

ECAT Paper

(Chemistry Section)

1. **Which of the following is used as a conversion factor in stoichiometric calculations?**
A) Density
B) Mole ratio
C) Atomic radius
D) Empirical formula
2. **Which of the following orbitals is spherical in shape?**
A) s-orbital
B) p-orbital
C) d-orbital
D) f-orbital
3. **The spectral lines in hydrogen atom are explained by:**
A) Rutherford's theory
B) Bohr's model
C) Dalton's theory
D) Quantum mechanical model
4. **According to Kinetic Molecular Theory, gases move:**
A) Slowly and steadily
B) Randomly and constantly
C) In circular motion
D) In fixed paths
5. **A saturated solution of a sparingly soluble salt is in equilibrium with:**
A) Gas
B) Ions in solution
C) Water
D) Catalyst
6. **Vapor pressure of a liquid increases with:**
A) Decrease in temperature
B) Increase in temperature
C) Decrease in volume

- D) Increase in atmospheric pressure
7. Which of the following is the correct form of the ideal gas equation?
- A) $PV = nRT$
 - B) $P + V = nRT$
 - C) $PV/T = nR$
 - D) $P = RT/V$
8. According to Boyle's Law, if pressure increases, the volume of gas:
- A) Increases
 - B) Remains constant
 - C) Decreases
 - D) Becomes zero
9. What is the standard electrode potential of the Standard Hydrogen Electrode (SHE)?
- A) 1.0 V
 - B) 0.5 V
 - C) 0.0 V
 - D) -1.0 V
10. The cathode is:
- A) Always positive
 - B) Always negative
 - C) Where oxidation occurs
 - D) Where reduction occurs
11. What happens during dehydration of alcohol?
- A) Addition of water
 - B) Removal of H_2
 - C) Removal of H_2O
 - D) Oxidation
12. Transition metals show variable oxidation states because:
- A) They are radioactive
 - B) They have filled d-orbitals
 - C) They have unpaired d-electrons

D) They are noble gases 13. **The functional group of aldehyde**

is:

- A) -COOH
- B) -OH
- C) -CHO
- D) -CO

14. A reaction at equilibrium is characterized by:

- A) Only forward reaction occurring
- B) Only reverse reaction occurring
- C) Forward and reverse reactions occurring at the same rate
- D) Reactions stopping completely

15. According to Le Chatelier's Principle, increasing temperature favors:

- A) Exothermic reaction
- B) Endothermic reaction
- C) Both
- D) Neither

16. Enthalpy is defined as:

- A) Internal energy + work
- B) Heat content at constant pressure
- C) Energy per mole
- D) Product of pressure and temperature

17. What is the first step in the free radical mechanism?

- A) Initiation
- B) Propagation
- C) Termination
- D) Ionization

18. According to Hess's Law:

- A) Enthalpy change depends on the path
- B) Energy cannot be destroyed
- C) Heat change is the same regardless of the path
- D) Energy is released in endothermic reactions

19. Absolute zero is the temperature at which:

- A) Gas volume becomes infinite
- B) Molecular motion stops
- C) Pressure is highest
- D) Gas changes into liquid

20. Which of the following is a crystalline solid?

- A) Glass
- B) Rubber
- C) Quartz
- D) Plastic

21. For the reaction $2A + 3B \rightarrow C$, if 6 moles of A and 12 moles of B are mixed, how many moles of C are formed, assuming complete reaction?

- A) 2 moles
- B) 3 moles
- C) 4 moles
- D) 6 moles

22. In the reaction $N_2 + 3H_2 \rightarrow 2NH_3$, 14 g of N_2 reacts with 8 g of H_2 . What is the maximum mass of NH_3 produced?

- A) 8.5 g
- B) 17 g
- C) 34 g
- D) 12 g

23. What is the electron configuration of Cu^+ (atomic number 29)?

- A) $[Ar] 4s^1 3d^9$
- B) $[Ar] 3d^{10}$
- C) $[Ar] 4s^2 3d^8$
- D) $[Ar] 4s^1 3d^{10}$

24. Which of the following quantum numbers is invalid for an electron in a 4p orbital?

- A) $n=4, l=1, m_l=0, m_s=+1/2$
- B) $n=4, l=2, m_l=-1, m_s=-1/2$
- C) $n=4, l=1, m_l=+1, m_s=+1/2$
- D) $n=4, l=1, m_l=0, m_s=-1/2$

25. What is the wavelength of light emitted when an electron in a hydrogen atom transitions from $n=4$ to $n=2$?
- A) 656 nm
 - B) 486 nm
 - C) 410 nm
 - D) 364 nm
26. A gas at 2 atm and 5 L is compressed to 1 L. What is the final pressure at constant temperature?
- A) 8 atm
 - B) 10 atm
 - C) 12 atm
 - D) 6 atm
27. Which of the following is a crystalline solid?
- A) Glass
 - B) Rubber
 - C) Quartz
 - D) Plastic
28. Which compound has the highest boiling point due to hydrogen bonding? A) CH_3NH_2
- B) H_2O
 - C) CH_3F
 - D) HF
29. For $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$, $\Delta H = -198 \text{ kJ/mol}$, what happens if pressure is increased? A) Shifts to reactants
- B) Shifts to products
 - C) No shift
 - D) Temperature increases
30. What is the major product of $\text{CH}_3\text{CH}=\text{CH}_2$ with HBr in the presence of peroxides? A) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$
- B) $\text{CH}_3\text{CHBrCH}_3$
 - C) $\text{CH}_2\text{BrCH}_2\text{CH}_3$
 - D) $\text{CH}_3\text{CH}_2\text{Br}$

(Physics Section)

31. **In case of motion of paratrooper, when weight of paratrooper and air resistance become equal then paratrooper falls with:**
- A) Variable acceleration
 - B) Zero acceleration
 - C) Uniform acceleration
 - D) Gravitational acceleration
32. **Which of the following has no acceleration?**
- A) Man driving a car on busy road
 - B) Rock rolling down a mountain
 - C) A luggage in flying airplane
 - D) A bike moving on a rough road
33. **When collision between the bodies in a system is inelastic in nature then for system?**
- A) Momentum changes but K.E remain conserve
 - B) K.E changes but momentum remain conserve
 - C) Both momentum and K.E change
 - D) Both momentum and K.E remain conserve
34. **A man pulling a bag with force of 20 N at an angle 60° with horizontal plane. If bag covers a distance of 15 m, then work done by the man is:**
- A) 50 J
 - B) 75 J
 - C) 150 J
 - D) 100 J
35. **The acceleration of a body traveling with uniform speed in a circle is:**
- A) Zero
 - B) Directed towards center of circle
 - C) Directed away from center of circle
 - D) Directed along tangent line
36. **The power required to raise a block of mass 500 kg vertical to height 15 m in a time of 50s is:**
- A) 1 hp

- B) 2 hp
 - C) 3 hp
 - D) 4 hp
37. According to Faraday's law of electromagnetic

induction:

- A) The direction of induced current is such that it opposes the cause producing it
- B) The magnitude of induced emf produced in a coil is directly proportional to the rate of change of magnetic flux
- C) The direction of induced emf is such that it opposes the cause producing it
- D) None of these

38. The energy stored in a parallel plate capacitor is 24 J. What is the potential difference between the plates if the capacitance of the capacitor is 3F?

- A) 4kV
- B) 8 kV
- C) 16kV
- D) 64 kV

39. The half-time of a radioactive sample (in minutes), if its mean life is 200s is:

- A) 0.69 min
- B) 2 min
- C) 2.57 min
- D) 2.31 min

40. A coil having an area 5 m^2 placed in a magnetic field which changes from 1 Wb/m^2 to 4 Wb/m^2 in an interval of 3 seconds. The emf induced in the coil will be:

- A) 15 V
- B) 10 V
- C) 1 V
- D) 5 V

41. What is the measure in radians of the angle $A = 330^\circ$?

- A) $5\pi/6$
- B) $11\pi/6$
- C) $\pi/6$

D) $7\pi/6$

42. A stationary wave is formed in a pipe which is open at one end. If two complete loops are formed and the wavelength of the wave is 10 cm, what is the length of the pipe?
- A) 10 cm
B) 15 cm
C) 12.5 cm
D) 7.5 cm
43. 100 W heater is used for 5 minutes to heat 500 g of water. What is the change in temperature of water? Specific heat capacity of water is $4.2 \text{ J/g}^\circ\text{C}$.
- A) 140°C
B) 40°C
C) 0.2°C
D) 14°C
44. The force between two charges Q and q, separated by a distance d is F. What will be the force between them when distance between them is $d/2$? A) 4F
B) 2F
C) F
D) $F/2$
45. Time constant is defined as the time required by the capacitor:
- A) To deposit 63% of the equilibrium charge
B) To deposit 36% of the equilibrium charge
C) To deposit 63 times of the equilibrium charge
D) To deposit 36 times of the equilibrium charge
- 46) How many Tesla is equal to 25000 Gauss?
- A) 5T
B) 2.5 T
C) 0.5 T
D) 2 T
47. Radon-222 has 136 neutrons, how many neutrons are there in Radon-220?

- A) 131
 - B) 134
 - C) 136
 - D) none of these
48. **The length of a string is 1m, tension in it is 40N, and mass of the string is 0.1 kg. Then the velocity of transverse waves produced in the string will be:** A) 400 m/s
- B) 80 m/s
 - C) 180 m/s
 - D) 20 m/s
49. **What should be the length of a closed pipe to produce resonance with sound waves of wavelength 62 cm?**
- A) 31 cm
 - B) 15.5 cm
 - C) 45 cm
 - D) 20.5 cm
50. **A stretched wire of length 1 m and weighing 1 gram is in unison with a tuning fork of frequency 200 Hz. The tension in the wire will be:**
- A) 160 N
 - B) 80 N
 - C) 320 N
 - D) 200 N
51. **A body is projected with kinetic energy E so as to attain maximum horizontal range. Its potential energy at the highest point is:**
- A) $2E$
 - B) $E/2$
 - C) $4E$
 - D) E
52. **The work done by gravity during the descent of a projectile:**
- A) Is negative
 - B) Depends for its sign on the direction of the y axis
 - C) Zero
 - D) Is positive

53. **The concept of the lines of force in the study of electric field was introduced by:** A) Edison
B) Faraday
C) Kirchhoff
D) Fleming
54. **A particle of mass m and charge Q moving with velocity V enters the region of a uniform magnetic field at right angle to the direction of its motion. How does its kinetic energy get affected?**
A) Its kinetic energy will be affected
B) Its kinetic energy will not be affected
C) Its kinetic force
D) None of the above
55. **What is the half-life of Iodine I-125?**
A) 1 weeks
B) 6 weeks
C) 8 weeks
D) 10 weeks
56. **A car travels 30 m toward east, then it takes turn and travels 40 m towards north. It takes 50 seconds. Its average velocity is:**
A) $7/5$ m/s
B) 1 m/s
C) $1/5$ m/s
D) 5 m/s
57. **Which physical quantity is a vector?**
A) Speed
B) Distance
C) Displacement
D) Work
58. **Which of the following has the same unit as energy?**
A) Power
B) Force
C) Work
D) Pressure
59. **The SI unit of electric charge is:**

- A) Coulomb
- B) Ampere
- C) Volt
- D) Ohm

60. **Acceleration is defined as:**

- A) Rate of change of speed
- B) Rate of change of distance
- C) Rate of change of velocity
- D) None of these

(English Section)

61. **Fill in the blank: The book is ____ the table.**

- A) on
- B) at
- C) in
- D) under

62. **Fill in the blank: She went to the store ____ buy some groceries.**

- A) to
- B) for
- C) from
- D) with

63. **Fill in the blank: John is as tall ____ his brother.**

- A) than
- B) like
- C) as
- D) so

64. **Fill in the blank: I met him ____ the train station.**

- A) on
- B) at
- C) in
- D) to

65. Find the error: He have never seen such a beautiful movie before.

- A) He
- B) have
- C) seen
- D) before

66. Find the error: She sings beautiful and everyone loves her voice.

- A) sings
- B) beautiful
- C) everyone
- D) loves

67. Choose the correct option: She plays tennis ____ than her brother.

- A) more better
- B) better
- C) best
- D) more good

68. Fill in the blank: I haven't seen her ____ a long time.

- A) since
- B) for
- C) in
- D) at

69. Find the error: The teacher asked the students to write a letter to the principal about the problem.

- A) The
- B) asked
- C) to
- D) about

70. Choose the correct option: ____ you like to come to the party tonight? A) Would

- B) Do
- C) Are
- D) Is

Mathematics

71) The number of words that can be formed from the letters of the word, "COMMITTEE" are

A) 9P_9

B) 9C_9

C) $\frac{9!}{2!2!2!}$

D) 9

72) Let $a, b \in R$ with $a < b$ then set of $(a, b) = \{x \in R | a < x < b\}$ is called

A) closed interval

B) open interval

C) semi-open interval

D) semi-closed interval

73) The value of $\lim_{x \rightarrow 0} \frac{\sin ax}{bx}$ is

A) a

B) $\frac{a}{b}$ (Correct)

C) b

D) $\frac{b}{a}$

74) $2\cos \alpha \cos \beta =$

A) $\cos(\alpha + \beta) + \cos(\alpha - \beta)$

B) $\cos(\alpha + \beta) - \cos(\alpha - \beta)$

C) $\sin(\alpha + \beta) + \sin(\alpha - \beta)$

D) $\sin(\alpha + \beta) - \sin(\alpha - \beta)$

75) $\sin 5\theta + \sin 3\theta =$

A) $2\cos 2\theta \sin \theta$

B) $-2\cos 4\theta \sin \theta$

C) $-2\sin 4\theta \cos \theta$

D) $2\sin 4\theta \cos \theta$

76) $\sin \frac{\alpha}{2} =$

A) $\pm \sqrt{\frac{s(s-c)}{ab}}$

B) $\pm \sqrt{\frac{s(s-b)}{ac}}$

C) $\pm \sqrt{\frac{s(s-a)}{bc}}$

D) $\pm \sqrt{\frac{s(s-b)(s-c)}{bc}}$

77) $\frac{d}{dx}(\sin^{-1}x) = \underline{\hspace{2cm}}$

A) $-\frac{1}{\sqrt{1-x^2}}$

B) $\frac{1}{\sqrt{1-x^2}}$

C) $\frac{1}{\sqrt{x^2-1}}$

D) $-\frac{1}{\sqrt{x^2-1}}$

78) $\frac{d}{dx} \ln(ax^2 + b) = \underline{\hspace{2cm}}$

A) $\frac{a}{ax^2+b}$

B) $\frac{2a}{ax^2+b}$

C) $\frac{2ax}{ax^2+b}$

D) $\frac{b}{ax^2+b}$

79) For an equilateral triangle which of the following must be true.

A) $r = 4R$

B) $r = \frac{R}{2}$

C) $r = \frac{R}{3}$

D) None

80) Equation $P^x + q.P^{2x} = y$ is known as.

A) Reciprocal equation

B) Exponential Equation

C) Quartic equation

D) None

81) The period of $\tan 3\theta$ is.

A) 2π

B) $\frac{2\pi}{3}$

C) $\frac{\pi}{3}$

D) π

82) n th harmonic mean between a & b is given as;

A) $\frac{ab(n+1)}{b+na}$

B) $\frac{nab}{2(a+b)}$

C) $\frac{2ab}{n(a+b)}$

D) $\frac{b+na}{ab(n+1)}$

83) If $\tan^{-1}(2x) + \tan^{-1}(3x) = \frac{\pi}{4}$ then $x = ?$

A) -1

B) 6

C) $\frac{1}{6}$

D) 1

84) The number of triangle formed by 4 points. When no three points are collinear is:

A) 4

B) 6

C) 8

D) 9

85) The matrix $\begin{bmatrix} \lambda & -1 & 4 \\ -3 & 0 & 1 \\ -1 & 1 & 2 \end{bmatrix}$ is non singular if;

- A) $\lambda \neq -5$ B) $\lambda \neq -17$ C) $\lambda \neq -16$ D) $\lambda \neq -18$

86) If $f(x) = 3x^2 - 1$ then $\frac{f(x) - f(1)}{x - 1} = ?$

- A) x B) $x + 1$ C) $x - 1$ D) 1

87) What is the range of $x = \sec \theta$.

- A) $-1 < x < 1$ B) $x < -1$ and $x > 1$ C) $x \geq -1$ and $x \leq 1$ D) $x \geq 1$ and $x \leq -1$

88) If $\sin \theta = \frac{1}{3}$ and $-\frac{\pi}{4} \leq \theta \leq \frac{\pi}{4}$, then $\cos(2\theta) =$

- A) $-\frac{7}{9}$ B) $-\frac{2}{3}$ C) $\frac{2}{3}$ D) $\frac{7}{9}$

89) Binomial theorem is used to following series

- A. Divergent
- B. Convergent
- C. Any
- D. None

90) The solution of $1 + \cos X = 0$ is

- A. $\pi + 2k\pi, k \in \mathbb{Z}$
- B. $2k, \pi$
- C. $\pi, 2k\pi$
- D. None

91) $\sin(180^\circ + \theta)$

- A. $-\sin \theta$
- B. $-\cos \theta$
- C. Both
- D. None

92) If eccentricity $e > 1$, then the equation of rectum is

- a) $X = \frac{3}{4}$
- b) $Y = \frac{4}{3}$
- c) $Y = \frac{1}{3}$
- d) $Y = \frac{5}{7}$

93) Let $A=[a_{ij}]$ be a square matrix. If $a_{ij} \neq 0 \forall i=j$ and $a_{ij}=0$ for all $i \neq j$, then A is

- A. scalar Matrix
- B. identity Matrix
- C. diagonal Matrix
- D. null Matrix

94) Two or more vectors are said to be coplanar if they

- A. are perpendicular to the same plane
- B. are not parallel to the same plane
- C. lie in the same plane
- D. do not lie in the same plane $an+1 + bn+1$

95) _____ⁿ b is arithmetic mean between a and b if $n = a + n$

- A. -1
- B. 1
- C. 0
- D. 2

96) If $2 + 1 + 1/2 + \dots$ is infinite geometric series then S_{∞}

- A. 2
- B. 4
- C. $1/2$
- D. $1/4$

97) If $r \geq 1$ in a geometric sequence such sequence is called _____

- A. convergent
- B. divergent
- C. both A and B
- D. imaginary

98) A bag contains 30 balls, some of which are red and the remaining are blue. The probability of drawing red is $1/6$, then the number of blue balls are

- A. 25
- B. 20
- C. 48
- D. 16

99) Let $S = \{3, \{1,4\}, 2\}$, then $|P(S)|$ will be.

- A) 16
- B) 8
- C) 12
- D) 32

100) If $1 + \frac{1}{4} + \frac{1.3}{4.8} + \frac{1.3.5}{4.8.12} + \dots + \infty$ is

- A) $\sqrt{2}$
- B) $\sqrt{3}$
- C) $\sqrt{5}$
- D) $\sqrt{7}$