



PART – A

1. Fill appropriate preposition in the blank :

The bread is made _____ wheat flour.

- A) of
B) from
C) in
D) on

2. Find the appropriate homonym for Altar.

- A) Alter
B) Altor
C) Altur
D) Altair

3. A Simile is a

- A) Contrast
B) Parallel
C) Combination
D) Comparison

4. Find the correct idiom.

- A) Better safe than sad
B) Better safe than serious
C) Better safe than sorry
D) Better safe than regretful

5. Find the correct expression.

- A) Between you and I
B) Between you and me
C) Between you and my
D) Between you and mine

6. Pair with harp from the following.

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

7. Choose the correct homophone for Ascent.

- A) Accent
B) Assent
C) Axent
D) Axant

8. Which of the following is an Indian Grammarian ?

- A) Bhash
B) Bharata
C) Panini
D) Prakasam

9. Who is the Indian Nobel Laureate for Literature ?

- A) Jatin Kumar Naik
B) Hargobind Khurana
C) Rabindranath Tagore
D) Mother Teresa



10. Who among the following wrote The Jungle Book?
A) Mark Twaine
B) R.K. Narayan
C) Rudyard Kipling
D) Rabindranath Tagore
11. Rangaswamy Cup is associated with
A) Archery
B) Cricket
C) Football
D) Hockey
12. Who is the father of Geometry ?
A) Aristotle
B) Euclid
C) Pythagoras
D) Kepler
13. Shivaji's war strategy used against the Mughals was
A) Alert Army
B) Political Supremacy
C) Large Army
D) Guerilla Warfare
14. Marginal utility, a consumer derives from a good, is
A) Change in his total utility as a result of adding one unit to his stock of a good
B) Utility derived from a particular good
C) Change in utility derived as a result of a change in the price of a good
D) Change in his total utility when he buys extra units of a good
15. Joint Military Exercise Nomadic Elephant 2017 is being held between India and
A) Vietnam
B) Mongolia
C) Sri Lanka
D) Thailand
16. $1014 \times 986 = ?$
A) 998804
B) 998814
C) 998904
D) 999804
17. After deducting a commission of 5%, a T.V. set costs Rs. 9595. Its marked price is
A) Rs. 10,000
B) Rs. 10,075
C) Rs. 10,100
D) Rs. 10,500
18. At what rate percent per annum will a sum of money double in 16 years ?
A) 6.25% p.a.
B) 6.00% p.a.
C) 6.75% p.a.
D) 6.50% p.a.



34. The angle between \hat{i} and $(2\hat{i} + \hat{j})$ is
- A) $\cos^{-1} \frac{2}{5}$ B) $\cos^{-1} \frac{2}{\sqrt{5}}$ C) $\cos^{-1} \frac{2}{3}$ D) $\cos^{-1} \frac{3}{2}$
35. For a particle executing SHM the phase difference between displacement and acceleration is
- A) $\pi/2$ B) π C) 0 D) $3\pi/2$
36. The Quality factor Q of an electrical oscillator is
- A) $\omega R/L$ B) ω/LR C) $\omega L/R$ D) $R/\omega L$
37. The relaxation time τ for a mechanical oscillator is related to damping constant r as
- A) $\tau = \frac{r}{2m}$ B) $\tau = \frac{r}{m}$ C) $\tau = \frac{2m}{r}$ D) $\tau = \frac{m}{r}$
38. On superimposing two mutually perpendicular SHMs, we get circular Lissajous figures when their phase difference (ϕ) and amplitudes (P,Q) are as follows
- A) $\phi=0, P=0$ B) $\phi = \frac{\pi}{2}, P=Q$ C) $\phi=0, P \neq 0$ D) $\phi=0, Q=0$
39. Which of the following phenomenon proves the transverse characteristics of light?
- A) Interference B) Dispersion
C) Polarisation D) Refraction
40. The sources are called coherent if they produce waves
- A) of equal wavelength
B) having same shape of wave front
C) having a constant phase difference
D) of equal frequency
41. Two coherent sources of different intensities send wave which interfere. The ratio of maximum intensity to the minimum intensity is 25. The intensities of the sources are in the ratio
- A) 25:1 B) 9:4 C) 5:1 D) 625:1
42. A thin transparent sheet is placed in front of Young's double slit. The fringe width will be
- A) remain same B) increase
C) decrease D) zero



43. If the source of light used in Young's double slit experiment is changed from red to violet
- A) the fringe will become brighter
 - B) consecutive fringes will come closer
 - C) the intensity of the minima will increase
 - D) the intensity of minima will decrease
44. Frame S' moves along the positive X direction of S frame. A rod placed along Y' axis if observed from S frame appears
- A) elongated
 - B) unchanged
 - C) contracted
 - D) doubled
45. If the twin brothers, one goes on a relativistic tour and comes back. The brother on tour will
- A) become older
 - B) become younger
 - C) be of the same age
 - D) none of above
46. Decay of π meson supports
- A) length contraction
 - B) time dilation
 - C) relativity of mass
 - D) relativity of velocity
47. A rocket has a velocity of $0.6c$. Velocity of light with respect to the rocket is
- A) $0.5c$
 - B) $1.6c$
 - C) c
 - D) $0.4c$
48. The de Broglie wavelength of material particles which are in thermal equilibrium at temperature T is
- A) $\frac{h}{\sqrt{2mkT}}$
 - B) $\frac{h}{\sqrt{mkT}}$
 - C) $\frac{h}{\sqrt{3mkT}}$
 - D) $\frac{h}{\sqrt{5mkT}}$
49. Davisson and Germer's experiment relates to
- A) Electron diffraction
 - B) Interference
 - C) Polarisation
 - D) Refraction
50. A free particle has
- A) Definite energy and definite momentum
 - B) Definite energy and indefinite momentum
 - C) Indefinite energy and definite momentum
 - D) Indefinite energy and indefinite momentum



51. The number of meaningful ways in which four fermions can be arranged in five compartments
A) 4 B) 5 C) 9 D) 12
52. For the case of simple cubic lattice, the co-ordinate number is
A) 6 B) 8 C) 12 D) 13
53. The atomic radius for simple cubic lattice is
A) $a/2$ B) $\frac{\sqrt{3}}{4}a$ C) $\frac{\sqrt{2}}{4}a$ D) $a/3$
54. The separation between lattice planes (100) in simple cubic lattices is
A) a B) $\frac{a}{\sqrt{2}}$ C) $\frac{a}{\sqrt{3}}$ D) $\frac{a}{\sqrt{5}}$
55. Which of the following has the Bragg's angle having wavelength 1.54 \AA in the 1st order, if the interplanar distance is 2.67 \AA .
A) 59.9° B) 35.22° C) 16.76° D) 8.76°
56. For laser action to occur, the medium used must have atleast
A) 4 energy levels B) 2 energy levels
C) 3 energy levels D) 1 energy level
57. Fibre optics is based on
A) Refraction B) Polarisation
C) Total internal reflection D) Dispersion
58. For stationary state the probability density is
A) Independent of time
B) Function of time
C) Independent of space co-ordinate
D) Independent of space and time coordinate
59. Third law of thermodynamics implies that
A) $T = 0^\circ\text{K}$ cannot be attained even by infinite number of process
B) $T = 0^\circ\text{K}$ can be attained by infinite number of process
C) T cannot be negative
D) Even at $T = 0$, there is non-zero entropy



60. The Temperature of a cavity of fixed volume is doubled. Which of the following is true for the black-body radiation inside the cavity?
- A) Its energy and the number of photons both increases 8 times
 - B) Its energy increases 8 times and the number of photon increases 16 times
 - C) Its energy increases 16 times and the number of photons increases 8 times
 - D) Its energy and the number of photons both increases 16 times
61. The number of Bravais lattice in three dimensions are
- A) 7
 - B) 9
 - C) 14
 - D) 19
62. Monochromatic X-rays are used in
- A) Laue method
 - B) Powder method
 - C) Rotating crystal method
 - D) None of these
63. Bragg's law in vector form is
- A) $2\vec{k} \cdot \vec{G} = 0$
 - B) $2\vec{k} \cdot \vec{G} + G^2 = 0$
 - C) $2\vec{k} \cdot \vec{G} - G^2 = 0$
 - D) $2\vec{k} \cdot \vec{G} + G^2 = k^2$
64. Debye theory of specific heat is valid at
- A) room temperature
 - B) low temperature
 - C) intermediate temperature
 - D) all temperature
65. In Einstein's theory of lattice specific heat, solids vibrate with the
- A) same frequency
 - B) band of frequency
 - C) discrete set of frequency
 - D) none of these
66. Lattice imperfections are generated when the entropy (S) of the crystal is
- A) $S=0$
 - B) $S<0$
 - C) $S>0$
 - D) $S \geq 0$
67. In Schottky defects the displaced positive ion settles at the
- A) Interstitial position
 - B) Surface of the crystal
 - C) Outside the crystal
 - D) None of these
68. Raman Shift is
- A) Independent of frequency of incident radiation, but depends on scatterer
 - B) Independent of scatterer, but depend on the frequency of incident radiation
 - C) Independent of both frequency of incident radiation and scatterer
 - D) Dependent on both the frequency of incident radiation and scatterer



69. Pure vibrational spectrum of a diatomic molecule are when
- A) it has a centre of symmetry
 - B) it has a permanent dipole moment
 - C) it exhibits change in polarisability due to electronic transition
 - D) it has no magnetic moments
70. In a full-wave rectifier circuit operating from 50 Hz mains frequency, the fundamental frequency in the ripple would be
- A) 25 Hz
 - B) 50 Hz
 - C) 70.7 Hz
 - D) 100 Hz
71. In a transistor, the value of β is 100, the value of α is
- A) 0.01
 - B) 0.1
 - C) 0.99
 - D) 1
72. A Young's double slit set-up for interference is shifted from air to within water, then the fringe width
- A) Becomes infinite
 - B) Decreases
 - C) Increases
 - D) Remains unchanged
73. The cause of Raman effect is
- A) Coherent scattering
 - B) Incoherent Scattering
 - C) Diffraction
 - D) Refraction
74. An electromagnetic wave is radiated by a straight wire antenna that is oriented vertically. What should be the orientation of a straight wire receiving antenna? It should be placed
- A) Vertically
 - B) Horizontally and in a direction parallel to the wave's direction of motion
 - C) Horizontally and in a direction perpendicular to the wave's direction of motion
 - D) None of the above
75. Which of the following correctly lists electromagnetic waves in order from longest to shortest wavelength?
- A) gamma rays, ultraviolet, infrared, microwaves
 - B) microwaves, ultraviolet, visible light, gamma rays
 - C) radio waves, infrared, gamma rays, ultraviolet
 - D) infrared, visible light, X-rays
76. The rate of energy transferred by convection to that by conduction is called
- A) Stanton number
 - B) Nusselt number
 - C) Biot number
 - D) Peclet number



77. The unit of overall coefficient of heat transfer is
A) $\text{W/m}^2\text{K}$ B) W/m^2 C) W/mK D) W/m
78. The Laplace's equation in CGS Gaussian system is
A) $\nabla^2 V = -\frac{\rho}{\epsilon_0}$ B) $\nabla^2 V = 4\pi\rho$ C) $\nabla^2 V = -4\pi\sigma$ D) $\nabla^2 V = 0$
79. According to the Stefan-Boltzmann law of thermal radiation for a perfect radiator, the rate of radiant energy per unit area is proportional to
A) the temperature of that radiator
B) the square of the temperature of that radiator
C) the cube of the temperature of that radiator
D) the fourth power of the temperature of that radiator
80. Which of the following statements is wrong ?
A) UV absorption is attributable to electronic transitions
B) UV spectra provide information about valence electrons
C) IR absorption is attributable to transitions between rotational energy levels of whole molecules
D) NMR spectrometers use radiofrequency electromagnet
81. Which of the following statements regarding NMR spectroscopy is wrong ?
A) NMR signals towards the left of the spectral chart correspond to larger chemical shifts
B) Chemical shifts are larger when the frequencies of the radiation which induces the nuclear transitions are higher
C) Chemical shifts are larger when shielding effects are greater
D) A hydrogen signal splits into $n+1$ peaks by spin-spin coupling when the number of equivalent hydrogen atoms on adjacent atom(s) is n , and no other neighbouring atoms are involved
82. In a series RLC circuit that is operating above the resonant frequency, the current
A) is zero
B) is in phase with the applied voltage
C) lags the applied voltage
D) leads the applied voltage



83. The Peak Inverse Voltage (PIV) across a non conducting diode in a bridge rectifier equals approximately
- A) half the peak secondary voltage
 - B) twice the peak secondary voltage
 - C) the peak value of the secondary voltage
 - D) four times the peak value of the secondary voltage
84. Frequency of oscillation of a compound pendulum having the same distance between point of suspension and the centre of gravity of mass as a simple pendulum will be
- A) Less
 - B) Same
 - C) More
 - D) Depends on other parameters
85. Sharpness of resonance is
- A) directly proportional to damping force
 - B) inversely proportional to damping force
 - C) directly proportional to square of damping force
 - D) equal to square of damping force
86. As amplitude of resonant vibrations decreases, degree of damping
- A) increases
 - B) remains same
 - C) decreases
 - D) varies
87. How many orbitals are there in an orbit characterized by $n=4$ and $l=1$?
- A) 1
 - B) 3
 - C) 4
 - D) 2
88. How many radial nodes do $4f$ orbital have ?
- A) $(n-l-1)$
 - B) $(n-l)$
 - C) $(n-l-2)$
 - D) $(n+l)$
89. Which hydrogenic orbitals give the electron greater probability of close approach to the nucleus ?
- A) $4s$
 - B) $4p$
 - C) $4d$
 - D) $4f$
90. Which would be more polarisable out of F^- ion, Cl^- ion, Br^- ion and I^- ion ?
- A) Br^- ion
 - B) F^- ion
 - C) Cl^- ion
 - D) I^- ion



91. The number of unpaired electrons of the oxygen molecule
A) 2 B) 1 C) 0 D) 4
92. Oxidation number of *S* in H_2S is
A) 0 B) +1 C) -1 D) +2
93. Oxidation number of Mn is $(MnO_4)^{-1}$ is
A) +7 B) -7 C) -5 D) +5
94. Identify the acid in the following reaction
 $(PO_4)^{-3}(aq) + H_2O(l) \rightarrow HPO_4^{2-}(aq) + (OH)^-$
A) HPO_4 B) PO_4
C) H_2O D) $(OH)^-$
95. The bond order of the metal-metal bond in the $[Hg_2]^{+2}$ ion is
A) 1 B) 2 C) 3 D) 4
96. The term symbols for an atom with the configuration s^1p^1 are
A) $[^1S, ^3P]$ B) $[^1P, ^3P]$
C) $[^1P, ^3S]$ D) $[^1D, ^3P]$.
97. 2 moles of CO_2 at *STP* occupy a volume of
A) 44.8 L B) 22.4 L
C) 11.2 L D) 33.6
98. The total pressure of a mixture of argon, helium, neon and krypton is 788mmHg.
 $P_{He} = 235\text{torr}$, $P_{Ne} = 341\text{ mm}$, $P_{Kr} = 124\text{ mmHg}$. The P_{Ar} in mmHg is
A) 89mmHg B) 87mmHg
C) 86mmHg D) 88mmHg
99. Which food has the highest energy per gram ?
A) Proteins B) Carbohydrate
C) Fat D) Starch
100. Number of allotropes of carbon
A) 4 B) 5 C) 6 D) 3
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SPACE FOR ROUGH WORK