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RANK BOOSTER

MOCK TEST

1

MULTIPLE CHOICE QUESTION (MCQ)

PART - A (Attempt any 15)

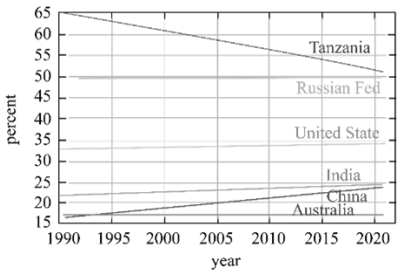
1. In humans, if both parents are of blood group AB, then, there is a 1/4 probability that their offspring will be of blood group A, and 1/2 probability that the offspring will be of blood group AB. If the couple have three children, what is the probability that NONE of the children will be of blood group A or AB?

(1) 1/4 (2) 3/4
(3) 1/64 (4) 63/64

2. The growth model for a population is
$N_t = N_0 e^{rt}$
where N_t is the population at time t, N_0 is the initial population and r is the per capita growth rate. How long does it take for the population numbers to double?

(1) $(In\ 2)\ /r$ (2) $2/r$
(3) $1/(r\ In\ 2)$ (4) $1/r$

3. The chart shows forest cover as percentages of total areas of 6 countries over the period 1990-2022 and their land areas (in million km²).



Land areas in million km²

Tanzania	0.9
Russian Fed	16.4
United State	9.1
India	3.0
China	9.4
Australia	7.7

The maximum change in forest area in absolute terms among these countries took place in

(1) Tanzania (2) Russian Federation
(3) India (4) China

4. Among five girls standing side by side, Leela has exactly one girl to her left, Alice is just right of Prerna, and there are at least two girls between Radha and Zarina. The girl in the middle is

(1) Prerna (2) Alice
(3) Leela (4) Zarina

5. A group of 54 boys and girls was made to stand in a queue as follows: a boy at the start was followed by a girl, then a boy followed by 2 girls, then a boy followed by 3 girls, and so on. The number of boys in the group was

(1) 8 (2) 9
(3) 10 (4) 27

6. A 1 m long rod having diameter of 12 mm weighs 880 g. What, approximately, is the density (in g/cm³) of the material of the rod?

(1) 6.2 (2) 6.6
(3) 7.8 (4) 8.8

7. Suppose liars always lie and truthful persons never. In a group of 4 people A, B, C and D, A says, "We're all liars", B says, "Only one of us is a liar", C says, "No, exactly two of us are liars" and D says, "I'm truthful". Which among the following is definitely FALSE?

(1) A is a liar (2) B is a liar
(3) C is a liar (4) D is a liar

8. Consider the first few consecutive natural numbers. The ratio of the sum of their squares to their sum can NEVER be

(1) 67 (2) 75
(3) 91 (4) 100

9. If $X > Y > 0$, then $X\%$ of Y is

(1) equal to $Y\%$ of X
(2) more than $Y\%$ of X
(3) less than $Y\%$ of X
(4) $(X + Y)\%$ of $(X + Y)$

10. If $16x^2 - 25y^2 + 7 = 0$, x and y being positive numbers, then which of the following may hold?

(1) $4x + 5y + 1 = 0$ (2) $4x + 5y + 7 = 0$
(3) $4x - 5y + 1 = 0$ (4) $4x - 5y - 7 = 0$

11. A spherical object of radius 6 cm was melted and cast into a cylindrical bar of radius 3 cm. What would be the length (in cm) of the bar?

(1) 24 (2) 32
(3) 36 (4) 42

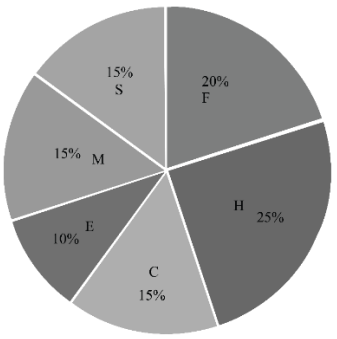
12. Every element in the central column of the matrix has a simple arithmetic relationship with the pairs on the left and right in the corresponding row.

$$\begin{bmatrix} 17 & 12 & 1 & 19 & 23 \\ 23 & 21 & X & 18 & 20 \\ 24 & 17 & 3 & 32 & 36 \\ 35 & 28 & 2 & 19 & 24 \end{bmatrix}$$

What would be the value of X?

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

13. The total monthly income of a family is split into expenses on food (F), house rent (H), college fees (C), entertainment (E), miscellaneous items (M), and savings (S), as shown in the pie chart.



The family transfers an amount of Rs 1000/- from the head food to the head entertainment, thereby making the expenses on the two heads equal. What is the net expenditure of the family?

(1) Rs 20,000 (2) Rs 50,000
(3) Rs 37,500 (4) Rs 17,000

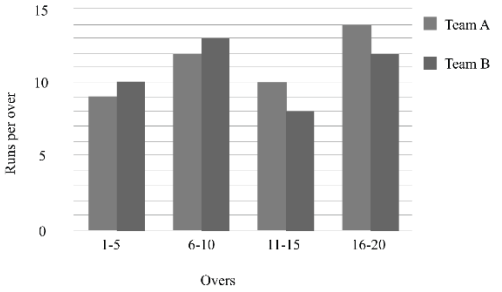
14. A certain item of raw food contains 35% starch, 25% protein, the rest fibre. The item is cooked by boiling in water, which doubles its weight. Half of the fibre in the food becomes soluble when cooked. If the cooked item weighs 200g, the amount of soluble fibre in it is

(1) 15 g (2) 30 g
(3) 20 g (4) 40 g

15. A straight irrigation canal in a plain area has a floor at a depth of 5 m from the surface. The canal is 20 m wide at the surface. The floor of the canal is flat and the embankments have a slope of 45°. When it is completely filled, what will be the volume of water (in m^3) in the canal over a length of 100m?

(1) 6000 (2) 7500
(3) 8000 (4) 9500

16. The graph shows average run rate (runs scored per over) by teams A and B in a twenty overs cricket match.



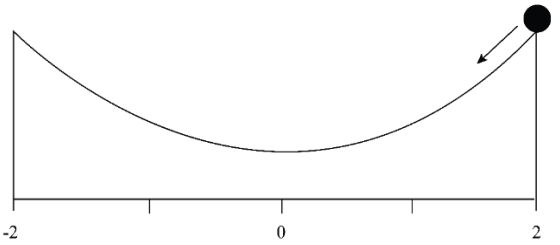
Select the INCORRECT statement.

(1) Team B scored more runs than team A in the first 10 overs.
(2) Team A scored more runs than team B in all.
(3) Team B scored more runs in overs 1-10 than in overs 11-20.
(4) Team A has a lower overall run rate than team B.

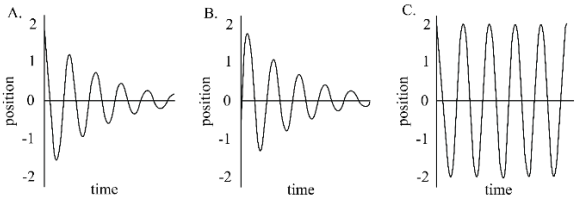
17. For any four consecutive decimal digits, the largest value of the product of the sum of any two and the sum of the other two is

(1) an even number and a perfect square
(2) an even number, but not a perfect square
(3) an odd number and a perfect square
(4) an odd number, but not a perfect square

18. A ball starts rolling from the edge of the slope at time t = 0 as shown in the diagram.



Referring to the graphs A, B, C, which of the following statements is correct?



(1) A depicts motion with friction while C depicts motion without friction
(2) C depicts motion with friction while A depicts motion without friction
(3) B depicts motion with friction while A depicts motion without friction
(4) B depicts motion with friction while C depicts motion without friction

19. A record player stylus moves along a spiral groove cut on an annular portion of a disc. A record with inner radius 4 cm and outer radius 10 cm of the annulus, turning 100 times plays for 22 minutes. During this time the stylus travels at an average linear speed that is approximately equal to

(1) 100 m/h (2) 120 m/h
(3) 220 m/h (4) 440 m/h

20. Choose the option that will make the following statement FALSE:

A CHILD COUNTED THE NUMBER OF APPEARANCES OF THE LETTERT

IN THIS SENTENCE, AND REPORTED IT CORRECTLY AS_____.

(1) TEN (2) ELEVEN
(3) TWELVE (4) THIRTEEN

PART - B (Attempt any 35)

21. For a reversible isothermal expansion of an ideal gas from volume V_1 to V_2 at temperature T, the work done by the gas is

(1) $RT \ln(V_2/V_1)$ (2) $RT \ln(V_1/V_2)$
(3) $P\Delta V$ (4) 0

22. At the triple point of water, which of the following holds true?

(1) $\mu_1(\text{liquid}) = \mu_1(\text{gas}) = \mu_1(\text{solid})$
(2) $\mu(\text{liquid}) = \mu(\text{gas}) \neq \mu(\text{solid})$
(3) $\mu(\text{liquid}) \neq \mu(\text{gas}) = \mu(\text{solid})$
(4) $\mu(\text{liquid}) + \mu(\text{gas}) = \mu(\text{solid})$

23. In a reaction A → products with rate law rate = $k[A]^2$, the half-life $t_{1/2}$ is

(1) $1/(k[A]_o)$ (2) $1/(k[A]_o^2)$
(3) $1/(k[A]_o)^2$ (4) $\ln 2/(k[A]_o)$

24. The Nernst equation for a half-cell reaction written as $Ox + n\,e^- \rightarrow Red$ is

(1) $E = E° - (RT/nF) \ln([Red]/[Ox])$
(2) $E = E° + (RT/nF) \ln([Ox]/[Red])$
(3) $E = E° - (RT/nF) \ln([Ox]/[Red])$
(4) $E = E° + (RT/nF) \ln([Red]/[Ox])$

25. The most probable distribution of N distinguishable particles in two energy levels ($\varepsilon_o=0$, ε_1) at temperature T is given by

(1) $N_o/N = e^{-o}/kT$
(2) $N_1/N_o = e^{-}\varepsilon_1/kT$
(3) $N_1/N = e^{-}\varepsilon_1/kT/(1 + e^{-}\varepsilon_1/kT)$
(4) $N_1/N = 1/(1 + e^{-}\varepsilon_1/kT)$

26. For a particle in a one-dimensional box of length L, the energy difference between levels n and (n+1) is proportional to

(1) $(n+1)^2 - n^2$ (2) $1/(n+1)^2 - 1/n^2$
(3) $(2n + 1)/n^2(n+1)^2$ (4) $\sqrt{(n+1)} - \sqrt{n}$

27. The Langmuir adsorption isotherm assumes

(1) multilayer adsorption
(2) no interaction between adsorbed molecules
(3) coverage $\theta = KP/(1 + KP)$
(4) both B and C

28. The rotational constant B of a diatomic molecule is given by

(1) $h/8\pi^2cI$ (2) $h^2/8\pi^2cI$
(3) $hc/8\pi^2I$ (4) $h/8\pi^2I$

29. The steric factor P in collision theory accounts for

(1) fraction of collisions with sufficient energy
(2) fraction of collisions with correct orientation
(3) quantum tunneling
(4) diffusion control

30. For the heterogeneous equilibrium between $CaCO_3(s)$, $CaO(s)$, and $CO_2(g)$, the number of degrees of freedom at constant pressure is

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

31. At high pressures, the fugacity f of a real gas is related to pressure P by

(1) $f/P \rightarrow 1$ (2) $f > P$
(3) $f < P$ (4) $f = P$

32. The steady-state approximation is most appropriate when

(1) all intermediates are in equilibrium
(2) intermediates have very short lifetimes
(3) the reaction is elementary
(4) product formation is instantaneous

33. A Schottky defect in NaCl involves

(1) cation vacancy only
(2) anion vacancy only
(3) equal number of cation and anion vacancies
(4) interstitial defects

34. Which actinide is most readily oxidized from +3 to +4 in aqueous solution?
(1) U (2) Th
(3) Pu (4) Am

35. The fluoride ion F^- in water acts as a
(1) weak acid (2) strong acid
(3) weak base (4) strong base

36. The decay mode of ^{60}Co is
(1) α-decay (2) β^--decay
(3) β^+-decay (4) γ-emission

37. The 18-electron count for ferrocene $[Fe(C_5H_5)_2]$ comes from
(1) Fe: 8 + 2×6 (2) Fe: 8 + 2×5
(3) Fe: 8 + 2×7 (4) Fe: 8 + 2×4

38. Phosphazenes have backbone –P=N–. The typical bond order of P=N is
(1) 1 (2) 1.5
(3) 2 (4) 2.5

39. Boron trifluoride (BF_3) is a Lewis acid because
(1) B has an empty p-orbital
(2) F withdraws electron density
(3) it forms adducts with bases
(4) all of the above

40. The enantiomer of (R)-2-butanol is
(1) (R)-2-butanol
(2) (S)-2-butanol
(3) meso-2,3-butanediol
(4) racemic mixture

41. The stability order of the following carbanions is:
i. CH_3^- ii. $(CH_3)_3C^-$ iii. $PhCH_2^-$ iv. $CF_3CH_2^-$
(1) ii > i > iii > iv (2) iv > iii > i > ii
(3) iii > i > ii > iv (4) iv > i > iii > ii

42. For the half-cell reaction
Fe3+ + e– ⟶ Fe2+
the standard potential is E∘=+0.77 V. At 25 °C, what is the potential when [Fe3+]=0.01 M and [Fe2+]=1.0 M?
(1) 0.715V (2) 0.825 V
(3) 0.693 V (4) 0.770 V

43. How many grams of Al are deposited at the cathode when a current of 5.00 A flows for 2.00 hours in a solution of Al3+? (MAl=27.0 g/mol)
(1) 10.8 g (2) 15.0 g
(3) 20.0 g (4) 3.35 g

44. The hydrogen-atom radial wavefunction for the 2s state has how many radial nodes?
(1) 0 (2) 1
(3) 2 (4) 3

45. X-rays of wavelength 1.54 Å are diffracted from a set of crystal planes with spacing 2.00 Å. The angle θ for the first order (n=1) reflection is closest to:
(1) 11° (2) 19°
(3) 23° (4) 37°

46. Which of the following set of peaks (m/z) appears in the mass spectrum of 2-pentanone?
(1) m/z = 86, 71, 43, 15
(2) m/z = 86, 57, 59
(3) m/z = 86, 71, 58, 43, 15
(4) m/z = 86, 57, 29, 15

47. Identify A, B & C in the following reaction:

(1) A = Propanoic Acid, B = Glutaraldehyde, C = Acetaldehyde
(2) A = Propanaldehyde, B = Glutaraldehyde, C = Acetaldehyde
(3) A = Propanoic Acid, B = Glutaric acid, C = Acetic acid
(4) A = Propanoic Acid, B = Glutaric acid, C = Acetaldehyde

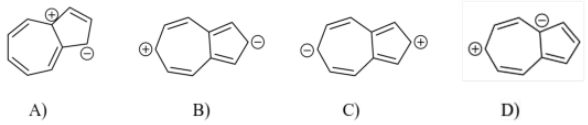
48. For an ideal gas undergoing reversible isothermal expansion, the function G and A are given as $G = H - TS$ and $A = U - TS$, respectively. Choose the correct answer from the options given below:
(A) $\Delta G = \Delta A$
(B) $\Delta(pV) = 0$
(C) $\Delta G > \Delta A$
(D) $\Delta(nRT) = 0$
(1) (A) and (B) only (2) (B), (C) and (D) only
(3) (C) and (D) only (4) (A), (B) and (D) only

49. Which of the following statement is true for the Lindemann mechanism for the unimolecular decomposition of a molecule?
(1) It follows second-order kinetics at high pressure.
(2) It follows second-order kinetics at low pressure.

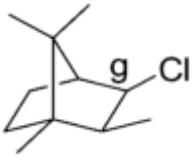
(3) The kinetics of the reaction does not depend on the gaseous pressure.
(4) It follows first-order kinetics at low pressure.

50. The biomedical applications of polyphosphazene polymers are:
(A) As structural materials for the construction of heart valves and blood vessels.
(B) They are used in drug delivery systems.
(C) Biodegradable support for *in vivo* bone regeneration.
Choose the correct answer from the options given below:
(1) (A) and (B) only (2) (B) and (C) only
(3) (A), (B) and (C) (4) (A) and (C) only

51. Among the resonance forms given below, which one is the most stable one?



52. Predict the approximate chemical shift and multiplicity of the ^1H-NMR peak for the proton at position 'g' marked in the structure shown below.

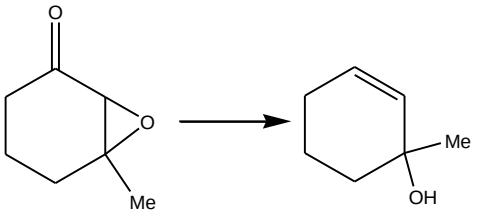


(1) 3 ppm and double-doublet
(2) 3 ppm and triplet
(3) 5.5 ppm and double-doublet
(4) 5.5 ppm and triplet

53. The intense red colour of [Fe(bpy)3]2+ (bpy=2,2-bipyridine) is due to
(1) Metal -to-ligand charge transfer (MLCT)
(2) Ligand- to-metal charge transfer(LMCT)
(3) d-d transition
(4) Inter valence charge transfer(IVCT)

54. One mole of a substance is heated from 300K to 400K at constant pressure. The Cp of the substance is given by, Cp(JK-mol-) = 5+0.1T. The change in entropy, in JK-mol- of the substance is.
(1) 117.43 (2) 114.8
(3) 11.438 (4) 14.38

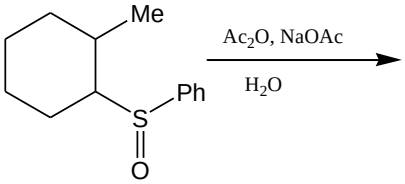
55. The most suitable reagent (s) to effect the following transformed is

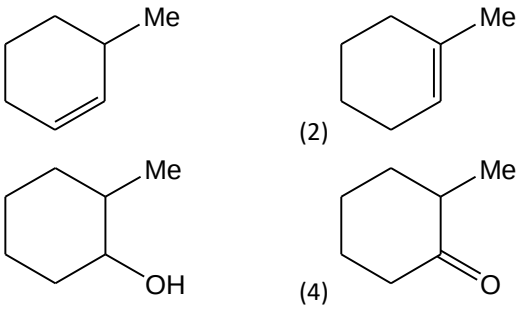


(1) N_2H_4, KOH HEAT (2) $TsNHNH_2$, CF_3COOH
(3) $LiAlH_4$ (4) Na, liq.NH_3

56. The point group of IF7 is
(1) D_{6h} (2) D_{5h}
(3) C_{6v} (4) C_{5v}

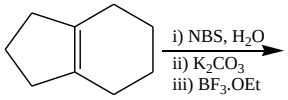
57. The major product formed in the following reaction is;

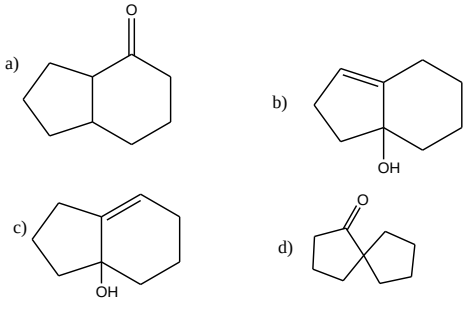




58. The percent transmittance of 8×10^{-5} M solution of KMnO4 is 39.8 when masured at 510nm in a cell of path length of 1cm. The absorbance and the molar extinction (in M- cm-) of this solution are, respectively
(1) 0.30 and 4500 (2) 0.35 and 4800
(3) 0.4 and 5000 (4) 0.48 and 5200

59. The major product formed in the following reaction is





60. The distance between two successive (110) planes in a simple cubic lattice with lattice parameter 'a' is

(1) $\sqrt{2}\,a$ (2) $\sqrt{3}\,a$

(3) $2\sqrt{2}\,a$ (4) $\frac{a}{\sqrt{2}}$

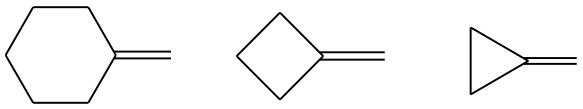
PART - C (Attempt any 25)

61. The value of the magnetic quantum number of a Px orbital is

(1) -1 (2) 0

(3) +1 (4) Undefined

62. The correct order of IR stretching frequency of the C=C in the following olefins is



(I) (II) (III)

(1) I > II > III (2) II > III >I

(3) III > II >I (4) III > I > II

63. $\varphi = Nr(6 - Zr)e^{-Zr/3}\cos\theta$, is a proposed hydrogenic wavefunction, where Z=atomic number, r=radial distance from the nucleus, θ= azimuthal angle, N is a constant. The incorrect statement about φ is

(1) φ=0 in the xy-plane

(2) Two radial nodes are present in φ

(3) One angular node is present in φ

(4) The size of the orbital decreases with increase in atomic number

64. R-(-)-2-Bromooctane on treatment with aqueous KOH mainly gives 2-octanol that is:

(1) optically active with 'R' configuration

(2) optically active with 'S' configuration

(3) a racemic mixture

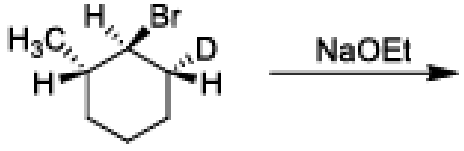
(4) a meso compound

65. The conductance at infinite dilution follows the order

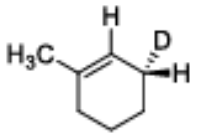
(1) $Li^+ > Na^+ > K^+$ (2) $Na^+ > Li^+ > K^+$

(3) $K^+ > Li^+ > Na^+$ (4) $K^+ > Na^+ > Li^+$

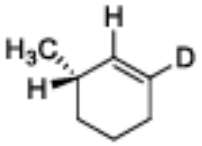
66. The reaction of the bromo compound shown below with sodium ethoxide gives predominantly.



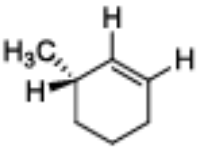
(A)



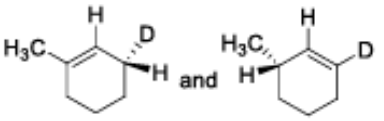
(B)



(C)



(D)



67. The structure of rock salt consists of

(1) A cubic close-packed array of anions with cations in all the octahedral sites.

(2) A cubic close-packed array of cations with anions in all the tetrahedral sites.

(3) A hexagonal close-packed array of anions with cations in all the octahedral sites.

(4) A cubic close-packed array of anions with cations in all the tetrahedral sites

68. The transition metal monoxide that shows metallic conductivity is:

(1) NiO (2) MnO

(3) TiO (4) CoO

69. In the following equation X is : $^{241}_{95}Am + \alpha \rightarrow {}^{243}_{97}Bk + X$

(1) $2\,^{1}_{0}n$ (2) $^{1}_{0}n$

(3) $2\,^{1}_{1}\mathrm{H}$ (4) $^{4}_{2}\mathrm{He}$

70. If we write a normalized wave function ψ as ψ = Â ϕ, then ϕ is also normalized when:

(1) Â is hermitian

(2) Â is anti – hermitian

(3) Â is unitary

(4) Â is any linear operator

71. The operator [x, [x, p2]] is identical with :

(1) [p x, [x, p]] (2) [x p, [x , p]]

(3) –[p,[x^2 p]] (4) [x, [x^2 , p]]

72. The rate constant of a unimolecular reaction was 2.66 × 10-1 and 2.2×10-1 at T=120K and 360 K respectively. The rate constant (in 1 s -1 units) at 240 K would be:

(1) 2.4×10^{-2} (2) 2.4×10^{-1}

(3) 4.8×10^{-2} (4) 1.8×10^{-3}

73. For a first order reaction A products, the plot of In[A]t[A]0vs time, where [A]0and [A]t refer to cocentration at time t = 0 and t respectively, is:

(1) a straight line with a positive slope passing through origin

(2) a straight line with a negative slope passing through origin.

(3) an exponential curve asymptotic to the time axis

(4) a curve asymptotic to the In[A]t[A]0 axis

74. The intensity of a light beam decreases by 50% when it passes through a sample of 1.0 cm path length. The percentage of transmission of the light passing through the same sample, but of 3.0 cm path length, would be

(1) 50.0 (2) 25.0

(3) 16.67 (4) 12.5

75. In kinetic study of a chemical reaction, slopes are drawn at different times in the plot of concentration· of reactants versus time. The magnitude of slopes with increase of time:

(1) remains unchanged

(2) increases

(3) decreases

(4) increases and decreases periodically

76. An example of a relaxation method of measuring rates is:

(1) Spectroscopic monitoring of product concentration.

(2) Stopped flow technique

(3) Temperature jump experiments.

(4) Measurement of spectral line widths.

77. Half-life t1/2 for a third order reaction 3C → products, where C0 is the initial concentration of C, will be:

(1) $\frac{3}{2kC_0^{\,2}}$ (2) $\frac{1}{kC_0}$

(3) $\frac{3}{2kC_0}$ (4) $\frac{2}{3kC_0^{\,2}}$

78. The angle between the z-axis the intrinsic spin angular momentum for $m_s = \pm 1/2$ is

(1) $(1/\sqrt{2})$ (2) $(\sqrt{3}/2)$

(3) $(1/2)$ (4) $(1/\sqrt{3})$

79. The fluorescence lifetime of a molecule in a solution is 5 × 10–9 s. The sum of all of the non-radiative rate constants (Σknr) for the decay of excited state is 1.2 × 108s -1. The fluorescence quantum yield of the molecule is:

(1) 0.1 (2) 0.2

(3) 0.4 (4) 0.6

80. The diffusion - controlled rate constant (in units of dm3s-1 mol-1) at 25°C for a species in a solvent with viscosity 1.00 × 10-3kg m-1s-1 is close to

(1) 19.8×10^9 (2) 6.6×10^9

(3) 2.3×10^6 (4) 6.6×10^3

81. The angular momentum operator $\hat{L}$y is:

(1) $-\frac{\hbar}{i}(y\frac{\partial}{\partial z} - z\frac{\partial}{\partial y})$ (2) $\frac{\hbar}{i}(z\frac{\partial}{\partial x} - x\frac{\partial}{\partial z})$

(3) $\frac{-i\hbar}{2m}\frac{\partial}{\partial x}$ (4) $\frac{\hbar}{i}(z\frac{\partial}{\partial x} - y\frac{\partial}{\partial y})$

82. In the Lindemann mechanism of unimolecular reactions, the observed order at low concentration is:

(1) 0.5 (2) 1

(3) 1.5 (4) 2

83. The degeneracy of an excited state of a particle in 3-dimensional cubic box with energy 3 times its ground state energy is:

(1) 3 (2) 2

(3) 1 (4) 4

84. Consider the cell:

Zn | Zn2+ (a = 0.01) || Fe2+(a = 0.001), Fe3+ (a = 0.01) | Pt

Ecell = 1.71V at 25ºC for the above cell.

The equilibrium constant for the reaction:

Zn + 2Fe3+ ⇌ Zn2+ + 2Fe2+ at 25oC would be close to:

(1) 10^{27} (2) 10^{54}

(3) 10^{81} (4) 10^{40}

85. If the specific conductance's of a sparingly soluble (1:1) salt (MW = 200 g mol-1) in its saturated aqueous solution at 250C and that of water are 1.5 x 10-3 ohm-1 and 1.5 x 10-5 ohm-1 dm-1, respectively, and the ionic conductance's for its cation and anion at infinite dilution are 0.485 and 1.0 ohm-1 dm2 mol-1, respectively, the solubility (in g L-1) of the salt in water at 250C is:

(1) 1×10^{-6} (2) 1×10^{-3}

(3) 2×10^{-1} (4) 2×10^{-4}

86. In a potentiometric titration, the end point is obtained by observing

(1) change in colour (2) jump in potential
(3) increase in current (4) increase in turbidity

87. The molar residual entropy (in J K-1) of solid OCS would be closest to

(1) 0 (2) 2.9
(3) 5.8 (4) 8.7

88. An ideal gas is composed of particles of mass in thermal equilibrium at a temperature in one container. Another container contains ideal gas particles of mass at a temperature. The correct statement about the two gases is:

(1) average kinetic energy and average speed will be same in the two cases.
(2) both the averages will be doubled in the second case.
(3) only the average kinetic energy will be doubled in the second case.
(4) only the average speed will be doubled in the second case.

89. The heat capacity of 10 mol of an ideal gas at a certain temperature is 300 JK–1 at constant pressure. The heat capacity of the same gas at the same temperature and at constant volume would be:

(1) 383 JK^{-1} (2) 217 JK^{-1}
(3) 134 JK^{-1} (4) 466 JK^{-1}

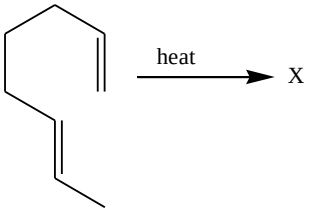
90. The dissociation constant of a weak acid HX at a given temperature is 2.5 × 10–5. The pH of 0.01 M NaX at this temperature is:

(1) 7.3 (2) 7.7
(3) 8.3 (4) 8.7

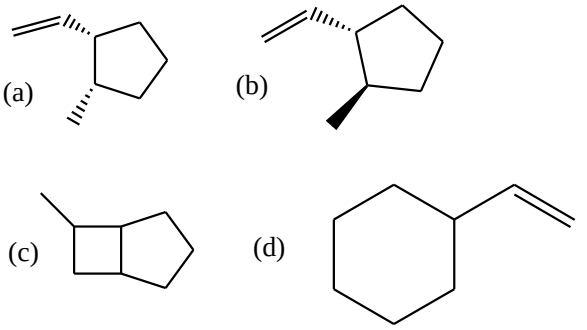
91. The region of electromagnetic spectrum employed in the electron spin resonance (ESR) spectroscopy is:

(1) Radiowave (2) Microwave
(3) Infrared (4) Visible

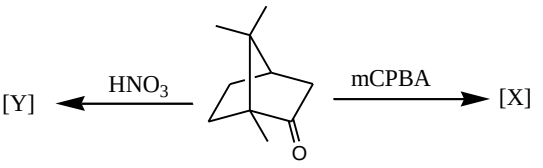
92. In the reaction



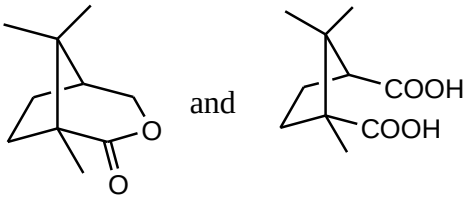
The major product X is

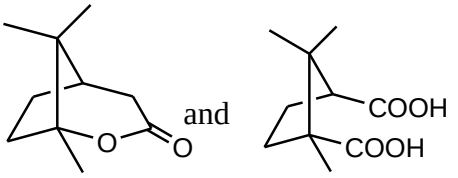


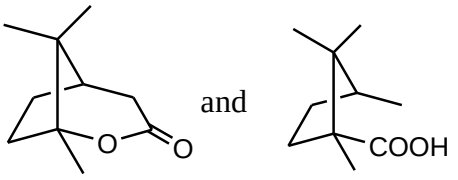
93. In the reaction

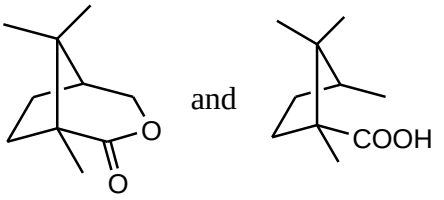


The major product [X] and [Y] respectively.









94. The wave function for a harmonic oscillator described by $N\exp(-\alpha x^2/2)$ has

(1) One maximum only
(2) One maximum, one minimum only
(3) Two maxima, one minimum only
(4) Two maxima, two minima only

95. The total number of metal-metal bonds in Ru3(CO)12 and Co4(CO)12 respectively, is

(1) 3 and 6 (2) 4 and 5
(3) Zero and 4 (4) 3 and 4

96. The crystal-field symbol for the ground state of [Mn(CN)6]4- is

(1) $^2T_{2g}$ (2) $^1A_{1g}$
(3) ^5E_g (4) $^6A_{1g}$

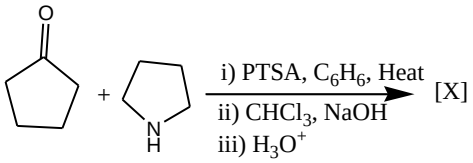
97. The activity of water at 11 bar and 298K is:

(1) 1.101 (2) 1.007
(3) 0.998 (4) 0.898

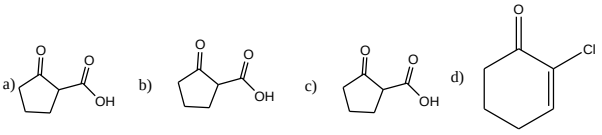
98. The freezing point constant for water is 1.86K(mol/Kg)-. The change in freezing point when 0.01 mol glucose is added to 1Kg water is:

(1) 1.86K (2) -1.86K
(3) 0.186K (4) -0.0186K

99. In the following reaction sequence



The major product [X] is:



100. For an irreversible adiabetic expansion of a perfect gas from volume Vi to Vf the change in entropy of the gas is:

(1) nRln(V_f/V_i) (2) Zero
(3) Less than zero (4) Greater than zero

101. The number of signals observed in 1H NMR spectrum of 3,5-dibromotoluene is:

(1) 3 (2) 4
(3) 2 (4) 6

102. The mean ionic activity coefficient of 0.0005 mol/Kg CaCl2 in water at 250C is:

(1) 0.98 (2) 0.67
(3) 0.81 (4) 0.91

103. The strongest reducing ion of the following is:

(1) U^{3+} (2) Am^{3+}
(3) Cm^{3+} (4) Cf^{3+}

104. The existence of two different coloured complexes of Co(NH3)4Cl2 is due to

(1) Optical isomerism
(2) Linkage isomerism
(3) Geometrical isomerism
(4) Coordination isomerism

105. Electron transfer from [Fe(H2O)6]2+ to [Fe(H2O)6]3+ is likely to occur via

(1) d-d transition
(2) Inner sphere electron transfer
(3) SN^1 mechanism
(4) Outer sphere electron transfer

106. The combination of two reflections, $\sigma_v'\sigma_v''$ about an intersecting mirror plane is equivalent to

(1) S_n (2) C_n
(3) σ_h (4) i

107. A certain system of non-interacting particles has the single-particle partition has the single-particle partition function $f = A\frac{T^m}{V}$ where A is some constant. The average energy per particle will be:

(1) $m_\kappa T$ (2) $A_\kappa T$
(3) $_\kappa T/ m$ (4) $_\kappa T/ A$

108. The character table of C3v point group is provided below, along with an additional reducible representation, Γ'

	E	$2C_3$	3σv
A_1	1	1	1
A_2	1	1	-1
E	2	-1	0
Γ'	6	0	2

Γ' is given by:

(1) $A_1 + A_2 + 2E$ (2) $2A_1 + 2E$
(3) $2A_2 + 2E$ (4) $2A_1 + 2A_2 + E$

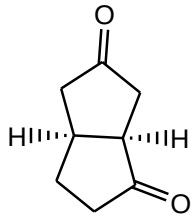
109. The half-life of a first order reaction varies with temperature according to

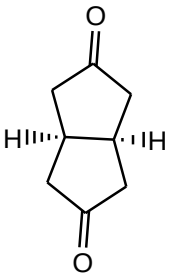
(1) $\ln t_{1/2} \alpha \frac{1}{T}$ (2) $\ln t_{1/2} \alpha T$
(3) $t_{1/2} \alpha \frac{1}{T^2}$ (4) $t_{1/2} \alpha T^2$

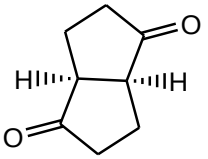
110. The most populated rotational state for HCl (B=8.5cm-) at 300K is:

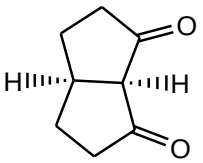
(1) 2 (2) 3
(3) 5 (4) 7

111. Among bicyclo [3,3,0] octanadiones given below, which one will exhibit FIVE signals in the broad decoupled 13C NMR spectrum?

A) 

B) 

C) 

D) 

112. The transmittance of an alcoholic solution of a certain compound at 500 nm is 1 percent in a 1cm cell. Its absorbance is:

(1) 1 (2) 2

(3) 2.5 (4) 4.0

113. The molecular that has an S6 symmetry element is:

(1) B_2H_6 (2) CH_4

(3) PH_5 (4) SF_6

114. Root mean square speed of the molecules of a perfect gas is proportional to

(1) $1/T^{1/2}$ (2) T

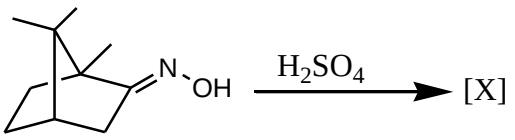
(3) $T^{1/2}$ (4) 1/T

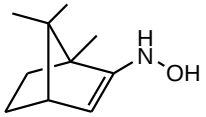
115. Consider an orthorhombic unit cell of dimension a=450pm, b=650pm, and c=400pm. The perpendicular distance between the (110) plane is

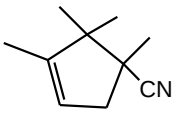
(1) 650pm (2) 450pm

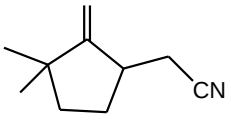
(3) 370pm (4) 500pm

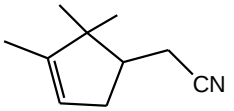
116. The major product formed in the following reaction is:



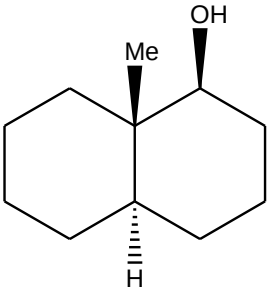
A) 

B) 

C 

D) 

117. The configurations at the three chiral centres in the bicyclodecanol given below, are



(1) 1S,2S,6R (2) 1S, 2S, 6S

(3) 1R, 2S, 6R (4) 1R, 2S, 6R

118. BH3.CO is more stable than BF3.CO because

(1) CO is a soft base and BH_3 and BF_3 are soft and hard acids respectively

(2) CO is a hard base and BH_3 and BF_3 are hard and soft acids respectively

(3) CO is a soft base and BH_3 and BF_3 are hard and soft acids respectively.

(4) CO is a soft acid and BH_3 and BF_3 are soft and hard bases respectively.

119. Adiabetic reversible expansion of a monoatomic gas (M) and a diatomic gas (D) at an initial temperature Ti, has been carried out independently from initial volume V1 to final volume V2. The final temperature (TM for monoatomic and TD for diatomic) atained will be

(1) $T_M = T_D > T_i$ (2) $T_M < T_D < T_i$

(3) $T_M > T_D > T_i$ (4) $T_D < T_M < T_i$

120. From the date of two half cell reactions:

$AgCl(s) + e^- \longrightarrow Ag(s) + Cl^-(aq)$ $E^0 = +0.22V$

$Ag^+(aq) + e^- \longrightarrow Ag(s)$ $E^0 = +0.80V$

The solubility product of AgCl at 298K, is calculated to be

(1) 1.5×10^{-10} (2) 2.1×10^{-7}

(3) 3.0×10^{-3} (4) 1.2×10^{-5}

ANSWER KEY									
PART - A									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
(3)	(1)	(4)	(1)	(2)	(3)	(4)	(4)	(1)	(3)
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
(2)	(3)	(4)	(3)	(2)	(4)	(3)	(1)	(2)	(1)
PART - B									
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
(1)	(1)	(1)	(4)	(3)	(1)	(4)	(1)	(2)	(2)
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
(2)	(2)	(3)	(2)	(3)	(2)	(2)	(2)	(4)	(2)
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
(2)	(3)	(4)	(2)	(1)	(1)	(3)	(4)	(2)	(4)
51	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
(4)	(1)	(1)	(3)	(1)	(2)	(4)	(3)	(4)	(4)
PART - C									
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**
(4)	(3)	(2)	(2)	(4)	(3)	(1)	(3)	(1)	(3)
71	**72**	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**
(3)	(1)	(2)	(4)	(3)	(3)	(1)	(4)	(3)	(2)
81	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**
(2)	(4)	(1)	(2)	(3)	(2)	(3)	(3)	(2)	(3)
91	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**100**
(2)	(1)	(2)	(2)	(1)	(1)	(1)	(4)	(4)	(4)
101	**102**	**103**	**104**	**105**	**106**	**107**	**108**	**109**	**110**
(1)	(4)	(1)	(3)	(4)	(2)	(1)	(2)	(1)	(2)
111	**112**	**113**	**114**	**115**	**116**	**117**	**118**	**119**	**120**
(4)	(2)	(4)	(3)	(3)	(4)	(1)	(1)	(4)	(1)

EXPLANATIONS

PART –A

1. Explanation: (3)

Step 1: Understand the probabilities

- Probability of offspring being blood group A = $\frac{1}{4}$.
- Probability of offspring being blood group AB = $\frac{1}{2}$.
- Thus, the combined probability of offspring being blood group A or AB is:

$$P(A \text{ or } AB) = \frac{1}{4} + \frac{1}{2} = \frac{3}{4}.$$

- The probability of offspring NOT being blood group A or AB is:

$$P(\text{Not A or AB}) = 1 - P(A \text{ or } AB) = 1 - \frac{3}{4} = \frac{1}{4}.$$

Step 2: Probability for three children

If the couple has three children, and none of them belong to blood group A or AB, the probability of this event is:

$$P = \left(\frac{1}{4}\right)^3 = \frac{1}{64}.$$

Final Answer:

The correct option is 3: 1/64.

2. Explanation: (1)

Doubling the population

The growth model is given as: $N_t = N_0 e^{rt}$

If the population doubles, then: $N_t = 2N_0$

Substitute this into the equation: $2N_0 = N_0 e^{rt}$

Simplify the equation

Divide through by N_0 (assuming $N_0 \neq 0$): $2 = e^{rt}$

Take the natural logarithm (ln) of both sides: $\ln(2) = rt$

$$t = \frac{\ln(2)}{r}$$

Final Answer:

The correct option is 1: $\frac{\ln(2)}{r}$.

3. Explanation: (4)

Let's analyze the maximum absolute change in forest area.

Step 1: Identify the forest cover percentages in 1990 and 2022

From the chart:

- Tanzania: Decreased from ~65% to ~50% (change = -15 percentage points)
- Russian Federation: Slight decrease, from ~45% to ~43% (change = -2 percentage points)
- India: Increased from ~20% to ~24% (change = +4 percentage points)
- China: Increased from ~16% to ~24% (change = +8 percentage points)

Step 2: Convert percentage change into absolute land area change

Using the given land areas:

Tanzania (0.9 million km²): 15% decrease → (15/100) × 0.9 = 0.135 million km² loss

Russian Federation (16.4 million km²): 2% decrease → (2/100) × 16.4 = 0.328 million km² loss

India (3.0 million km²):4% increase → (4/100) × 3.0 = 0.12 million km² gain

China (9.4 million km²):8% increase → (8/100) × 9.4 = 0.752 million km² gain

Step 3: Compare the absolute changes

- Tanzania: 0.135 million km² loss
- Russian Federation: 0.328 million km² loss
- India: 0.12 million km² gain
- China: 0.752 million km² gain (Largest absolute change)

Conclusion:

The maximum absolute change in forest area occurred in China.

Correct Answer: 4. China

4. Explanation: (1)

The Explanation: Prerna.

Explanation:

The positions of the five girls are determined based on the given conditions:

1. Leela has exactly one girl to her left: This means Leela must be in position 2.
2. Alice is just right of Prerna: Alice and Prerna must occupy consecutive positions, with Alice immediately to the right of Prerna.
3. There are at least two girls between Radha and Zarina: Radha and Zarina must be placed at the two ends (positions 1 and 5) to satisfy this condition.

Final Arrangement:

1. Radha
2. Leela
3. Prerna
4. Alice
5. Zarina

The girl in the middle position (position 3) is Prerna

5. Explanation: (2)

Arrangement Pattern

1. The first boy is followed by 1 girl.
2. The second boy is followed by 2 girls.
3. The third boy is followed by 3 girls.
4. The fourth boy is followed by 4 girls.
5. This pattern continues, with each subsequent boy followed by one more girl than the previous boy.

Total Number of Participants

Let n be the number of boys in the queue. The total number of participants can be represented as:

- Boys: n
- Girls: $1 + 2 + 3 + \ldots + n$ (which is the sum of the first n natural numbers)

The sum of the first n natural numbers is given by the formula:

$$\text{Sum} = \frac{n(n+1)}{2}$$

Total Equation

The total number of boys and girls is given as 54:

$$n + \frac{n(n+1)}{2} = 54$$

$$2n + n(n+1) = 108$$

$$n^2 + 3n - 108 = 0$$

$$n^2 + 12n - 9n - 108 = 0$$

$$\mathrm{n}(\mathrm{n}+12) - 9(\mathrm{n}+12) = 0$$

$$(\mathrm{n}+12)(n-9) = 0$$

n = -12 (not valid since n cannot be negative), 9

Conclusion

The number of boys in the group is 9.

6. Explanation: (3)

Convert Given Values to Consistent Units

- Mass of the rod = 880 g
- Length of the rod = 1 m = 100 cm
- Diameter of the rod = 12 mm = 1.2 cm
- Radius $r = \frac{1.2}{2} = 0.6$ cm

Calculate the Volume of the Rod

The rod is cylindrical, so its volume is:

$V = \pi r^2 h$
$V = \pi(0.6)^2(100)$
$V = \pi(0.36)(100)$
$V = 36\pi \approx 36 \times 3.1416$
$V \approx 113.1\ \text{cm}^3$
$\text{Density} = \frac{\text{Mass}}{\text{Volume}} = \frac{880}{113.1}$
$\approx 7.8\ \text{g/cm}^3$
Final Answer:
The density is 7.8 g/cm³, so the correct option is:
3. 7.8.

7. Explanation: (4)

- If A says, "We're all liars", and A is truthful, it leads to a contradiction because A would be lying about being a liar. Hence, A must be a liar.
- If B says, "Only one of us is a liar", and B is truthful, then it means only one person is a liar. Since we already determined A is a liar, this statement cannot be true. Hence, B must be a liar.
- We know A and B are liars. If C were telling the truth, then there would be exactly two liars. However, if C is truthful, then D's statement "I'm truthful" must also be true, contradicting C's statement of exactly two liars. Therefore, C must also be lying. So, C is a liar.
- If C were telling the truth, there would be exactly two liars.

  If C is truthful, then no one else can be a liar, which means D must be truthful. Therefore, "D is a liar" is an incorrect statement.

  Conclusion:

  Based on the analysis, the statement that is definitely FALSE is "D is a liar".

8. Explanation: (4)

We need to determine which ratio of the sum of squares to the sum of the first n natural numbers is never possible.

Step 1: Formulating the Ratio

For the first n natural numbers:

- Sum of squares: $S_2 = 1^2 + 2^2 + 3^2 + \ldots + n^2 = \frac{n(n+1)(2n+1)}{6}$
- Sum of numbers: $S_1 = 1 + 2 + 3 + \ldots + n = \frac{n(n+1)}{2}$
- Ratio: $R = \frac{S_2}{S_1} = \frac{\frac{n(n+1)(2n+1)}{6}}{\frac{n(n+1)}{2}} = \frac{(2n+1)}{3}$

Step 2: Checking the Given Options

From our formula: $R = \frac{(2n+1)}{3}$

This means R must be of the form $\frac{(2n+1)}{3}$, where $2n + 1$ is an odd number and divisible by 3.

Let's check:

- 67: $3 \times 67 = 201$ (odd, divisible by 3) (Possible)
- 75: $3 \times 75 = 225$ (odd, divisible by 3) (Possible)
- 91: $3 \times 91 = 273$ (odd, divisible by 3) (Possible)
- 100: $3 \times 100 = 300$ (not odd, not valid) (Impossible)

Correct answer: Option 4 (100).

9. Explanation: (1)

We need to determine the relationship between X% of Y and Y% of X, given that X > Y > 0.

Step 1: Expressing in Mathematical Form

- X% of Y = $\frac{X}{100} \times Y = \frac{XY}{100}$
- Y% of X = $\frac{Y}{100} \times X = \frac{YX}{100}$

Step 2: Compare the Two Expressions

$$\frac{XY}{100} = \frac{YX}{100}$$

Since multiplication is commutative (XY = YX), both expressions are equal.

Conclusion:

The Explanation::

Option 1: equal to Y% of X

10. Explanation: (3)

Given equation:
$16x^2 - 25y^2 + 7 = 0$
$16x^2 - 25y^2 = -7$
Compare the given options by putting them into the quadratic form.
Option 1: $4x + 5y + 1 = 0$
If we assume this to be true, then:

$$4x = -5y - 1$$

Since both x and y are positive numbers, this equation would result in a negative value, which is not possible.
Option 2: $4x + 5y + 7 = 0$
If we assume this to be true, then:

$$4x = -5y - 7$$

Again, both x and y are positive, leading to a negative value, which is not possible.
Option 3: $4x - 5y + 1 = 0$
If we assume this to be true, then:

$$4x - 5y = -1$$
$$16x^2 - 25y^2 = (-1)^2 = 1$$

which correctly balances our original equation when substituting values for x and y, maintaining the same quadratic relation.
Option 4: $4x - 5y - 7 = 0$
If we assume this to be true, then:
$4x - 5y = 7$
$(4x - 5y)^2 = 49$
leading to: $16x^2 - 25y^2 = 49$

which is incompatible with our initial equation.

Conclusion:

The correct option is:

Option 3: $4x - 5y + 1 = 0$

11. Explanation: (2) To find the length of the cylindrical bar, we use the principle of volume conservation, which states that the volume of the melted spherical object is equal to the volume of the cylindrical bar.

The volume of a sphere is given by the formula:

$V_{\text{sphere}} = \frac{4}{3}\pi r^3$

$V_{\text{sphere}} = \frac{4}{3}\pi(6)^3$

$= \frac{4}{3}\pi(216) = 288\pi$ cm^3

The volume of a cylinder is given by:

$V_{\text{cylinder}} = \pi r^2 h$

Given that the radius of the cylinder is 3 cm, and its height (length) is h, we equate the volumes:

$288\pi = \pi(3)^2 h$

$288\pi = 9\pi h$

$288 = 9h$

$h = \frac{288}{9} = 32$ cm

Final Answer:

The length of the cylindrical bar is 32 cm. Correct option: (2) 32

12. Explanation: (3)

We observe that the element in the central column (1, X, 3, 2) is the difference between the sums of the pairs on the left and right in the corresponding row.

For the first row: $(17 - 12) - (23 - 19) = 5 - 4 = 1$

For the third row: $(24 - 17) - (36 - 32) = 7 - 4 = 3$

For the fourth row: $(35 - 28) - (24 - 19) = 7 - 5 = 2$

Now, for the second row: $(23 - 21) - (20 - 18) = 2 - 2 = 0$

Therefore, the value of X should be 0.

13. Explanation: (4)

- Let the total monthly income of the family be x.
- Initially, the expenses on food (F) = 20% of x, and the expenses on entertainment (E) = 10% of x.
- After transferring Rs 1000 from food to entertainment, we have:
- New expenses on food = (20% of x) - Rs 1000
- New expenses on entertainment = (10% of x) + Rs 1000
- Since the expenses on food and entertainment are now equal:
- $(20\% \text{ of } x) - 1000 = (10\% \text{ of } x) + 1000$
- Solving for x: 10% of x = Rs 2000
- x = Rs 20,000
- The net expenditure of the family is the total income minus savings.
- Savings = 15% of Rs 20,000 = Rs 3000.
- Therefore, the net expenditure = Rs 20,000 - Rs 3000 = Rs 17,000.

Conclusion:

The Explanation: Option 4: Rs 17,000.

14. Explanation: (4)

Let the initial weight of the raw food be x grams.

After cooking, the weight of the food becomes 2x grams.

Given that the cooked item weighs 200 g, we have:

$2x = 200g$

$\Rightarrow x = 100g$

Amount of fibre in raw food = $100 - (35 + 25) = 40\%$ of 100 g = 40 g

Half of the fibre becomes soluble when cooked:

Soluble fibre $= 40g/2 = 20g$

Therefore, the amount of soluble fibre in the cooked item is 20 g.

15. Explanation: (2)

Step 1: Determine the dimensions at the bottom of the canal:

Slope of 45° means the horizontal distance increases by 1 m for every 1 m of depth.

The total increase in width due to the slope from both sides = 5 m + 5 m = 10 m

The width at the bottom of the canal = 20 m - 10 m = 10 m

Step 2: Identify the shape and calculate the cross-sectional area:

The cross-sectional area is a trapezoid.

Area (A) of a trapezoid = $\frac{1}{2}$ × (top width + bottom width) × height

Here, top width = 20 m, bottom width = 10 m, height = 5 m

$AreaA = \frac{1}{2} \times (20 + 10) \times 5$

$AreaA = \frac{1}{2} \times 30 \times 5$

$AreaA = 15 \times 5 = 75$

Step 3: Calculate the volume:

Volume = Cross-sectional area × Length

Volume = 75 m^2 × 100 m

Volume = 7500 m^3

Thud the Explanation: 7500

16. Explanation: (4)

Observations from the Graph:

1. Overs 1-5: Team B has a slightly higher run rate than Team A.
2. Overs 6-10: Team B's run rate is again slightly higher than Team A.
3. Overs 11-15: Team A's run rate is higher than Team B.
4. Overs 16-20: Team A has a higher run rate than Team B.

Evaluating the Statements:

1. "Team B scored more runs than Team A in the first 10 overs."
- True, because Team B has a higher run rate in both 1-5 and 6-10 overs.
2. "Team A scored more runs than Team B in all."
- Likely true because Team A had a significantly higher run rate in the last 10 overs (which compensates for the lower run rate in the first 10 overs).
3. "Team B scored more runs in overs 1-10 than in overs 11-20."
- True, because Team B's run rate was higher in the first 10 overs and lower in the last 10 overs.
4. "Team A has a lower overall run rate than Team B."
- Incorrect, since Team A had a better run rate in the second half of the innings and likely outscored Team B overall.

Answer:

The incorrect statement is:

4.Team A has a lower overall run rate than Team B.

17. Explanation: (3)

For any four consecutive decimal digits, the largest value of the product of the sum of any two and the sum of the other two is:

Let's consider four consecutive decimal digits: 1, 2, 3, and 4.

The possible sums of any two digits are:

- 1 + 2 = 3
- 1 + 3 = 4
- 1 + 4 = 5
- 2 + 3 = 5
- 2 + 4 = 6
- 3 + 4 = 7

Now, we need to find the product of the sum of any two and the sum of the other two.

Let's consider all possible combinations:

- $(1 + 2) \times (3 + 4) = 3 \times 7 = 21$
- $(1 + 3) \times (2 + 4) = 4 \times 6 = 24$
- $(1 + 4) \times (2 + 3) = 5 \times 5 = 25$

Among these, the largest value is 25, which is an odd number and a perfect square.

Therefore, the Explanation: an odd number and a perfect square.

18. Explanation: (1)

Concept

- The motion of a ball rolling on a slope can be categorized as:
- Motion with friction: The presence of friction causes the amplitude of oscillations to decrease over time due to the loss of mechanical energy.
- Motion without friction: In the absence of friction, the ball undergoes simple harmonic motion, and the amplitude remains constant over time.
- In the graphs:
- Graph A shows a damped oscillation where the amplitude decreases over time, indicating motion with friction.
- Graph B shows heavily damped motion where the amplitude decreases quickly, likely showing more friction than A.
- Graph C shows simple harmonic motion with constant amplitude, indicating motion without friction.

Explanation:

- **Option 1:** "A depicts motion with friction while C depicts motion without friction" is correct because Graph A shows decreasing amplitude (damped motion), while Graph C shows constant amplitude (no friction).
- **Option 2:** "C depicts motion with friction while A depicts motion without friction" is incorrect, as C shows constant amplitude and A shows damped motion.
- **Option 3:** "B depicts motion with friction while A depicts motion without friction" is incorrect, as A also shows frictional effects (damped motion).
- **Option 4:** "B depicts motion without friction" is incorrect because B shows highly damped motion with rapidly decreasing amplitude, indicating friction.

Thus the correct option is (1)

19. Explanation: (2)

Step 1: Length of the Spiral Groove

The record player's stylus travels along a spiral groove over the annular area of the disc. The length of the spiral groove can be approximated by considering the average radius of the annulus.

- Inner radius: $r_{\text{inner}} = 4$ cm
- Outer radius: $r_{\text{outer}} = 10$ cm
- Average radius:$r_{\text{avg}} = \frac{r_{\text{inner}} + r_{\text{outer}}}{2} = \frac{4+10}{2} = 7$ cm

The circumference corresponding to this average radius is:

Circumference $= 2\pi r_{avg} = 2\pi \times 7 = 44$ cm.

Over 100 revolutions, the total length traveled by the stylus is:

Total length $= 100 \times 44 = 4400$ cm $= 44$ m.

Step 2: Total Time Taken

The record plays for 22 minutes, which is:

$t = 22$ minutes $= 22 \times 60 = 1320$ seconds.

Step 3: Average Linear Speed

The average linear speed is calculated as:

$$v_{avg} = \frac{\text{Total distance traveled}}{\text{Total time taken}} = \frac{44 \text{ m}}{22 \text{ min}} = 2 \text{ m/min}.$$

Convert the speed to meters per hour:

$v_{avg} = 2$ m/min $\times 60 = 120$ m/h.

Final Answer:

The correct option is 2: 120 m/h.

20. Explanation: (1)

Total 'T's:

- T in "A CHILD COUNTED THE NUMBER OF APPEARANCES OF THE LETTER T IN THIS SENTENCE, AND REPORTED IT CORRECTLY AS _____."
- Count of 'T's: 13

Thus, the number of 'T's is 13.

Conclusion:

The Explanation: THIRTEEN.

So, the option that makes the statement FALSE is TEN.

PART - B

21. Explanation: (1)

For ideal gas;

PV=nRT

For a reversible isothermal expansion of an ideal gas (one mole) at temperature T, the work done by the gas is:

$$W = \int_{V_1}^{V_2} PdV = \int_{V_1}^{V_2} \frac{RT}{V} dV$$

$$= RT \ln \frac{V_2}{V_1}$$

22. Explanation: (1)

The triple point is the unique combination of temperature and pressure at which solid, liquid, and gas phases coexist in equilibrium. At equilibrium, the chemical potentials (μ) of all coexisting phases are equal; if any μ differed, a net phase change would occur until equality is restored. Hence

μ_1(liquid) = μ_1(gas) = μ_1(solid)

23. Explanation: (1)

rate = k[A]²

This is second order reaction;

For second order reaction $t_{1/2}$ is $1/(k[A]_o)$

24. Explanation: (4)

Nernst equation is;

E = E° – (RT/nF) ln([Ox]/[Red])

E = E° + (RT/nF) ln([Red]/[Ox])

25. Explanation: (3) For distinguishable particles in two levels, the probability of a particle being in the upper level is

$$p_1 = \frac{e^{-\epsilon_1/kT}}{1 + e^{-\epsilon_1/kT}}$$

so the most probable number in level 1 is

$$N_1 = Np_1 = \frac{Ne^{-\epsilon_1/kT}}{1 + e^{-\epsilon_1/kT}}$$

26. Explanation: (1)

Energy for one-dimensional box level n^{th} is;

$$E_n = \frac{n^2h^2}{8ml^2}$$

$$E_{n+1} = \frac{(n+1)^2h^2}{8ml^2}$$

The energy difference between;

$E_{n+1} - E_n$

$\frac{(n+1)^2h^2}{8ml^2} - \frac{n^2h^2}{8ml^2} = (n+1)^2 - n^2$

27. Explanation: (4)

1. The adsorption includes a monolayer at the surface.
2. No interaction takes place between the molecules on different sites.
3. Each site can hold only a single adsorbed molecule.
4. The heat of adsorption is not dependent on the number of sites. It is equal for everyone.

Fractional coverage is;

coverage θ = KP/(1 + KP)

28. Explanation: (1)

The rotational constant B of a diatomic molecule is

$$\frac{h}{8\pi^2 IC}$$

29. Explanation: (2)

For a bimolecular gas-phase reaction A + B → products, collision theory gives the rate constant as

$$K = Z_{AB} P e^{-E_a/RT}$$

Z is the collision frequency (collisions per unit time per unit concentration),

exp (−Ea/RT) is the fraction of collisions having energy ≥ activation energy Ea

P is the **steric factor**.

Even when two molecules collide with enough energy, they must also collide in an orientation that allows bonds to break and form. The steric factor PPP quantifies this requirement:

$$P = \frac{\text{number of effective collision}}{\text{number of collision with } E \geq E_a}$$

P≤1: only a fraction of energetic collisions actually lead to reaction. A small P (e.g. 10^{-2}-10^{-4}) indicates a very specific orientational requirement.

30. Explanation: (2)

The generalized phase rule for a reacting system is;

$$F = C - P + 2$$

F = degrees of freedom ,

C = number of **components** ,

P = number of phases.

Here, component is 2,

Phases is 3, $CaCO_{3(s)}$, $CaO_{(s)}$, $CO_{2(g)}$

$F = C - P + 2$

$F = 2 - 3 + 2 = 1$

31. Explanation: (2)

Fugacity (f) is the effective pressure of a real gas.

The fugacity coefficient (φ) is defined as

$$\phi = \frac{f}{P}$$

For an ideal gas,

f=P and φ=1

At high pressures, repulsive forces between gas molecules become significant.

The compressibility factor Zcap Z

Z

is defined as $Z = \frac{PV}{nRT}$

At high pressures,

Z>1

The relationship between fugacity coefficient and compressibility factor is given by

$$\ln\phi = \int_0^P \frac{Z-1}{P} dP$$

At high pressures, repulsive forces dominate, leading to Z>1

Since Z>1 at high pressures, the integral $\int_0^P \frac{Z-1}{P} dP$ is positive

Therefore, lnφ>0 which means

φ>1

Since, $\phi = \frac{f}{P}$ if $\phi > 1$ then $f > P$

At high pressures, the fugacity of a real gas is greater than its pressure.

32. Explanation: (2)

When a reaction mechanism has several steps of comparable rates, the rate-determining step is often not obvious. However, there is an intermediate in some of the steps. An **intermediate** is a species that is neither one of the reactants, nor one of the products. The **steady-state approximation** is a method used to derive a rate law. The method is based on the assumption that one intermediate in the reaction mechanism is consumed as quickly as it is generated. Its concentration remains the same in a duration of the reaction.

33. Explanation: (3)

- A Schottky defect occurs when an equal number of cations and anions are missing from the lattice.
- This defect maintains the electrical neutrality of the crystal.
- It typically occurs in ionic solids where the size of cations and anions is similar.
- Example: In NaCl, if one Na+ and one Cl- ion are missing, it creates a Schottky defect.

34. Explanation: (2)

Thorium (Th) is the actinide that is most readily oxidized from the +3 to the +4 oxidation state in aqueous solutions. Thorium in the +4 oxidation state is highly stable, and the transition from Th(III) to Th(IV) is relatively easy compared to other actinides.

35. Explanation: (3)

The fluoride ion (F^-) in water acts as a weak base. This is because it can accept a proton (H^+) from water, forming HF (hydrofluoric acid) and OH^- (hydroxide ion) in the process:

$$F^- + H_2O \rightleftharpoons HF + OH^-$$

36. Explanation: (2)

In this process, **^{60}Co** undergoes beta-minus decay, where a neutron in the nucleus of the atom is converted into a proton, emitting an electron (beta particle) and an antineutrino:

$$^{60}Co \longrightarrow {}^{60}Ni + \beta^- + \upsilon_e$$

This results in the formation of **^{60}Ni (Nickel-60)**, which is stable, and the release of a beta particle (electron) and an antineutrino. This process is responsible for the radioactive properties of **^{60}Co**.

37. Explanation: (2)

Fe has 8 valence electron.

Cyclopetadiene has 5 electron

2 cyclopetadiene has 10 valence electron.

$8 + 2 \times 5 = 18$

38. Explanation: (2)

In phosphazenes, the backbone consists of the repeating unit –P=N–, where the phosphorus-nitrogen (P=N) bond has a bond order of approximately 1.5. This is due to the resonance between the structures that contributes to the partial double bond character between phosphorus and nitrogen, leading to a bond order between 1 and 2. Hence, the bond order of P=N is typically considered to be 1.5.

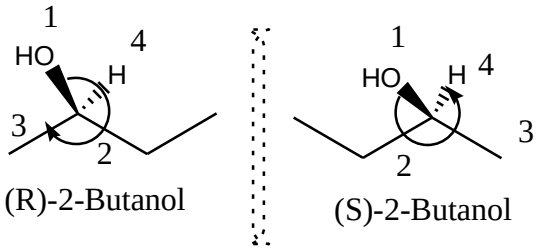
39. Explanation: (4)

B has an empty p-orbital: Boron in BF_3 has an incomplete octet, meaning it can accept a pair of electrons. This makes it a Lewis acid.

(B) F withdraws electron density: The fluorine atoms in BF_3 are highly electronegative and withdraw electron density from boron, enhancing boron's ability to accept electron pairs.

(C) It forms adducts with bases: BF_3 readily forms adducts with Lewis bases by accepting electron pairs from the base, demonstrating its Lewis acid behavior.

40. Explanation: (2)



41. Explanation: (2)

$CF_3CH_2^-$ (iv): The carbanion is stabilized by the electron-withdrawing inductive effect of the CF_3 group. The fluorine atoms pull electron density away from the carbanion, stabilizing it through induction.

$PhCH_2^-$ (Phenylmethyl carbanion): The negative charge on the carbon is stabilized by **resonance** with the benzene ring. The lone pair of electrons on the carbanion can be delocalized into the aromatic ring, stabilizing the carbanion.

CH_3^- (i): This is a simple methyl carbanion, which is relatively unstable due to the lack of any stabilizing effect and because the negative charge is localized on a carbon without any delocalization or stabilization.

$(CH_3)_3C^-$ (ii): The tert-butyl carbanion is the least stable among these because the negative charge is on a sterically hindered carbon, and there is no resonance stabilization or significant inductive effect to stabilize the carbanion.

42. Explanation: (3)

$$E = E^0 - \frac{0.0591}{n}\log\frac{[Fe]^{2+}}{[Fe]^{3+}}$$

$$E = E^0 - \frac{0.0591}{1}\log\frac{1}{0.01}$$

$$E = E^0 - 0.1182$$

$$E = 0.77 - 0.1182 = 0.693$$

43. Explanation: (4)

$$Al^{3+} + 3e^- \longrightarrow Al$$

$Q = It$

$Q = 5 \times 2 \times 60 \times 60 = 36000$

3×96500 gives 27gm

36000 gives X gram

$$X = \frac{36000 \times 27}{3 \times 96500} = 3.35gm$$

44. Explanation: (2)

$radial\ node = n - l - 1$

For 2s orbital, n=2 and l=0

$radial\ node = 2 - 0 - 1 = 1$

45. Explanation: (3)

According to Bragg's law

$n\lambda = 2dsin\theta$

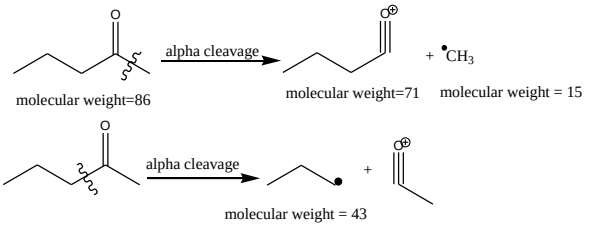
$1 \times 1.54 = 2 \times 2sin\theta$

$sin\theta = 0.385$

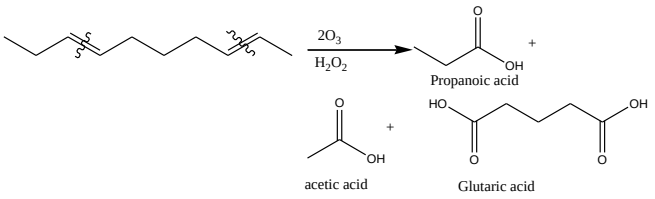
$\theta = \sin^{-}(0.385)$

$\theta = 23^0$

46. Explanation: (1)



47. Explanation: (3)



48. Explanation: (4)

$\Delta G = \Delta H - T\Delta S$

$\Delta A = \Delta U - T\Delta S$

For the reversible isothermal expansion of an ideal gas, the internal energy change (ΔU) and enthalpy change (ΔH) are both zero.

$\Delta G = -T\Delta S$

$\Delta A = -T\Delta S$

It means, $\Delta G = \Delta A$

Temperature is constant in isothermal process, $\Delta(PV) = 0$ in ideal gas.

For an ideal gas $PV = nRT$

$\Delta(PV) = \Delta(nRT) = 0$

49. Explanation: (2)

$$r = \frac{k_1 k_2 [A]^2}{k_{-1}[A] + k_2}$$

At high pressure, $k_{-1}[A] >> k_2$

k_2 *neglected*

$$r = \frac{k_1 k_2 [A]^2}{k_{-1}[A]} = \frac{k_1 k_2 [A]}{k_{-1}}$$

At high pressure it follows first order reaction.

$$r = \frac{k_1 k_2 [A]^2}{k_{-1}[A] + k_2}$$

At low pressure, $k_{-1}[A] << k_2$

$k_{-1}[A]$ *neglected*

$$r = \frac{k_1 k_2 [A]^2}{k_2} = k_1 [A]^2$$

At low pressure it follows second order reaction.

50. Explanation: (4)

Biomedical research on PPZs has been performed in various fields, including drug delivery, bioimaging, phototherapy, vaccine and bone regenerative engineering. The intriguing characteristic of biomaterials in a wide range of medical application is the limited diversity. The substitution reaction allows the incorporation of several functional groups into the PPZ backbone. Hence, PPZs incorporated drugs into their structure by physical encapsulation or chemical bonding, to form a prodrug delivery system. The possibility of synthesizing materials with tailored degradation kinetics and their structural flexibility makes PPZs an attractive choice for medical applications, such as a delivery carrier and for bone regeneration.

51. Explanation: (4)

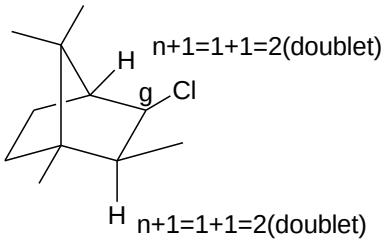
In option D, both rings follows huckel rule both ring is aromatic and hence it is more stable.

Stability order; Aromatic > Homoaromatic > Non-aromatic > Anti-aromatic.

52. Explanation: (1)

The chemical shift of the hydrogen (H) attached to an alkyl halide in nuclear magnetic resonance (NMR) spectroscopy typically falls in the range of **3.0 to 4.5 ppm**.

A proton adjacent to two non-equivalent protons (say a $-CH_2-$ group next to both a $-CH_3$ and another $-CH_2-$) might produce a **doublet of doublets** (dd), each of which corresponds to the splitting from each of the two neighboring protons.



53. Explanation: (1)

In this complex the charge transfer occurs from Fe(II) to the empty π^* orbital of bpy ligand.

54. Explanation: (3)

$$\Delta S = \int \frac{nC_{p,m}}{T} dT \text{ at constant pressure}$$

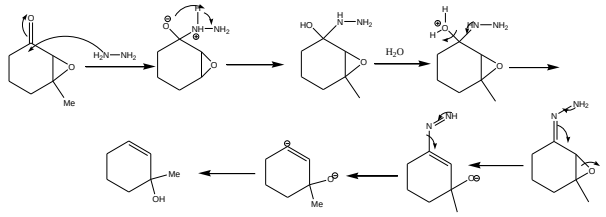
$$\Delta S = \int \frac{5 + 0.1T}{T} dT$$

$$\Delta S = \int_{300}^{400} \frac{5}{T} dT + \int_{300}^{400} 0.1 dT$$

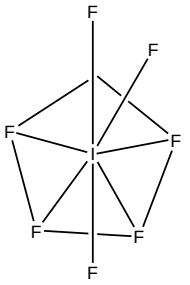
$$\Delta S = 5\ln\left(\frac{400}{300}\right) + 0.1(400 - 300)$$

$$\Delta S = 1.438 + 10 = 11.438 J/Kmol$$

55. Explanation: (1)

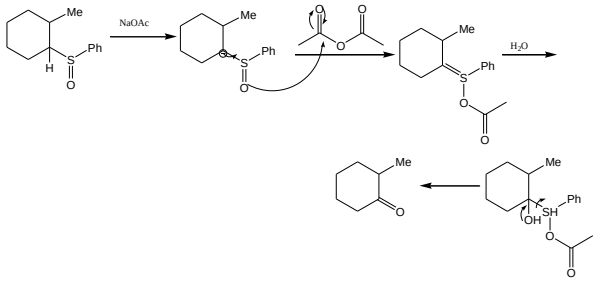


56. Explanation: (2)



D_{5h} point group

57. Explanation: (4)



58. Explanation: (3)

$\%T = 39.8, C = 8 \times 10^{-5} M$

$T = 0.398, l = 1cm$

$A = -logT;$

$A = -\log(0.398) = 0.4$

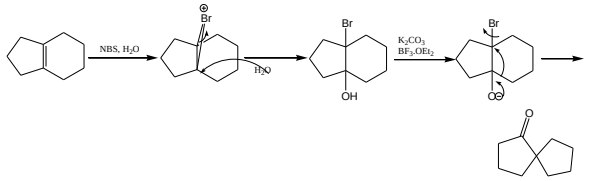
$A = \epsilon\, bc$

$$\epsilon = \frac{A}{bc}$$

$$\epsilon = \frac{0.4}{1 \times 8 \times 10^{-5}}$$

$\epsilon = 5000$

59. Explanation: (4)



60. Explanation: (4)

$$d = \frac{a}{\sqrt{h^2 + k^2 + l^2}}$$

$$d = \frac{a}{\sqrt{(1)^2 + (1)^2 + (0)^2}} = \frac{a}{\sqrt{2}}$$

PART - C

61. Explanation: (4)

The velue of magnetic quantum number of P_x orbital is undefined first of all fix the direction of applied magnetic field. Then decide the value of magnetic quantum number.

62. Explanation: (3)

Cyclopropane (3-membered ring) exhibits significant **ring strain**, leading to higher bond tension and higher vibrational frequencies in the IR spectrum.

Cyclohexane (6-membered ring), being more relaxed with less ring strain, will show **lower IR absorption frequencies** for similar vibrational modes.

Increasing in the ring size decreasing IR (C=C) stretching frequency.

63. Explanation: (2)

$\varphi = Nr(6 - Zr)e^{-Zr/3}\cos\theta$

$\varphi = 0$ in the $xy -$ plane

The power of θ=1, so l=1 one angular node

$radial\ node = n - l - 1$

n calculated from exponential term

n=3

$radialnode = 3 - 1 - 1 = 1$

One radial node present.

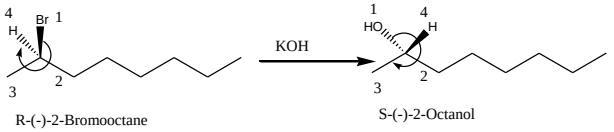
Two radial node not present

$$Z = \frac{r}{6}$$

$$r = 0.529 \times \frac{n^2}{Z}$$

The size of the orbital decrease with increasing atomic number.

64. Explanation: (2)



R-(-)-2-Bromooctane S-(-)-2-Octanol

65. Explanation: (4)

Size of cation $K^+ > Na^+ > Li^+$

Charge density; $Li^+ > Na^+ > K^+$

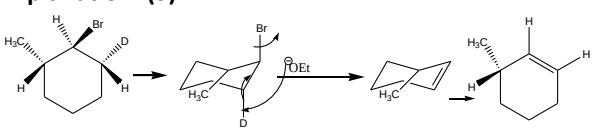
Hydrated radius;$Li^+ > Na^+ > K^+$

Speed $Li^+ < Na^+ < K^+$

Conductance; $Li^+ < Na^+ < K^+$

The number of water molecules attached to any ions depend on its charge density. Charge density= $\frac{charge}{size}$ larger the charge density larger the water molecule attached to ion. Hydrated radius increases and speed decreases so is the molar conductance decreases.

66. Explanation: (3)



67. Explanation: (1)

Cubic Close-Packed (CCP) Array of Anions: In a CCP arrangement, the anions (Cl^-) form the close-packed structure, which means that every anion is surrounded by other anions in a very efficient packing arrangement. The cations (Na^+) occupy the **octahedral sites** formed by the arrangement of the anions.

Cations in Octahedral Sites: In the cubic close-packed structure, there are interstitial sites that are either **octahedral** or **tetrahedral**. In the case of rock salt, the cations (Na^+) occupy the **octahedral sites** between the anions (Cl^-).

68. Explanation: (3)

Among the first row transition metal monoxides, early metal oxides, TiO & VO are metallic conductors, the others MnO, FeO, CoO are semiconductors & NiO is an insulator. As in the case of pure metals, a partly filled band leads to metallic conductivity. Consequently TiO & VO have metallic conductivity.

69. Explanation: (1)

the total mass number on the left-hand side (before the reaction) is:

241(Am)+4(α)=245

On the right-hand side, **Bk-243** has a mass number of 243, so the mass number of **X** must be:

245−243=2

Therefore, the mass number of **X** is **2**

We now know that **X** has:

- **Atomic number = 0**
- **Mass number = 2**

A particle with an atomic number of 0 and a mass number of 2 is **a dineutron**. A **dineutron** is a hypothetical particle that consists of two neutrons, and it's denoted as $2\,{}^{1}_{0}n$

70. Explanation: (3)

$\psi = \hat{A}\,\phi$

normalised wave function $\Psi = \hat{A}\,\phi$

SO $\int \Psi^* \Psi\, dz = 1$

$\Rightarrow \int (\hat{A}\,\phi)^* (\hat{A}\,\phi) dz = 1$

$\Rightarrow \int \hat{A}^+ \phi^+ (\hat{A}\,\phi) dz = 1$

$\Rightarrow \int A^+ A\, \phi^* \phi\, dz = 1$

Hence for $'\phi'$ to be normalized function

$A^+ A = 1$

i.e. A should be unitary

71. Explanation: (3)

$[x, [x, p^2]]$

$= [\hat{x}, [x, p_x . p_x]]$ .....(1)

$\Rightarrow [x, p^2] = [x, p_x, p_x] = [x, p_x]p_x + p_x[x, p_x]$

$= i\hbar p_x + p_x(i\hbar) = 2i\hbar p_x$

From eq.(1)

$\Rightarrow [\hat{x}, 2i\hbar\, p_x] = 2i\hbar\, [x, p_x] = 2i\hbar\, (i\hbar) = 2i^2\hbar^2$

$= -2\hbar^2$

(i) $[p_x, [x, p]] = [p, x, +i\hbar] = 0$

(ii) $[xp, [x, p]] = [x.p, +i\hbar] = 0$

(iii) $-[p, [x^2, p]] = -[p, (2xi\hbar)] = -2i\hbar[p, x]$

$= -2i\hbar(-i\hbar) = -2\hbar^2$

(iv) $[x, [x^2, p]] = [x, 2i\hbar x]$

$= 2i\hbar\, [x, x] = 0$

72. Explanation: (1)

If k_1 and k_2 are rate constant at temperature T_1 and T_2 respectively and ϕ in temperature coefficient then these are related by expression

$k_2 = k_1(\phi)^{\Delta T/10}$ [whose, $\Delta T = T_2 - T_1$]

Have,

$k_1 = 2.66 \times 10^{-3} s^{-1}$; $k_2 = 2.2 \times 10^{-1} s^{-1}$

And, $T_1 = 120\ k$; $T_2 = 360\ k$

$\therefore \frac{2.2\times10^{-1}}{2.66\times10^{-3}} = (\phi)^{24}$

$\therefore \phi = 1.2$

Now at temperature 240k, rate constant (k_3)

$k_3 = 2.66 \times 10^{-3} \times (1.2)^{12}$

$= 0.024$ or $2.4 \times 10^{-2} s^{-1}$

73. Explanation: (2)

For a first order reaction $A \rightarrow$ Products the plot of $\ln\left(\frac{[A]_t}{[A]_o}\right)$ vs t, will look like

$t = -\frac{1}{k} \ln \frac{[A]_t}{[A]_o}$

Or $\ln \frac{[A]_t}{[A]_o} = -kt$

A straight line with a negative slope passing through origin

74. Explanation: (4)

According to the Beer – Lambert law, the fractional decrease in intensity of transmitted light is constant. Thus, after every 1cm, the intensity will be halved.

$100 \xrightarrow{1cm} 50 \xrightarrow{1cm} 25 \xrightarrow{1cm} 12.5$

75. Explanation: (3)

The magnitude of the slopes will decrease over time. This is because on the reaction progresses the concentration of the reactant decreases.

76. Explanation: (3)

When equilibrium reaction are disturbed form their equilibrium condition via either T-jump or pH-jump then measurement of relocation time leads to the study of reaction rate

So, option 'c' will be the correct option

77. Explanation: (1)

For any 3rd order reaction,

$\alpha_3 k = \frac{1}{2}\left[\frac{1}{a^2} - \frac{1}{c_0^2}\right]$

Or $k_3 t = \frac{1}{2}\left[\frac{1}{(a-x)^2} - \frac{1}{a_0^2}\right]$

At, $t = t_{1/2}, a = {}^{a_0}/_2$

Or, $k_3 t_{1/2} = \frac{1}{2}\left[\frac{1}{a_0^2} - \frac{1}{a_0^2}\right]$

$= \frac{1}{2}\left[\frac{3}{a_0^2}\right]$

Or in terms of c_0

$t_{1/2} = \frac{1}{2k}\frac{3}{c_0^2}$

$t_{1/2} = \frac{3}{2kc_0^2}$

78. Explanation: (4)

The angle between the z-axis and the intrinsic spin angular momentum is given by

$\theta = \cos^{-1}\frac{m_s}{\sqrt{s(s+1)}}$

$= \cos^{-1}\frac{\frac{1}{2}}{\sqrt{\frac{1}{2}\left(\frac{1}{2}+1\right)}}$

$= \cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$

79. Explanation: (3)

$\tau_f = \frac{\phi_f}{\mu_f}$ (I)

$\tau_f = \frac{1}{k_f + k_{IC} + k_{ISC}}$ (II)

Given $k_{IC} + k_{ISC} = 1.2 \times 10^8\ sec^{-1}$

And $\tau_f = 5 \times 10^{-9}$ sec

Therefore (II) $\Rightarrow 5 \times 10^{-9}$ sec $= \frac{1}{k_f + (1.2\times10^8\ sec^{-1})}$

$k_f + 1.2 \times 10^8\ sec^{-1} = \frac{1}{5\times10^{-9}\ sec}$

$= 2 \times 10^8\ sec^{-1} - 1.2 \times 10^8\ sec^{-1}$

$= 0.8 \times 10^8\ sec^{-1}$

Therefore (1) $\Rightarrow \phi_f = T_f \times k_f$

$= (5 \times 10^{-9} sec) \times (0.8 \times 10^8 sec^{-1})$

$= 0.4$

80. Explanation: (2)

The diffusion – controlled rate constant is given by

$k_D = \frac{8RT}{3\eta}$

$= \frac{8 \times 8.314 \times 298}{3 \times 1.00 \times 10^{-3}}$

$= 6.6 \times 10^6\ m^3.s^{-1}.mol^{-1}$

$= 6.6 \times 10^9\ dm^3.s^{-1}.mol^{-1}$ ... (As $1m^3 = 10^3\ dm^3$)

81. Explanation: (2)

$\hat{L}y$ (angular momentum)

$Ly = (z\hat{p}_x - x\hat{p}_z)$

$= z\left(-i\hbar\frac{\partial}{\partial x}\right) - x\left(-i\hbar\frac{\partial}{\partial z}\right)$

$= -i\hbar\left(z\frac{d}{dx} - x\frac{d}{dz}\right)$

$=(\frac{i}{i}) - i\hbar\left(Z\frac{d}{dx} - x\frac{\partial}{\partial z}\right)$

$= (-i^2)\frac{\hbar}{i}\left(Z\frac{\partial}{\partial x} - x\frac{\partial}{\partial z}\right)$ $(i^2 = -1)$

$= \frac{\hbar}{i}\left(Z\frac{\partial}{\partial x} - x\frac{\partial}{\partial z}\right)$ $\left(\frac{1}{1} = -i\right)$

82. Explanation: (4)

In the Lindemann mechanism of unimolecular reactions the observed order at low concentration in 2nd order reaction

Or, $r = \frac{k_1 k_2 [A]^2}{k_{-1}[A] + k_2}$

So, at low pressure [A] is quite small hence,

$k_{-1}[A] <<< k_2$ i.e., chance of decomposition becomes very small so that the term $k_{-1}[A]$ can be neglected as compared to k_2 form the denominator

Hence, $r = \frac{k_1 k_2}{k_2}[A]^2$

$= k_1[A]^2$

So, it follows second order kinetics

83. Explanation: (1)

Energy=3× $E_0 = 3 \times \left(\frac{3h^2}{8ml^2}\right) = \frac{9h^2}{8ml^2}$

Degeneracy=3 (1,2,2 ; 2,1,1 ; 2,2,1)

84. Explanation: (2)

Given that $E_{cell} = 1.71\ V$

$E_{cell} = E^0_{cell} - \frac{0.059}{n} log \frac{(Fe^{2+})^2 \times Zn^{+2}}{(Fe^{3+})^2}$

$1.71 = E^0_{cell} - \frac{0.059}{2} log \frac{(0.001)^2 \times 0.01}{(0.01)^2}$

E^0_{cell}=1.592V

$\therefore \Delta G = \Delta G^0 + RTlnk$

Rearrange above equation as

At $equilibrium$ $\Delta G = 0$

$\Delta G^0 = -RTlnk$

$-nFE^0_{cell} = -RT \times 2.303 logk$

$k = 10^{\frac{nFE^0_{cell}}{2.303RT}}$

at 25°C above equation becomes

$k = 10^{\frac{2\times1.592\,V}{0.0591}}$

$k = 10^{54}$

85. Explanation: (3)

$k_{salt} = k_{solution} - k_{water}$

$= (1.5 \times 10^{-3} - 1.5 \times 10^{-5})$

$k_{salt} = 1.5 \times 0.99 \times 10^{-3}$

$Solubility\ (s) = \frac{k_{salt}}{\wedge_{salt}} = \frac{(1.5\times0.99\times10^{-3})}{(0.485+1)}$

$(s) = \frac{1.485}{1.485} \times 10^{-3}$

$(s) = 1 \times 10^{-3}\ mol\ dm^{-3}$

$(s) = 1 \times 10^{-3}\ \times 200\ g\ dm^{-3}$

$(s) = 2 \times 10^{-1}\ \ g\ Lit^{-1}$

86. Explanation: (2)

In a potentiometric titration, the end point is obtained by plotting observed E.M.F. versus volume of titrant added observing jump in potential

87. Explanation: (3)

$\Delta S = NKlnW$

$\Delta S = 6.022 \times 10^{23} \times 1.381 \times 10^{-23} JK^{-1} ln2$

$\Delta S = 5.8 JK^{-1}$

88. Explanation: (3)

Average speed α $\frac{\sqrt{T}}{M}$

The average speed of first container =$\frac{\sqrt{T}}{M}$

The average speed of second container =$\frac{\sqrt{2T}}{2M} = \frac{\sqrt{T}}{M}$

That is average speed of both containers is same

The Average kinetic energy α T

∴The average kinetic energy of first container α T & average kinetic energy of Second container α 2T that is only average K.E. is doubled for second container.

89. Explanation: (2)

Given that, $n = 10$ moles

$C_p = 300\ JK^{-1}$

$C_p - C_v = nR$

$\therefore C_v = C_p - nR$

$C_v = 300\ JK^{-1} - 10\ mol \times 8.314\ JK^{-1}mol^{-1}$

$C_v = 217\ JK^{-1}$

90. Explanation: (3)

Given that $k_a(HX) = 2.5 \times 10^{-5}$

$NaX + H_2O \rightarrow HX + NaOH$

Initial C 0 0

After $C(1-\alpha)$ $C\alpha$ $C\alpha$

$K_h = \frac{C\alpha^2}{(1-\alpha)}$

As we have given weak acid so $\alpha \ll 1$

So in denominator $1 - \alpha = 1$

$\therefore K_h = C\alpha^2$

$\therefore \alpha = \sqrt{\frac{K_h}{C}} = \sqrt{\frac{K_W}{k_a C}}$

$[OH^-] = C\alpha = \sqrt{\frac{CK_W}{k_a}}$

$[OH^-] = \sqrt{\frac{0.01\times10^{14}}{2.5\times10^{-5}}} = 2 \times 10^{-6}$

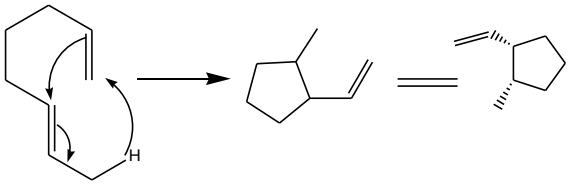
$P^{OH} = -log[OH^-] = -log(2 \times 10^{-6}) = 5.698$

$P^H = 14 - 5.698 = 8.301$

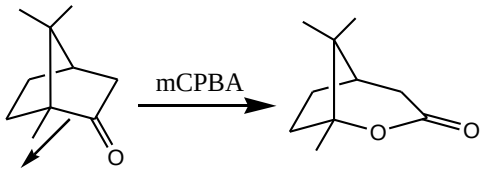
91. Explanation: (2)

The region of electromagnetic spectrum employed in the electron spin resonance (ESR) in microwave. [$3 \times 10^{10} - 3 \times 10^{12}$Hz

92. Explanation: (1)

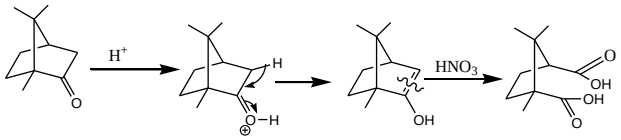


93. Explanation: (2)



High migrating ability

Bayer villiger oxidation



94. Explanation: (2)

$\varphi = Ne^{-\frac{ax^2}{2}}$

$\frac{d\varphi}{dx} = Ne^{-\frac{ax^2}{2}} + Ne^{-\frac{ax^2}{2}}[i - ax^2]$

$x = \pm\frac{1}{\sqrt{a}}$

Further differentiation,

$\frac{d^2\varphi}{dx^2} = Nexp(-\frac{ax^2}{2})(-2ax) + (1 - ax^2);$

$[Nexp(\frac{ax^2}{2})(\frac{-2ax}{2})]$

ANSWER SHEET

MOCK TEST 1

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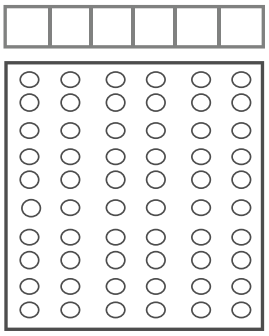
ANSWER SHEET

Checked By _____

Seat Number



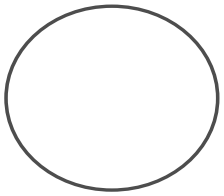
Booklet Code

A

Medium

E

Marks Obtained



ANSWER COLUMNS

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ANSWER				
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119	○	○	○	○
120	○	○	○	○

Note : Roll Number, Subject Code & Centre Code Should Be Filled In the Boxes Using The Pattern Given As :

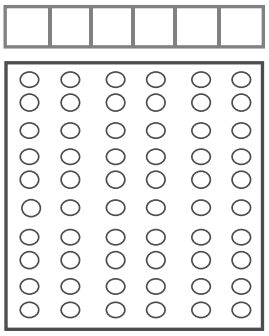
MOCK TEST 3

Name _____

ANSWER SHEET

Checked By _____

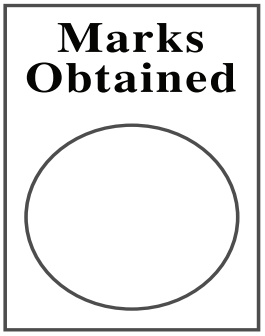
Seat Number



Booklet Code A

Medium E

Marks Obtained



ANSWER COLUMNS

Part A				
Q. No.	①	②	③	④
1	○	○	○	○
2	○	○	○	○
3	○	○	○	○
4	○	○	○	○
5	○	○	○	○
6	○	○	○	○
7	○	○	○	○
8	○	○	○	○
9	○	○	○	○
10	○	○	○	○
11	○	○	○	○
12	○	○	○	○
13	○	○	○	○
14	○	○	○	○
15	○	○	○	○
16	○	○	○	○
17	○	○	○	○
18	○	○	○	○
19	○	○	○	○
20	○	○	○	○
Part B				
21	○	○	○	○
22	○	○	○	○
23	○	○	○	○
24	○	○	○	○
25	○	○	○	○
26	○	○	○	○
27	○	○	○	○
28	○	○	○	○
29	○	○	○	○
30	○	○	○	○

ANSWER				
Q. No.	①	②	③	④
31	○	○	○	○
32	○	○	○	○
33	○	○	○	○
34	○	○	○	○
35	○	○	○	○
36	○	○	○	○
37	○	○	○	○
38	○	○	○	○
39	○	○	○	○
40	○	○	○	○
41	○	○	○	○
42	○	○	○	○
43	○	○	○	○
44	○	○	○	○
45	○	○	○	○
46	○	○	○	○
47	○	○	○	○
48	○	○	○	○
49	○	○	○	○
50	○	○	○	○
51	○	○	○	○
52	○	○	○	○
53	○	○	○	○
54	○	○	○	○
55	○	○	○	○
56	○	○	○	○
57	○	○	○	○
58	○	○	○	○
59	○	○	○	○
60	○	○	○	○

Part C				
	①	②	③	④
61	○	○	○	○
62	○	○	○	○
63	○	○	○	○
64	○	○	○	○
65	○	○	○	○
66	○	○	○	○
67	○	○	○	○
68	○	○	○	○
69	○	○	○	○
70	○	○	○	○
71	○	○	○	○
72	○	○	○	○
73	○	○	○	○
74	○	○	○	○
75	○	○	○	○
76	○	○	○	○
77	○	○	○	○
78	○	○	○	○
79	○	○	○	○
80	○	○	○	○
81	○	○	○	○
82	○	○	○	○
83	○	○	○	○
84	○	○	○	○
85	○	○	○	○
86	○	○	○	○
87	○	○	○	○
88	○	○	○	○
89	○	○	○	○
90	○	○	○	○
91	○	○	○	○

ANSWER				
Q. No.	①	②	③	④
92	○	○	○	○
93	○	○	○	○
94	○	○	○	○
95	○	○	○	○
96	○	○	○	○
97	○	○	○	○
98	○	○	○	○
99	○	○	○	○
100	○	○	○	○
101	○	○	○	○
102	○	○	○	○
103	○	○	○	○
104	○	○	○	○
105	○	○	○	○
106	○	○	○	○
107	○	○	○	○
108	○	○	○	○
109	○	○	○	○
110	○	○	○	○
111	○	○	○	○
112	○	○	○	○
113	○	○	○	○
114	○	○	○	○
115	○	○	○	○
116	○	○	○	○
117	○	○	○	○
118	○	○	○	○
119	○	○	○	○
120	○	○	○	○

Note : Roll Number, Subject Code & Centre Code Should Be Filled In the Boxes Using The Pattern Given As :

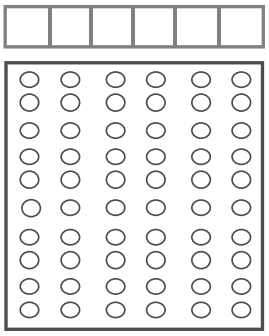
MOCK TEST 10

Name _____

ANSWER SHEET

Checked By _____

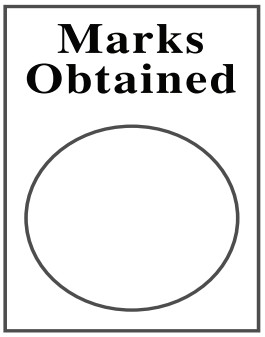
Seat Number



Booklet Code A

Medium E

Marks Obtained



ANSWER COLUMNS

Part A				
Q. No.	①	②	③	④
1	○	○	○	○
2	○	○	○	○
3	○	○	○	○
4	○	○	○	○
5	○	○	○	○
6	○	○	○	○
7	○	○	○	○
8	○	○	○	○
9	○	○	○	○
10	○	○	○	○
11	○	○	○	○
12	○	○	○	○
13	○	○	○	○
14	○	○	○	○
15	○	○	○	○
16	○	○	○	○
17	○	○	○	○
18	○	○	○	○
19	○	○	○	○
20	○	○	○	○
Part B				
21	○	○	○	○
22	○	○	○	○
23	○	○	○	○
24	○	○	○	○
25	○	○	○	○
26	○	○	○	○
27	○	○	○	○
28	○	○	○	○
29	○	○	○	○
30	○	○	○	○

ANSWER				
Q. No.	①	②	③	④
31	○	○	○	○
32	○	○	○	○
33	○	○	○	○
34	○	○	○	○
35	○	○	○	○
36	○	○	○	○
37	○	○	○	○
38	○	○	○	○
39	○	○	○	○
40	○	○	○	○
41	○	○	○	○
42	○	○	○	○
43	○	○	○	○
44	○	○	○	○
45	○	○	○	○
46	○	○	○	○
47	○	○	○	○
48	○	○	○	○
49	○	○	○	○
50	○	○	○	○
51	○	○	○	○
52	○	○	○	○
53	○	○	○	○
54	○	○	○	○
55	○	○	○	○
56	○	○	○	○
57	○	○	○	○
58	○	○	○	○
59	○	○	○	○
60	○	○	○	○

Part C				
	①	②	③	④
61	○	○	○	○
62	○	○	○	○
63	○	○	○	○
64	○	○	○	○
65	○	○	○	○
66	○	○	○	○
67	○	○	○	○
68	○	○	○	○
69	○	○	○	○
70	○	○	○	○
71	○	○	○	○
72	○	○	○	○
73	○	○	○	○
74	○	○	○	○
75	○	○	○	○
76	○	○	○	○
77	○	○	○	○
78	○	○	○	○
79	○	○	○	○
80	○	○	○	○
81	○	○	○	○
82	○	○	○	○
83	○	○	○	○
84	○	○	○	○
85	○	○	○	○
86	○	○	○	○
87	○	○	○	○
88	○	○	○	○
89	○	○	○	○
90	○	○	○	○
91	○	○	○	○

ANSWER				
Q. No.	①	②	③	④
92	○	○	○	○
93	○	○	○	○
94	○	○	○	○
95	○	○	○	○
96	○	○	○	○
97	○	○	○	○
98	○	○	○	○
99	○	○	○	○
100	○	○	○	○
101	○	○	○	○
102	○	○	○	○
103	○	○	○	○
104	○	○	○	○
105	○	○	○	○
106	○	○	○	○
107	○	○	○	○
108	○	○	○	○
109	○	○	○	○
110	○	○	○	○
111	○	○	○	○
112	○	○	○	○
113	○	○	○	○
114	○	○	○	○
115	○	○	○	○
116	○	○	○	○
117	○	○	○	○
118	○	○	○	○
119	○	○	○	○
120	○	○	○	○

Note : Roll Number, Subject Code & Centre Code Should Be Filled In the Boxes Using The Pattern Given As :