats with half its volume immersed and B floats with $2/3$ of its volume immersed. The ratio of densities of A and B is given as $\frac{\rho_A}{\rho_B} = \frac{N}{4}$ then find N.

50. If pressure at half the depth of a lake is equal to $\frac{2}{3}$ pressure at the bottom of the lake then what is the depth of the lake in meter (if atmospheric pressure = $10^5 \frac{N}{m^2}$, density of water $= 10^3 \frac{Kg}{m^3}$ and $g = 10 \frac{m}{s^2}$).

PART – C: CHEMISTRY

SECTION-I

51. The molecular formula of diphenylmethane,

 , is $C_{13}H_{12}$;

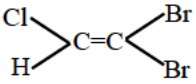
How many structural isomers are possible when one of the hydrogen is replaced by a chlorine atom ?
(A) 6 (B) 4 (C) 8 (D) 7

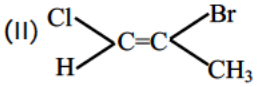
52. Tautomerism will be explained by:
(A) $(CH_3)_2NH$ (B) $(CH_3)_3$ CNO (C) R_3CNO_2 (D) RCH_2NO_2

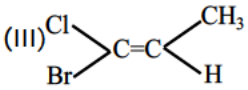
53. C_7H_7Cl shows how many aromatic isomers ?

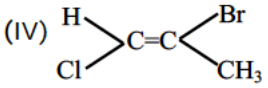
(A) 4 (B) 5 (C) 3 (D) 2

54. Which is a pair of geometrical isomers ?

(I) 

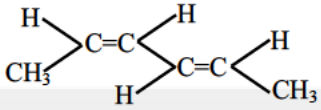
(II) 

(III) 

(IV) 

(A) I & II (B) I & III (C) II & IV (D) III & IV

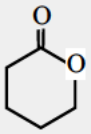
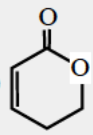
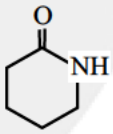
55. The correct name of the structure :



(A) (E), (E)-2,4-hexadiene (B) (Z), (Z)-2,4-hexadiene

(C) (E), (Z)-3,5-hexadiene (D) (Z), (E)-2,4-hexadiene

56. Which of the following compounds can not show tautomerism ?

(A) $HO-CH=CH_2$ (B)  (C)  (D) 

57. Which one of the following pairs are called position isomers

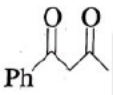
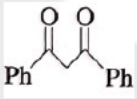
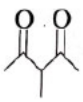
(A) $CH_2(OH)CH_2COOH$ & $CH_3-CH(OH)COOH$

(B) C_2H_5OH & CH_3OH

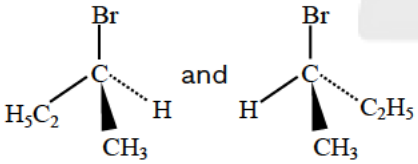
(C) $(C_2H_5)_2CO$ & $CH_3COCH_2CH_2CH_3$

(D) All are

58. Which of the following compound has highest enol content?

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

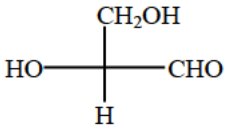
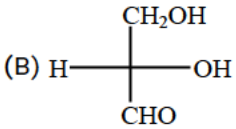
59. The given pair is

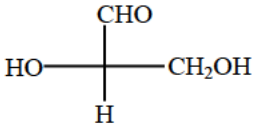
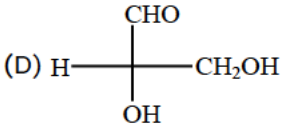


(A) enatiomers (B) Identical

(C) constitutional isomers (D) diastereomers

60. Which of the following Fischer's projection formula is identical to D-glyceraldehyde ?

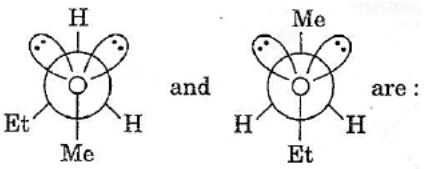
(A)  (B) 

(C)  (D) 

61. Most stable form of ethylene glycol is :

(A) anti (B) gauche

(C) fully eclipsed (D) partially eclipsed

62.  and are :

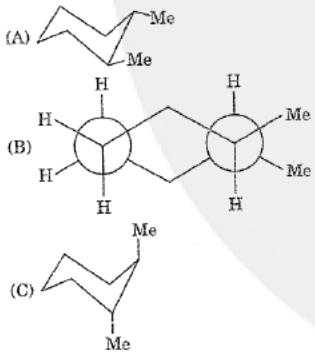
(A) chain isomers (B) metamers

(C) positional isomers (D) conformers

63. Minimum C atoms required for a compound to show geometrical isomerims:

(A) 2 (B) 3 (C) 4 (D) none of these

64. The correct stability order of the following species is.



(A) C < A < B (B) C = B < A (C) C < A = B (D) A = B = C

65. Which of the following statement is not correct?

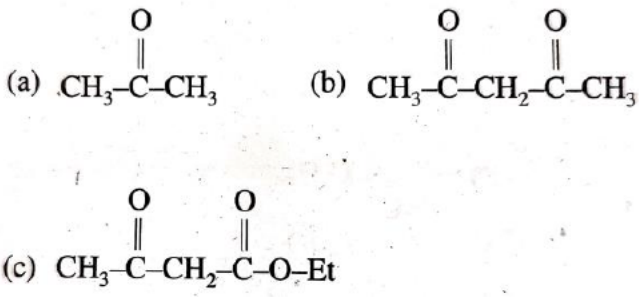
(A) Cyclobutane is a planar compound

(B) Trans cyclohexadecene is relatively more stable than its cis form

(C) Cis form of 1, 3, 5-trimethylcyclohexane is relatively more stable than its transform

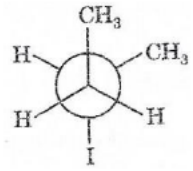
(D) Cis 1,2-dichloroethene is relatively more stable than its transform

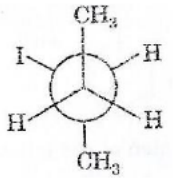
66. Order of stability of enol content:

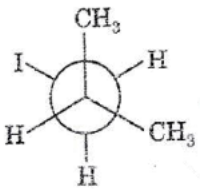


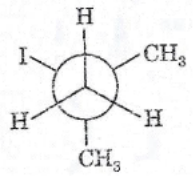
(A) a > b > c (B) b > a > c (C) b > c > a (D) a > b > c

67. Which of the Newman projections shown below represents the most stable conformation about the $C_1 - C_2$ bond of 1-iodo-2-methyl propane?

(A) 

(B) 

(C) 

(D) 

68. The correct order of the substituent in each of the following set in order of priority according to CIP rule

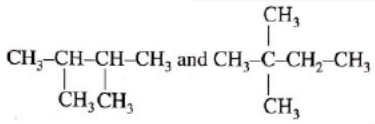
(A) -Cl > -OH > -SH > H

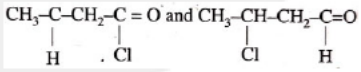
(B) $-CH_2 - Br > -CH_2-Cl > -CH_2-OH > -CH_3$

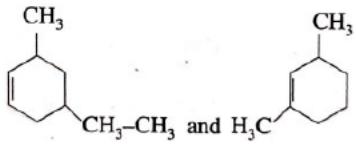
(C) $-CH = O > -OH > -CH_3 > -H$

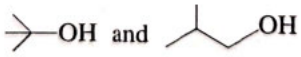
(D) $-OCH_3 > -N(CH_3)_2 > -CH_3 > -CD_3$

69. Which are not position isomers?

(A) 

(B) 

(C) 

(D) 

70. Which of the following will have zero dipole moment?

(A) cis-1, 2-Dichloroethene

(B) trans-1, 2-Dichloroethene

(C) trans-1, 2-Dichloropropene

(D) 2-Pentyne

SECTION-II

71. C_7H_8O shows how many Isomers

72. How many alcohols of the molecular formula $C_4H_{10}O$ are possible

73. $C_6H_4Cl_2$ is converted into $C_6H_3Cl_3$

(a) o–isomer will give x types of $C_6H_3Cl_3$

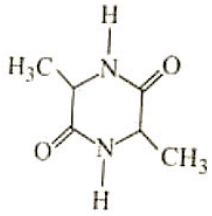
(b) m–isomer will give y types of $C_6H_3Cl_3$

(c) p–isomer will give z types of $C_6H_3Cl_3$.

What is the value of x + y + z =?

74. Number of structural isomers of given compounds is :
C_5H_{10}

75. How many isomers of the molecular formula C_7H_{16} are possible



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