**Time : 3 Hrs. 15 Mins.****SUBJECT : MATHEMATICS (35)****Max Marks : 100****Instructions :**

- 1) The question paper has Five parts namely A, B, C, D and E. Answer all the parts.
- 2) Section A has 10 Multiple choice questions. 5 Fill in the blanks and 5 Very Short Answer questions of 1 mark each.
- 3) The sub question I and II of Part A should be answered continuously at one or two pages, only first answer is considered for the marks in sub question I and II of part A.
- 4) Use the graph sheet for the question on linear inequality in Part-D

**PART - A****I Answer All the Multiple Choice Questions :****10x1=10**

- 1) Which one of the following sets is a finite set  
a)  $\{x : x \in \mathbb{N} \text{ and } 2x - 1 = 0\}$       b)  $\{x : x \in \mathbb{N} \text{ and } x \text{ is a prime}\}$   
c)  $\{x : x \in \mathbb{N} \text{ and } x \text{ is even}\}$       d)  $\{x : x \in \mathbb{N} \text{ and } x \text{ is odd}\}$
- 2) If  $(x + 1, y - 2) = (3, 1)$  then  
a)  $x = 3$  and  $y = 2$       b)  $x = 2$  and  $y = 3$       c)  $x = 2$  and  $y = 2$       d)  $x = 3$  and  $y = 3$
- 3) If  $\sin x = \frac{3}{5}$  and  $x$  lies in the first quadrant then  $\cos x$  is equal to  
a)  $\frac{5}{3}$       b)  $\frac{5}{4}$       c)  $\frac{4}{5}$       d) None of these
- 4) The conjugate of the complex number  $i + 3$  is  
a)  $i - 3$       b)  $3 - i$       c)  $-3 - i$       d)  $-3 + i$
- 5) If  ${}^nC_8 = {}^nC_2$  then  $n$  is equal to  
a) 8      b) 2      c) 6      d) 10
- 6) In  $a_n = 2^n$  then  $a_5$  is equal to  
a) 25      b) 32      c) 16      d) 64
- 7) Slope of the line passing through the points  $(3, -2)$  and  $(7, -2)$  is equal to  
a) 0      b) 2      c) 4      d) not defined
- 8)  $\lim_{x \rightarrow 3} (x(x+1))$  is equal to  
a) 21      b) -12      c) 12      d) 10
- 9) The negation of the proposition ' $\sqrt{7}$  is rational' is  
a)  $\sqrt{7}$  is irrational      b)  $\sqrt{7}$  is real      c)  $\sqrt{7}$  is imaginary      d)  $\sqrt{7}$  is not rational
- 10) If  $P(A) = \frac{3}{5}$  then the probability of the event not(A) is  
a)  $\frac{1}{5}$       b)  $\frac{2}{5}$       c)  $\frac{3}{5}$       d)  $\frac{4}{5}$

**II Fill in the blanks by choosing the appropriate answer from those given in the bracket: (9, 1, 4, 0, 8)****5x1=5**

- 11) The number of subsets of the set  $\{a, b\}$  is \_\_\_\_\_.
- 12) The number of terms in the expansion of  $(x + 3)^8$  is \_\_\_\_\_.
- 13) The length of the latus rectum of the parabola  $x^2 = 8y$  is \_\_\_\_\_.
- 14) A point is in the XZ plane then its  $y$  - coordinate is \_\_\_\_\_.
- 15) The derivative of  $x$  at  $x = 1$  is \_\_\_\_\_.

**(P.T.O.)**

**III Answer ALL the following questions :**

5x1=5

- 16) Define radian measure.
- 17) Solve  $3x - 2 < 2x + 1$
- 18) Compute  $\frac{12!}{10! \times 2!}$
- 19) Find the distance between parallel lines  $3x - 4y + 7 = 0$  and  $3x - 4y + 5 = 0$ .
- 20) Find the median for the following data  
3, 9, 5, 3, 12, 10, 18, 4, 7, 19, 21

**PART - B**

**IV Answer any NINE questions :**

9x2=18

- 21) If  $A = \{5, 7, 9, 11\}$ ,  $B = \{7, 9, 11, 13\}$  and  $C = \{11, 13, 15\}$  find  $A \cap (B \cup C)$ .
- 22) If X and Y are two sets such that  $n(X) = 17$ ,  $n(Y) = 23$  and  $n(X \cup Y) = 38$ , find  $n(X \cap Y)$ .
- 23) Let  $A = \{1, 2, 3, \dots, 14\}$  Define a relation  $\mathbb{R}$  from A to A by  
 $\mathbb{R} = \{(x, y) : 3x - y = 0, \text{ where } x, y \in A\}$ . Write the domain and range of relation R.
- 24) Find the radius of the circle in which a central angle of  $60^\circ$  intercepts an arc of length 37.4 cm.
- 25) Find the value of  $\sin 75^\circ$ .
- 26) Find the multiplicative inverse of  $\sqrt{5} + 3i$
- 27) Solve  $5x - 3 < 7$  and show the graph of the solution on number line.
- 28) Find the equation of the line through the points (1, -1) and (3, 5)
- 29) Find the x and y intercepts of the line  $3x - 4y + 10 = 0$
- 30) Show that the points (0, 7, -10), (1, 6, -6) and (4, 9, -6) are the vertices of an isosceles triangle.
- 31) Evaluate :  $\lim_{x \rightarrow 0} \frac{\sin 4x}{\sin 2x}$ .
- 32) Write the contrapositive and converse of the statement 'If x is a prime number, then x is odd'.
- 33) The co-efficient of variation of a distribution is 70 and its standard deviation is 16. Find the arithmetic mean.
- 34) A coin is tossed thrice, Let E : Exactly one head appear, F : atleast two heads appear Are E and F mutually exclusive ?

**PART - C**

**V Answer any NINE questions :**

9x3=27

- 35) In a survey of 600 students in a school, 150 students were found to be taking tea and 225 taking coffee, 100 were taking both tea and coffee. Find how many students were taking neither tea nor coffee ?
- 36) Let  $f(x) = x^2$  and  $g(x) = 2x + 1$  be two real functions. Find  $(f + g)(x)$ ,  $(f - g)(x)$  and  $(f \cdot g)(x)$
- 37) Find the general solution of the equation  $2\cos^2 x + 3 \sin x = 0$ .
- 38) Express the complex number  $Z = 1 + i\sqrt{3}$  in the polar form.
- 39) Solve  $2x^2 + x + 1 = 0$ .
- 40) Find r, if  $5 \cdot {}^4P_r = 6 \cdot {}^5P_{r-1}$
- 41) Find the middle term in the expansion  $\left(3 - \frac{x^3}{6}\right)^7$
- 42) The sum of first three terms of a G.P. is  $\frac{39}{10}$  and their product is 1. Find the common ratio and the terms.

(P.T.O.)



- 43) Insert Five numbers between 8 and 26 such that the resulting sequence is an AP.
- 44) Find the centre and radius of the circle  $x^2 + y^2 + 8x + 10y - 8 = 0$ .
- 45) Find the derivative of  $\cos x$  with respect to  $x$  from first principle.
- 46) Verify the method of contradiction that ' $\sqrt{7}$  is irrational'.
- 47) A and B are events such that  $P(A) = 0.42$ ,  $P(B) = 0.48$  and  $P(A \text{ and } B) = 0.16$   
Determine (i)  $P(\text{not } A)$  (ii)  $P(\text{not } B)$  (iii)  $P(A \text{ or } B)$
- 48) A die is thrown, find the probability that  
(i) A prime number will appear  
(ii) A number greater than or equal to 3 will appear  
(iii) A number more than 6 will appear.

### PART - D

#### VI Answer any FIVE questions :

5x5=25

- 49) Define signum function, Draw its graph, Also write the domain and range.
- 50) Prove that  $\frac{\sin 5x - 2\sin 3x + \sin x}{\cos 5x - \cos x} = \tan x$ .
- 51) Prove by method of mathematical induction, that  
$$1^3 + 2^3 + 3^3 + \dots + n^3 = \frac{n^2(n+1)^2}{4} \quad \forall n \in \mathbb{N}$$
- 52) Solve the following system of inequalities graphically :  
 $5x + 4y \leq 40, \quad x \geq 2, \quad y \geq 3$ .
- 53) A committee of 7 has to be formed from 9 boys and 4 girls. In how many ways can this be done when the committee consists of (i) exactly 3 girls  
(ii) atleast 3 girls  
(iii) atleast 3 girls
- 54) Prove Binomial theorem for any positive integer  $n$ ,  
 $(a + b)^n = {}^nC_0 a^n + {}^nC_1 a^{n-1} \cdot b + {}^nC_2 a^{n-2} \cdot b^2 + \dots + {}^nC_n \cdot b^n$
- 55) Derive the formula to find perpendicular distance from the point  $(x_1, y_1)$  to the line  $Ax + By + C = 0$ .
- 56) Find the coordinates of a point  $R(x, y, z)$  dividing a line segment joining the points  $P(x_1, y_1, z_1)$  and  $Q(x_2, y_2, z_2)$  internally in the ratio  $m : n$ .
- 57) Prove that  $\lim_{x \rightarrow 0} \left( \frac{\sin x}{x} \right) = 1$ ,  $x$  being measured in radius.
- 58) Find the mean deviation about mean for the following data.

Marks Obtained	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Number of students	2	3	8	14	8	3	2

### PART - E

#### VII Answer the following questions :

- 59) Prove geometrically that  $\cos(x + y) = \cos x \cos y - \sin x \sin y$  (6)

**OR**

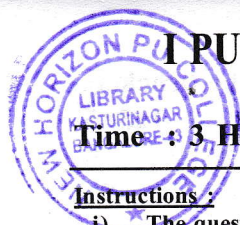
Define ellipse, Derive its equation in the form  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

- 60) Find the derivative of  $\frac{x + \cos x}{\tan x}$  with respect to  $x$ . (4)

**OR**

Find the sum to  $n$  terms of the series  $3 \times 1^2 + 5 \times 2^2 + 7 \times 3^2 + \dots$

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Time : 3 Hrs. 15 Mins.

SUBJECT : CHEMISTRY (34)

Max Marks : 70

**Instructions :**

- i) The question paper has four parts. All the four parts are compulsory.  
Part-A carries 20 marks. Each question carries one mark.  
Part-B carries 8 marks. Each question carries two marks.  
Part-C carries 12 marks. Each question carries three marks.  
Part-D carries 30 marks. Each question carries five marks.
- ii) Write balanced chemical equations and draw diagrams wherever necessary. Use log table and simple calculators if necessary. (Use of Scientific Calculator is not allowed)

**PART - A****I Select the correct option from the given choices.****1x15=15**

- 1) Number of significant figures in 0.0052  
a) 5                      b) 2                      c) 4                      d) 3
- 2) Most electronegative element in the periodic table  
a) Iodine                      b) Sulphur                      c) Oxygen                      d) Fluorine
- 3) The geometry of  $\text{NH}_3$  molecule  
a) Pyramidal                      b) Octahedral                      c) Square pyramid                      d) Bent
- 4) The type of intermolecular attraction that exists between non polar molecules is  
a) Dipole-Dipole force                      b) Repulsive force  
c) London Force                      d) Dipole-Induced dipole force
- 5) Process in which there is no transfer of heat between the system and surroundings is known as  
a) Isothermal process                      b) Adiabatic process  
c) Isochoric process                      d) Isobaric process
- 6) According to Lewis concept an acid is  
a) Proton donor                      b) electron pair donor  
c) electron pair acceptor                      d) proton acceptor
- 7) The oxidation number of oxygen in  $\text{O}_2\text{F}_2$   
a) +1                      b) -2                      c) -1                      d) +2
- 8) 'Syngas' is a mixture of  
a)  $\text{CO}_2 + \text{H}_2$                       b)  $\text{CO} + \text{H}_2$                       c)  $\text{CO} + \text{N}_2$                       d)  $\text{N}_2 + \text{H}_2$
- 9) Strongest reducing agent among all the alkali metals  
a) Lithium                      b) Sodium                      c) Potassium                      d) Rubidium
- 10) An aqueous solution of borax is  
a) Acidic                      b) Neutral                      c) Alkaline                      d) Amphoteric
- 11) In diamond each carbon atom undergoes  
a)  $\text{SP}$  hybridization                      b)  $\text{SP}^2$  hybridization  
c)  $\text{SP}^3\text{d}^2$  hybridization                      d)  $\text{SP}^3$  hybridization
- 12) Homolytic cleavage of a covalent bond liberates  
a) Carbocations                      b) Free radicals                      c) Carbanions                      d) Carbenes
- 13) A suitable method to separate chloroform and aniline  
a) Sublimation                      b) Filtration                      c) Distillation                      d) Crystallisation
- 14) The gas liberated when calcium carbide is added to water  
a) Ethyne                      b) Methane                      c) Oxygen                      d) Hydrogen
- 15) Bio chemical oxygen demand value for highly polluted water is  
a) Equal to 10 ppm                      b) less than 5ppm                      c) more than 17ppm                      d) Equal to 5 ppm

(P.T.O.)



**II Fill in the blanks by choosing the appropriate word from those given in the brackets:**

1x5=5

( $\text{HSO}_4^-$  Alcoholic KOH  $\text{SiO}_4^{4-}$  Gallium  $\text{Kg m}^{-3}$ )

- 16) SI unit of density \_\_\_\_\_
- 17) Mendeleev kept a gap for an element under aluminium and called it Eka-Aluminium. Later the element \_\_\_\_\_ fitted in that gap.
- 18) Conjugate base of  $\text{H}_2\text{SO}_4$  is \_\_\_\_\_.
- 19) \_\_\_\_\_ is the structural unit of silicates.
- 20) The reagent used in dehydrohalogenation reaction is \_\_\_\_\_.

**PART -B**

**III Answer any FOUR of the following. Each question carries two marks.**

4x2=8

- 21) Calculate the molarity of NaOH in the solution prepared by dissolving its 4g in enough water to form 250 ml of the solution [molar mass of NaOH is  $40 \text{ g mol}^{-1}$ ]
- 22) Write the electronic configuration of  $\text{Li}_2$  molecule based on molecular orbital theory and calculate bond order.
- 23) State Boyle's Law and write its mathematical expression.
- 24) Write any two similarities between Beryllium and Aluminium.
- 25) Complete the following reactions  

$$\text{B}_2\text{H}_6 + 3\text{O}_2 \longrightarrow \text{_____} + 3\text{H}_2\text{O}$$

$$\text{Fe}_2\text{O}_3 + 3\text{CO} \xrightarrow{\Delta} \text{_____} + 3\text{CO}_2$$
- 26) Explain the preparation of ethene by dehydration of ethanol.
- 27) Write Cis-trans isomers of the compound  

$$\text{CH}_3\text{CH} = \text{CHCH}_3$$
- 28) How is ozone layer formed in the stratosphere ? Name a chief chemical that causes its depletion.

**PART - C**

**IV Answer any FOUR of the following. Each question carries three marks.**

4x3=12

- 29) What is ionisation enthalpy ? How does Ionisation enthalpy vary along the period, and down the group?
- 30) Write any three postulates of VSEPR theory.
- 31) Explain  $\text{Sp}^2$  hybridization by taking  $\text{BCl}_3$  as an example.
- 32) Define hydrogen bond. Give an example for the molecule having  
 i) Intermolecular hydrogen bond.  
 ii) Intramolecular hydrogen bond.
- 33) Balance the following redox reaction by oxidation number method.  

$$\text{MnO}_4^- \text{(aq)} + \text{Br}^- \text{(aq)} \longrightarrow \text{MnO}_2 \text{(s)} + \text{BrO}_3^- \text{(aq)}$$

(in acidic medium)
- 34) a) What are Saline Hydrides ? Give an example.  
 b) Give any one use of heavy water.
- 35) Write the chemical equations during the preparation of sodium carbonate by 'Solvay Process'.
- 36) a) What are Silicones ? Which is the starting material for the manufacture of silicones.  
 b) Graphite is soft and slippery. Why ?

(P.T.O.)

PART - D

- V Answer any FOUR of the following. Each question carries five marks. 4x5=20
- 37) a) A compound contains 4.07% hydrogen 24.27% carbon and 71.65% chlorine. Its molar mass is 98.96 g. What are the empirical and molecular formula.  
[Atomic mass : C = 12 H = 1 Cl = 35.45] 4
- b) Define limiting reagent. 1
- 38) a) Explain the significance of four quantum numbers. 4
- b) What is the shape of S orbital 1
- 39) a) Write any two drawbacks of Rutherford atomic model. 2
- b) Using s, p, d, f notations describe the orbital with the following quantum numbers  
1)  $n = 2, l = 1$   
2)  $n = 5, l = 3$  2
- c) State Pauli's exclusion principle. 1
- 40) a) Write any three postulates of Kinetic theory of gases. 3
- b) Write Ideal gas equation. 1
- c) What is absolute zero temperature. 1
- 41) a) Calculate the Standard enthalpy of formation of  $\text{CH}_3\text{OH}(l)$  from the following data
- $$\text{C}_{(s)} + \text{O}_{2(g)} \longrightarrow \text{CO}_{2(g)} \quad \Delta H^\circ = -393 \text{ kJ mol}^{-1}$$
- $$\text{H}_{2(g)} + \frac{1}{2} \text{O}_{2(g)} \longrightarrow \text{H}_2\text{O}_{(l)} \quad \Delta H^\circ = -286 \text{ kJ mol}^{-1}$$
- $$\text{CH}_3\text{OH}_{(l)} + \frac{3}{2} \text{O}_{2(g)} \longrightarrow \text{CO}_{2(g)} + 2\text{H}_2\text{O}_{(l)} \quad \Delta H^\circ = -726 \text{ kJ mol}^{-1}$$
- b) What is extensive property ? Give an example. 2
- 42) a) 6 moles of an ideal gas undergoes a reversible and isothermal expansion from volume 5L to 20L at 27°C. Calculate the workdone by the gas.  $[R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}]$  3
- b) Write Gibb's Equation. What is the criteria for spontaneity in terms of free energy change? 2
- 43) a) What is a Buffer Solution ? Give an example for acidic Buffer Solution. 2
- b) The concentration of hydrogen ion in a sample of soft drink is  $3.8 \times 10^{-3} \text{ M}$  what is its  $\text{pH}$  ? 2
- c) Dissociation constant of formic acid and Benzoic acid are  $1.8 \times 10^{-4}$   $6.5 \times 10^{-5}$  respectively at 298 K. Which of them is stronger acid. 1
- 44) a) State Le Chatelier's principle. What is the effect of pressure on the following equilibrium.  
 $\text{CO}_{(g)} + 3\text{H}_{2(g)} \rightleftharpoons \text{CH}_{4(g)} + \text{H}_2\text{O}_{(g)}$  3
- b) Deduce the relation between  $K_p$  and  $K_c$  for the equilibrium reaction  
 $\text{N}_{2(g)} + 3\text{H}_{2(g)} \rightleftharpoons 2\text{NH}_{3(g)}$  2

- VI Answer any TWO of the following. Each question carries five marks.** **2x5=10**
- 45) a) Explain functional isomerism with an example. 2
- b) Write any two differences between Inductive effect and electromeric effect. 2
- c) What is the IUPAC name of  $\text{CH}_3 - \text{CH}_2 - \text{CH}(\text{Cl}) - \text{CH}_2\text{OH}$  1
- 46) a) How do you estimate carbon and hydrogen present in the organic compound by Liebig's method. (Diagram not necessary) 3
- b) For the compound  $\text{CH} \equiv \text{C} - \text{CH} = \text{CH} - \text{CH}_3$  write bond line formula of the compound identify the number of sigma and Pi bonds. 2
- 47) a) Write the steps involved in the mechanism of nitration of benzene. 3
- b) Explain Wurtz Reaction with an example. 2

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