**043/2022**

1. Which among the following formation is not an example of Covalent bond?

   (A)  LiF                                      (B)  $NH_3$

   (C)  $CF_4$                                   (D)  HF

2. The wave length of a spectral line for an electronic transition is inversely related to :
   (A)  Number of electrons undergoing transition
   (B)  The nuclear charge of the atoms
   (C)  The difference in the energy levels involved in the transition
   (D)  The velocity of an electron undergoing transition

3. Which of the following quantum number has not been derived from Schrodinger wave equations?
   (A)  Principal quantum number          (B)  Subsidiary quantum number
   (C)  Magnetic quantum number          (D)  Spin quantum number

4. Increasing order of electronegativity is :

   (A)  Bi < P < S < Cl                      (B)  P < Bi < S < Cl

   (C)  C > F > N > O                        (D)  F > O > N > C

5. Examples of super octet molecule is :

   (A)  $PCl_5$                               (B)  $SF_6$

   (C)  $IF_7$                                (D)  All of these

6. When $P_4O_{10}$ is dissolved in water, the acid formed finally is :

   (A)  $H_3PO_2$                             (B)  $H_3PO_4$

   (C)  $H_3PO_3$                             (D)  $H_4P_2O_7$

7. $XeF_2$ reacts with $PF_5$ to give :

   (A)  $XeF_6$                               (B)  $[XeF]^+ [PF_6]^-$

   (C)  $XeF_4$                               (D)  $[PF_4]^+ [XeF_3]^-$

8. The Vander Waals equation $(P = a/V^2) (V\text{-}b) = RT$, where P is pressure, V is the specific volume, T is the temperature and R is the gas constant. The SI unit of 'a' is :
   (A)  J/Kg.K                               (B)  $m^3$/Kg
   (C)  $m^5$/Kg$S^2$                         (D)  Pa/Kg

**A**

**9.** Which of the following can not exist on the basis of Molecular orbital theory?

(A) $H_2^+$
(B) $He_2^+$
(C) $C_2$
(D) $He_2$

**10.** Cesium chloride on heating to 760K changes into :

(A) NaCl structure
(B) CsCl(g)
(C) Antifluorite structure
(D) ZnS structure

**11.** Effective Atomic Number (EAN) of Fe in $Fe(CO)_4^-$ is :

(A) 34
(B) 35
(C) 36
(D) 37

**12.** Hybridization of Fe in $K_3[Fe(CN_6)]$ and $K_4[Fe(CN_6)]$ :

(A) $d^2sp^3$ and $sp^3d^2$
(B) $sp^3d^2$ and $sp^3d^2$
(C) $d^2sp^3$ and $d^2sp^3$
(D) $sp^3d^2$ and $d^2sp^3$

**13.** Which of the following metal has lowest melting point?

(A) Antimony
(B) Silver
(C) Tin
(D) Zinc

**14.** The element with maximum cosmic abundance :

(A) Hydrogen
(B) Helium
(C) Nitrogen
(D) Oxygen

**15.** Among the following mixtures, dipole-dipole as the major interaction, is present in :

(A) Benzene and ethanol
(B) Acetonitrile and acetone
(C) KCl and water
(D) Benzene and carbon tetrachloride

**16.** The value of n in the molecular formula $Be_nAl_2Si_6O_{18}$ is :

(A) 3
(B) 5
(C) 7
(D) 9

**17.** What is the role of ultra violet radiation in water purification system?

1. It inactivates / kill the harmful microorganisms in water
2. It removes all the undesirable odours from the water
3. It quickens the sedimentations of solid particles and improves the clarity of water, which of the statements given above is/are corrected

(A) 1 only
(B) 2 and 3 only
(C) 1 and 3 only
(D) 1, 2 and 3

**18.** The pH of water at 250 is 7, when it is heated to $100^{\circ}C$, the pH of water :

    (A)  Increases

    (B)  Decreases

    (C)  Remain same

    (D)  Decreases up to $50^{\circ}C$ and then increases

**19.** Which of the following copper alloys is used for the manufacture of springs and suspension of springs and suspension filaments in electrical instruments?

    (A)  Bronze

    (B)  Aluminum bronze

    (C)  German silver

    (D)  Phosphor bronze

**20.** Which of the following is/are the hazardous pollutant(s) present in automobiles exhaust gases?

    1.    $N_2$

    2.    CO

    3.    $CH_4$

    4.    Oxides of nitrogen

    (A)  2 and 3

    (B)  1 and 2

    (C)  2 and 4

    (D)  1 and 3

**21.** Which of the following is correctly matched?

    (A)  Aluminum   –  Haematite

    (B)  Lead         –  Galena

    (C)  Iron          –  Bauxite

    (D)  Magnesium  –  Malachite

**22.** In cold water, aquatic animals survive even when water to the top layer of the lake freezes into ice because :

    (A)  They can breathe in ice

    (B)  They have enough of accumulated oxygen inside them

    (C)  Their body structure is such that they can survive without oxygen

    (D)  Water has structure density of $4^{\circ}C$ so underneath the top layer of there is layer of water

**23.** Ferrocene cannot undergo which of the following reaction?

    (A)  Friedal craft acylation

    (B)  Diels-Alder reaction

    (C)  Oxidation by $Ag^+$ ions

    (D)  Electrophilic substitution

**24.** According to wade's Rule, $[C_2B_{10}H_{12}]$ adopts which type of structure?

    (A)  closo structure

    (B)  nido structure

    (C)  archano structure

    (D)  hypo structure

**25.** Which of these can be used as moth repellent?

(A) Benzene hexachloride  (B) Benzal chloride

(C) Hexachloroethane  (D) Tetrachloroethane

**26.** What is the major organic product obtained from the following reaction?



(A)



(B)



(C)



(D)
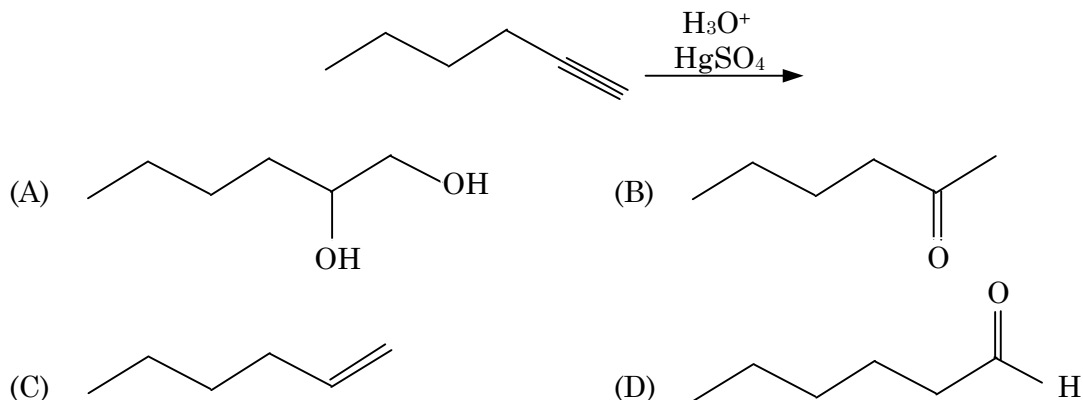


**27.** Which of the following statement is incorrect about nucleophiles?

(A) Nucleophiles have an unshared electron pair and can make use of this to react with an electron deficient species

(B) The nucleophilicity of an element (an electron donor) generally increases on going down a group in the periodic table

(C) A nucleophile is electron-deficient species

(D) All good nucleophiles are good bases when we deal across the period

**28.** A layer of reddish-brown precipitate which is formed on the iron knife, when an iron knife is dipped in an aqueous solution of copper sulphate is of which compound or element?

(A) Iron sulphate  (B) Copper

(C) Rust  (D) Copper sulphate

**29.** Who proposed arrow pushing method of showing progression of elections?

(A) Robert Burns Woodward  (B) Adolf Von Baeyer

(C) Victor Grignard  (D) Sir Robert Robinson

**30.** What is obtained by thermolysis of azides?

(A) Free radicals  (B) Carbocation

(C) Nitrene  (D) Arene

**31.** Results from long-term exposure to lower doses of a chemical is known as

(A) Acute toxicity  (B) Chronic toxicity

(C) Moderate toxicity  (D) High toxicity

**32.** LD50 in a toxicity test stands for
    (A) a dose that will kill 50% of an exposed population
    (B) a dose that would not affect or harm 50% of an exposed population
    (C) a dose that will kill 25% of an exposed population
    (D) a dose that would not kill 25% of an exposed population

**33.** Which of the following is not soluble in $NaHCO_3$?
    (A) 2, 4, 6-Trinitrophenol      (B) Benzoic acid
    (C) o-Nitrophenol      (D) Benzene sulphonic acid

**34.** The product formed by the reaction of an aldehyde with a primary amine is :
    (A) Carboxylic acid      (B) Aromatic acid
    (C) Ketone      (D) Schiff's base

**35.** Which of the following is most reactive towards $S_N1$ reaction?
    (A) $C_6H_5C(CH_3)C_6H_5Br$      (B) $C_6H_5CH_2Br$
    (C) $C_6H_5CH(C_6H_5)Br$      (D) $C_6H_5CH(CH_3)Br$

**36.** A dihalogen derivative 'X' of a hydrocarbon with three carbon atoms react with ale. KOH and produces hydrocarbon which forms red ppt. with ammoniacal $Cu_2Cl_2$. 'X' gives an aldehyde on reaction with aq. KOH. The compound 'X' is
    (A) 1, 3-Dichloropropane      (B) 1, 2-Dichloropropane
    (C) 2, 2-Dichloropropane      (D) 1, 1-Dichloropropane

**37.** The synthesis of alkyl fluoride is best accomplished by :
    (A) Finkelstein reaction      (B) Swartz reaction
    (C) Free radical fluorination      (D) Sandmeyer's reaction

**38.** Which of the following compounds will give racemic mixture on nucleophilic substitution by OH" ion?

1 -Bromoethane, 1-Bromopropane, 1-Bromobutane, Bromobenzene
    (A) Bromobenzene < 1-Bromobutane < 1-Bromopropane < 1-Bromoethane
    (B) Bromobenzene < 1-Bromoethane < 1-Bromopropane < 1-Bromobutane
    (C) 1-Bromopropane < 1-Bromobutane < 1-Bromoethane < Bromobenzene
    (D) 1-Bromoethane < 1-Bromopropane < 1-Bromobutane < Bromobenzene

**39.** Which of the following has ester linkages?
    (A) Nylon      (B) Bakelite
    (C) Terylene      (D) PVC

40. Zeigler-Natta catalyst is used in making :
    (A) Low density polyethylene      (B) High density polyethylene
    (C) Polystyrene                    (D) PMMA

41. What will be the fraction of molecules having energy equal to or greater than activation energy, Ea?
    (A) K                              (B) A
    (C) $Ae^{-Ea/Rt}$                  (D) $e^{-Ea/Rt}$

42. What is the geometry of pentacarbonyl iron (0)?
    (A) Square planar                  (B) Tetrahedral
    (C) Trigonal bipyramidal           (D) Octahedral

43. Which of the following will give effective reduction of 3-hexyne to trans-3-hexene?
    (A) $H_2$/Lindlar's catalyst       (B) Na/liq. $NH_3$
    (C) Fe/NaCl                        (D) DIBAL

44. An organic compound (MF; $C_8H_{10}O$) exhibited the following $^1H$ NMR special data: 62.5 (3H, s), 3.8 (314, s), 6.8 (2H, d, J 8 Hz), 7.2 (2H, d, J 8 Hz) ppm. What will be the compound among the choices?
    (A) 4-methylbenzyl alcohol         (B) 4-methyl anisole
    (C) 4-ethylphenol                  (D) 2-ethylphenol

45. Which Biomolecules simply refers as "Staff of life" in the given macromolecules?
    (A) Vitamins                       (B) Carbohydrate
    (C) Lipids                         (D) Protein

46. Who discovered the mass spectrometer?
    (A) Walter Kaufmann                (B) Ernest O. Lawrence
    (C) Francis Aston                  (D) J.J. Thomson

47. Which of the following is a product formed in Claisen condensation?
    (A) $\beta$-ester                  (B) $\beta$-ketone
    (C) $\beta$-keto ester             (D) Y-diketone

48. Which of the following will form alkyl bromide on reaction with $Br_2$?
    (A) Alcohols                       (B) Alkenes
    (C) Silver salt of fatty acids     (D) All of these

**49.** Reaction of chlorobenzene with $NaNH_2 / NH_3$ forms :

    (A)   Carbene                        (B)   Carbocation

    (C)   Carbanion                   (D)   Benzyne

**50.** Bischler-Napieralski synthesis is used to prepare :

    (A)   Pyridine                      (B)   Pyrazine

    (C)   Isoquinoline                (D)   Quinoline

**51.** Which of the following is a hetrocyclic compound not having 2 nitrogen atoms in the same ring?

    (A)   Isoxazole                    (B)   Pyrimidine

    (C)   Pyrazine                    (D)   Pyridazine

**52.** Chlorination of toluene with excess $Cl_2$ in presence of heat followed by hydrolysis gives :

    (A)   Benzyl alcohol              (B)   Benzoic acid

    (C)   o-Cresol                    (D)   p-Cresol

**53.** Alkyl halide may be converted to alkane by reduction with :

    (A)   Zn/Cu/HCl                  (B)   $H_2/Pt$

    (C)   $NaNH_2/NH_3$            (D)   All of these

**54.** $LiAlH_4$ converts acetic acid into :

    (A)   Acetaldehyde               (B)   Ethane

    (C)   Ethanol                     (D)   Methanol

**55.** A pure organic compound dissolved in dry benzene evolves hydrogen on reaction with sodium. It may be :

    (A)   Ether                          (B)   Alcohol

    (C)   Aldehyde                    (D)   Ketone

**56.** To obtain 1-Propanol from propene, the reagent of choice is :

    (A)   $OsO_4/CH_2Cl_2$          (B)   $O_3$/Zn dust

    (C)   Alk.$KMnO_4$             (D)   $B_2H_6$/Alk.$H_2O_2$

**57.** Ethanol may be distinguished from methanol by :

    (A)   Benedict's test              (B)   Tollen's test

    (C)   Iodoform test              (D)   Lucas test

**58.** Oxymercuration of alkenes may be used to prepare :
    (A) Alkanes                                 (B) Alkynes
    (C) Alkanoic acid                      (D) Alcohols

**59.** The reaction, which is used to convert phenol to salicylic acid is :
    (A) Kolbe-Schmidt reaction         (B) Phthalein reaction
    (C) Leibermann reaction            (D) Cannizzaro reaction

**60.** Reformatsky reaction is the reaction between a carbonyl compound, zinc and :
    (A) Unsaturated acid              (B) Unsaturated ester
    (C) $\alpha$-Halo ester                   (D) $\beta$-Halo ester

**61.** The reagent which is capable of reacting both with aldehyde as well as ketone :
    (A) Schiff's reagent               (B) Grignard reagent
    (C) Tollen's reagent              (D) Fehling's solution

**62.** Benzoin condensation takes place between :
    (A) Aromatic aldehyde and aromatic ketone
    (B) Aromatic aldehyde and aliphatic ketone
    (C) Aromatic aldehyde and aliphatic aldehyde
    (D) Aromatic aldehyde only

**63.** Which of the following method is specific for the preparation of aromatic aldehydes?
    (A) Stephen's reaction          (B) Etard's reaction
    (C) Rosenmund reduction       (D) Hydrolysis of gem dihalides

**64.** Perbenzoic acid reacts with alkenes to form :
    (A) Epoxides                     (B) Ethers
    (C) Glycols                       (D) Alcohols

**65.** Hell Volhard Zelenski reaction is used to prepare :
    (A) Acid halides                 (B) Nuclear halogen acid halides
    (C) Nuclear halogen acids       (D) Side chain halogen acids

**66.** Consider two identical containers, one with 1 mole of hydrogen and the other with 1 mole of helium. If the RMS velocity of these two gases are the same, then the ratio of the temperature, i.e., $T_{H_2}/T_{He}$ = —————?

    (A) $\dfrac{1}{2}$                            (B) $\dfrac{2}{1}$

    (C) $\dfrac{1}{\sqrt{2}}$                        (D) $\sqrt{2}$

67. Four 1 litre flasks are separately filled with the gases $O_2, F_2, CH_4$ and $CO_2$, under the same conditions of temperature and pressure. The ratio of their number of moles will be :
   (A)  $1 : 2 : 3 : 4$   (B)  $1 : 2 : 4 : 3$
   (C)  $1 : 1 : 1 : 1$   (D)  $2 : 2 : 4 : 3$

68. Most probable velocity, average velocity and RMS velocity are related as :
   (A)  $1 : 1.28 : 1.224$   (B)  $1 : 1.28 : 1.424$
   (C)  $1 : 1.128 : 1.224$   (D)  $1 : 1.428 : 1.441$

69. The rate of diffusion of $SO_3, CO_2, PCl_3$ and $SO_2$ are in the following order :
   (A)  $PCl_3 > SO_3 > SO_2 > CO_2$   (B)  $SO_2 > SO_3 > PCl_3 > CO_2$
   (C)  $CO_2 > SO_2 > PCl_3 > SO_3$   (D)  $CO_2 > SO_2 > SO_3 > PCl_3$

70. The ratio of the total volume of bcc to simple cubic structure is :
   (A)  $8 : 3\sqrt{3}$   (B)  $3\sqrt{3} : 8$
   (C)  $24\sqrt{3} : 1$   (D)  $1 : 24\sqrt{3}$

71. A gas at temperature 250 K and pressure 15 atm, has a molar volume 12% smaller than that calculated from ideal gas equation, then compressibility factor under these condition is :
   (A)  12   (B)  88
   (C)  0.12   (D)  0.88

72. Calculate the freezing point of an aqueous solution of urea, it is boils at 373.1 K $K_f = 1.8$ K Kg/mol, $K_b = 0.5$ K Kg/mol :
   (A)  273 K   (B)  373 K
   (C)  272.64 K   (D)  276.24 K

73. Assuming ideal behaviour, calculate the mass of a non-volatile liquid, whose molecular mass = 120, which would be dissolved in 200 g of octane, by 2% lowering of vapour pressure :
   (A)  4.12 gm   (B)  4.21 gm
   (C)  2.41 gm   (D)  2.14 gm

74. $K_{sp}$ of a salt, with general formula $MX_2$, in water is $4 \times 10^{-12}$. Calculate the concentration of $M^{2+}$ ions in the saturated aqueous solution of the salt :
   (A)  $4 \times 10^{-12}$ mol/L   (B)  $1 \times 10^{-12}$ mol/L
   (C)  $4 \times 10^{-4}$ mol/L   (D)  $1 \times 10^{-4}$ mol/L

75. Which of the following change the value of K?
   (A)  adding reactant   (B)  adding product
   (C)  changing temperature   (D)  adding catalyst

**76.** A system with zero-degree of freedom is known as :
    (A) Monovarient            (B) Bivarient
    (C) Invarient              (D) None of these

**77.** A catalyst will increase the rate of a chemical reaction by :
    (A) shifting the equilibrium to the right
    (B) shifting the equilibrium to the left
    (C) increasing the activation energy
    (D) lowering the activation energy

**78.** The units of erg, Joule and Calorie are interconvertible, which of the following is incorrect :
    (A) $10^7$ ergs = 1 Joule       (B) 4.184 J = 1 Cal
    (C) 1 Joule = 0.2390 Cal     (D) 1 erg = 4.184 Cal

**79.** One mole of an ideal gas at 300 K is expanded isothermally from 1 litre volume to 10 litre volume. $\Delta E$ for the process is ——————. (R = 2 Cal K$^{-1}$ mol$^{-1}$) :
    (A) 300 cal             (B) 600 cal
    (C) 1200 cal           (D) 0 cal

**80.** The equation $\dfrac{dp}{dT} = \dfrac{\Delta H}{T(V_2 - V_1)}$ is called :
    (A) Gibb's Helmholtz equation     (B) Clapeyron equation
    (C) Kirchoff's equation          (D) None of these

**81.** A process is in the equilibrium state when :
    (A) $\Delta G = 0$            (B) $\Delta G > 0$
    (C) $\Delta G < 0$            (D) None of these

**82.** The efficiency of a heat engine operating between 400 K and 300 K is :
    (A) 1.0               (B) 0.75
    (C) 0.50             (D) 0.25

**83.** In a process $\Delta H = 100\,KJ$ and $\Delta S = 100\,J/K$ at 400 K. The value of $\Delta G$ will be :
    (A) 0                (B) 100 KJ
    (C) 60 KJ            (D) 50 KJ

**84.** The half life for a first order reaction is 2768 years. If the concentration after 11072 years is 0.0216 M, what was the initial concentration?
    (A) 0.0690 M        (B) 0.345 M
    (C) 0.173 M         (D) 1.000 M

**85.** For a certain reaction, a plot of $\ln[A]$ versus t gives a straight line with a slope of $-1.46$ s$^{-1}$. Then the order of the reaction in A is :

    (A)   0                                 (B)   1

    (C)   2                                 (D)   3

**86.** For a reaction $A \rightarrow B$, the activation energy is $E_a = 125$ KJ/mol and the heat of reaction, $\Delta H = 50$ KJ/mol. What is the $E_a$ for the reverse reaction in KJ/mol?

    (A)   75 KJ/mol                        (B)   $-75$ KJ/mol

    (C)   125 KJ/mol                    (D)   175 KJ/mol

**87.** The heat of adsorption in physical adsorption lies in the range :

    (A)   $1 - 10$ KJ/mol                (B)   $10 - 400$ KJ/mol

    (C)   $40 - 100$ KJ/mol            (D)   $40 - 400$ KJ/mol

**88.** 0.5 Normal solution of a salt placed between two platinum electrodes, 20 cm apart and of area of cross-section 4.0 sq.cm has a resistance of 25 ohms. Calculate the equivalent conductance of the solution :

    (A)   200 ohm$^{-1}$ cm$^2$ eqvt$^{-1}$       (B)   250 ohm$^{-1}$ cm$^2$ eqvt$^{-1}$

    (C)   400 ohm$^{-1}$ cm$^2$ eqvt$^{-1}$       (D)   500 ohm$^{-1}$ cm$^2$ eqvt$^{-1}$

**89.** 30% of 2$^{nd}$ order reaction is completed in 15 minutes. Calculate the time for 60% completion :

    (A)   60 minutes                         (B)   52.5 minutes

    (C)   30 minutes                         (D)   32.5 minutes

**90.** A certain current liberated 1.008 g of hydrogen in 2 hours. How many grams of copper can be deposited by the same current flowing for the same time in $CuSO_4$ solution (atomic mass of Cu = 63.5) :

    (A)   31.75 g                           (B)   63.5 g

    (C)   127.0 g                           (D)   15.875 g

**91.** The specific conductance of a 0.01 M solution of KCl is $1.4 \times 10^{-3}$ ohm$^{-1}$ cm$^{-1}$ at 298 K. Its molar conductance is :

    (A)   0.14 ohm$^{-1}$ cm$^2$ mol$^{-1}$       (B)   1.4 ohm$^{-1}$ cm$^2$ mol$^{-1}$

    (C)   14.0 ohm$^{-1}$ cm$^2$ mol$^{-1}$       (D)   140 ohm$^{-1}$ cm$^2$ mol$^{-1}$

**92.** The equivalent conductance at 18°C of a normal solution of KCl is 98.2 and for infinite dilution at the same temperature is 131. Calculate the degree of dissociation of KCl at this dilution :

    (A)   0.1                                 (B)   0.2

    (C)   0.5                                 (D)   0.75

93. pH of an aqueous solution of weak acid and strong base is given by the relation :

(A) $pH = 7 + \frac{1}{2}pKa + \frac{1}{2}\log C$

(B) $pH = 7 + \frac{1}{2}pKa - \frac{1}{2}\log C$

(C) $pH = 7 - \frac{1}{2}pKa + \frac{1}{2}\log C$

(D) $pH = 7 - \frac{1}{2}pKa - \frac{1}{2}\log C$

94. The heat of neutralisation of all strong acid and strong base is:
   (A) equal to zero
   (B) nearly the same
   (C) not fixed
   (D) varies from acid to acid

95. Which among the following is not microwave active?
   (A) HCl
   (B) $H_2$
   (C) HBr
   (D) CO

96. The NMR active molecule is :
   (A) $_6C^{12}$
   (B) $_6C^{13}$
   (C) $_8O^{16}$
   (D) $_2He^4$

97. The magnetic moment of a molecule is 1.732 magnetons. The number of unpaired electrons is :
   (A) 0
   (B) 1
   (C) 2
   (D) 3

98. $n \rightarrow \sigma^*$ transition occurs in :
   (A) alkanes
   (B) alkenes
   (C) halogen compounds
   (D) carbonyl compounds

99. Specific selection rule for rotational spectrum is :
   (A) $\Delta V = \pm 1$
   (B) $\Delta J = \pm 1$
   (C) $\Delta V = \pm 1, \pm 2$
   (D) $\Delta J = \pm 1, \pm 2$

100. The formula used for the determination of relative viscosity by Ostwald's method is :

(A) $\frac{y_1}{y_2} = \frac{d_1 t_1}{d_2 t_2}$

(B) $\frac{y_1}{y_2} = \frac{d_1 t_2}{d_2 t_1}$

(C) $\frac{y_1}{y_2} = \frac{d_2 t_1}{d_1 t_2}$

(D) $\frac{y_1}{y_2} = \frac{d_2 t_2}{d_1 t_1}$

——————————

**SPACE FOR ROUGH WORK**