TRB
P.G. PHYSICS
(Previous Year QUESTIONS & ANSWERS)
by
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1) Klystron is a device used to generate Microwaves
2) Intel 8085 microprocessor is a 8 bit device
3) The mnemonic used to transfer contents of one register into another is MOV
4) EEROM is a read only but erasable memory
5) Video RAM is a both static and dynamic memory
6) Fermi’s theory of beta decay is based on the following assumption the rest mass of the electron is negligible
7) Nuclear fission can be successfully explained using liquid drop model of the nucleus
8) The particles which cannot be accelerated by means of cyclotron are electrons
9) Nuclear radiation can be detected by G.M. Counter
10) The material used as a moderator in a nuclear reactor is graphite
11) Maxwell’s thermodynamic relations make use of temperature, entropy pressure and volume


12) The process which takes place in the liquefaction of gases is Joule-Kelvin effect
13) The effective unit of charge in BCS theory is 2e
14) According to uncertainty principle \( \Delta x \cdot \Delta p_x \geq \hbar / 2\pi \)
15) The zero-point energy of a linear harmonic oscillator is equal to \( \frac{1}{2} \hbar \nu \)
16) The lambda point which separates Helium I and Helium II is 2.186K
17) Thermal conductivity of Helium II is more than that of copper
18) The value of permittivity of free space in \( c^2 N^{-1} m^{-2} \) is \( 10^{-9} / 36\pi \)
19) The total normal electric flux over a closed surface surrounding a charge is directly proportional to the charge

20) Laplace’s equation for free space is $\nabla^2 V = 0$

21) The total internal energy of a diatomic molecule is made up of vibrational energy only

22) The pure rotation bands in the far I.R. were first noticed in the absorption spectra of Water

23) In the case of Stokes’ line observed in Raman effect the frequency of the line is less than that of the incident radiation

24) Raman effect may be considered as the optical analogue of Phototlectric effect

25) Frank-Condon principle explains Photochemical dissociation

26) Lagrangian represents the difference between K.E and PE

27) The equation of motion of a simple pendulum is $\ddot{\theta} - \frac{1}{g} \theta = 0$

28) The relation between angular momentum ($\mathbf{L}$), angular velocity ($\mathbf{\omega}$) and moment of inertia (I) is $\mathbf{L} = I \mathbf{\omega}$

29) Only one phase point can occupy one phase cell according to Fermi-Dirac statistics

30) The statistical theory which readily leads to Planck’s law of radiation is Bose – Einstein statistics

31) If the probability of husband’s selection is 1/7 and that of wife’s selection is 1/5 in an interview, then the probability for both of them to be selected is $\frac{12}{35}$

32) The probability of getting 4 heads in 6 tosses of a fair coin is $\frac{15}{64}$

33) If $m$ is the mean of Poisson distribution, then the standard deviation of the distribution is $\sqrt{m}$


34) The mean for normal distribution is greater than zero

35) The number of sum values to be found out in order to fit a straight line to the given points using method of least squares is 2

36) If a vector function $V$ is said to be solenoidal, then $\nabla \cdot V = 0$

37) The condition for a vector function $F$ to be irrotational is $\nabla \times F = 0$

38) Stokes’ theorem relates line integral with surface integral

39) The characteristic roots of a Hermitian matrix are all imaginary

40) The rank of the matrix 2

41) The binary equivalent of the decimal number 51 is 110011
42) The decimal equivalent of the hexadecimal number 12A is 298
43) The correct Boolean equation is \( \overline{A} \cdot B = \overline{A} + \overline{B} \)
44) One of the following statements is correct: The output of the AND gate in a half adder is the SUM
45) In the case of a JK M/S flip-flop, if the master sets, the slave resets
46) For \( j = 0 \), the components of \( J \) are all represented by null matrices of rank 1
47) If a wave function is normalized, then \( \int \psi^2 \, d\tau = 1 \)
48) Born approximation may be used to find out total scattering cross-section
49) The binding energy per nucleon is maximum for iron nucleus
50) The strongest available force is gravitational force
51) According to Debye’s theory of specific heats, at very low temperatures, the specific heat capacity is directly proportional to the cube of temperature
52) Wiedemann-Franz law gives the relation between thermal conductivity and electrical conductivity
53) Lorenz number (L) is defined as \( L = \frac{K}{\sigma T} \)
54) A pure semiconductor becomes an insulator at 0 K
55) The eigen functions of the wave equation for a periodic potential may be obtained using Poynting theorem

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56) The value of \( \frac{1}{\sqrt{\mu_0 \varepsilon_0}} \) is \( 3 \times 10^8 \)
57) If a rod of length \( l \) moves with a velocity \( C \) with respect to an observer, then the apparent length of the rod will be none of these (more than \( l \), equal to \( l \), equal to zero)
58) The proper time of a moving object is always less than the corresponding interval in the clock at rest
59) The maximum velocity attainable in nature is \( 3 \times 10^8 \) m/sec
60) The mass of an object moving with velocity of light will appear to be equal to infinity
61) The statistical theory which supports the zero point energy of a gas even at absolute zero is Classical statistics
62) According to M.B. Statistics, the number of particles in the given energy range is given by \( n_i = \frac{Z_i}{A e^{E_i/KT}} \)

63) Phase points are endowed with a distinct unchanging individuality of their own, according to B.E. Statistics

64) The number of dimensions of phase space is 4

65) A divergence in the behavior of an actual gas from that of a perfect gas is referred to as pressure of the gas

66) The order of full linear group is \( \infty \)


69) Every sub-group of a cyclic group is unitary

70) For equilibrium of a system, virtual work of the applied forces is zero

71) Hamiltonian represents the potential energy of a system

72) If A represents the action in mechanics, then according to the principle of least action \( \Delta A \neq 0 \) but positive

73) The matrix which satisfies its own characteristic equation is square matrix

74) The value of \( (m+1)! \) is \( n! \)

75) The relation between Beta and gamma functions is \( \beta(m,n) = \frac{m}{n} / (m+n) \)

76) The value of \( P_o(x) \) is 1

77) The probability of getting a king while drawing a card at random from a pack of 52 cards is \( 1/13 \)

78) Stoke’s theorem relates line integral and surface integral

79) The rank of the matrix
\[
\begin{pmatrix}
1 & 3 & 4 & 7 \\
2 & 4 & 5 & 8 \\
3 & 1 & 2 & 3
\end{pmatrix}
\]
is 3

80) The eigen values of a Hermitian matrix are all really only

81. The eigen values of the matrix are
\[
\begin{pmatrix}
2 & 2 & 1 \\
1 & 3 & 1 \\
1 & 2 & 2
\end{pmatrix}
\]
is \( 1, 1.5 \)

82. If \( P_n(x) \) is the Legendre polynomial of order n, then \( P_2(x) \) equals \( (3x^2-1)/2 \)
83. If the probability for x to solve a problem is, $P_1$ and the probability for y to solve the same is $p_2$, then the probability for both of them to solve it is $P_1 p_2$.

84. If a die is thrown 5 times, the probability for an ace to turn up 3 times is $\frac{256}{6^5}$.

85. The probability that the ace of spade is drawn from a pack of 52 cards at least once in 104 consecutive trials is $1 - e^2$.

86. The sum the the squares of the distance of the points $(1,2),(2,4),(3,6)$ and $(4,8)$ from the fittest straight line for these points is $0$.

87. The curve for the equation $y = e^x$ a straight line, if it is drawn between $x$ and $\log y$.

88. According to D’Alembert’s principle, $\sum (F_i \cdot p_i) \cdot \delta r_i = 0$.

89. If $T$ and $V$ represent the kinetic and potential energy respectively, Lagrangian $L$ is given by $L = T - V$.

90. Hamiltonian $H$ is given by $H = T + V$.

91. If the time integral of $n$ times the kinetic energy is called the action; then the value of $n$ is $2$.


92. If $H$, $L$ and $T$ represent the Hamiltonian, Lagrangian and kinetic energy respectively, the value of $(H + L)/T$ is $2$.

93. An equilibrium macroscopic state is one for which the number of microscopic states is maximum.

94. As the energy of a cell increases, the number of particles distributed in the cell decreases.

95. The unit of phase space volume is $kg^3 m^6 s^{-3}$.

96. Pauli’s exclusion principle is imposed on Fermi-Dirac statistics.

97. Planck’s law governing the blackbody radiation can be deduced using Bose-Einstein statistics.

98. The total normal electric flux through a spherical surface which encloses a dipole of charge $q$ and length $2d$ is zero.

99. The equation, $\nabla^2 \phi = -\rho /\varepsilon_0$ is known as Poisson’s equation.
100. Poisson’s equation reduces to Laplace’s equation, if charge per unit volume is zero.

101. The unit of polarizability is Cm$^{-2}$.

102. Which of the following is wrong? The unit of the ratio of magnetic induction to the intensity of magnetic field is Tm$^{-2}$.

103. If the mass of a body in motion is $2\sqrt{3}$ times its rest mass, then its velocity ms$^{-1}$ is 1.5x10$^8$.

104. The energy equivalence of 1kg mass is 9x10$^{16}$ J.

105. Pure rotation spectra lie in the far infrared region.

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106. Electronic spectra are effected by quantum changes in rotational energy only, vibrational energy only, electronic energy.

107. Franck-Condon principle can be used to explain photochemical dissociation.

108. The coherence length in a superconductor is inversely proportional to the transition temperature.

109. The ratio of the penetration depth to the coherence length for type II superconductors is greater than $1/\sqrt{2}$.

110. The total expulsion of magnetic flux from the Interior of a specimen on entering the superconducting state is called Meissner effect.

111. SQUID can be constructed using the principle of Josephson effect.

112. Which of the following is not correct? Low temperature can be obtained by means of magnetization.

113. In the depletion layer of a junction diode, Charge carriers are not present.

114. The unit of mobility of electrons is m$^2$V$^{-1}$s$^{-1}$.

115. Which of true following is wrong? According to uncertainty principle $\Delta E.\Delta x \geq h$.

116. If the wavefunction $\Psi(r,t)$ is normalized, $\int |\Psi(r,t)|^2 d^3 r = 0$.

117. The energy of particle in a square potential well is proportional to the square of the quantum number $n$.

118. Born approximation cannot be used for scattering of slow electrons by atoms.
119. The four matrices $\alpha_x, \alpha_y, \alpha_z$ and $\beta$ in Dirac’s free particle equation, must be **hermitian**

120. If the mass defect in the case of Lithium($L^7$) is 0.04048 amu, the bind energy per nucleon is **5.4MeV**

121. The mass number of the most stable nucleus is **56**

122. Which of the following statements is not correct? The nuclear force between two nucleons is **an electrostatic force**

123. The atomic number of fission products in the nuclear fission of U-235 range from **34 to 58**

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124. Chain reaction can be set up only if the mass of the fissionable material is **greater than the critical mass**

125. Which of the following is wrong? The energy released in the nuclear fission of 1kg of U-235 is **$1.5 \times 10^{25}$ J**

126. The material used as the moderator and coolant in a nuclear reactor is **heavywater**

127. Natural Uranium consists of **0.72% of U-235 and 99.28% of U-238**

128. The number of bits which can be added by a full adder is **3**

129. The number of stable states in a flip-flop is **2**

130. In the case of JK M/S flip-flop **the master is active and the slave is inactive while the clock is high**

131. The number of clock pulses required to store a 4-bit word in a register parallel loading is **1**

132. The IC number of widely used decade counter is **7490**

133. Which of the following is not correct? Microwaves are generated by means of **phase shift oscillator**

134. In the case of 8085 microprocessor, +5V is connected to pin number **40**

135. The instruction MOV B,A copies A into B

136. RAM is a **read-write only memory**
137. In the case of EPROM data can be erased with ultraviolet light.
138. The condition for a vector to be solenoidal is $\nabla \cdot \mathbf{V} = 0$.
139. For a vector $\mathbf{F}$ to be irrotational, the condition to be satisfied is $\nabla \times \mathbf{F} = 0$.
140. If $r = \sqrt{x^2+y^2+z^2}$, the value of $\nabla^2 (1/r)$ is 0.
141. The value of $\int$ in spherical coordinate system is given by $\tan^{-1}(y/x)$.
142. Gauss’s divergence theorem relates volume integral and surface integral.
143. Hermite’s differential equation is given by $y'' - 2xy' + 2\lambda y = 0$.
144. Laguerre’s polynomial $L_3(x)$ equals $-x^3 + 9x^2 - 18x + 6$.
145. The value of the gamma function $\Gamma(\frac{1}{2})$ is $\sqrt{\pi}$.
146. The probability of drawing -2 aces in succession from a pack of 52 cards is $\frac{1}{221}$.
147. If all the elements of a group commute with one another, the group is said to be abelian.

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148. The order of full linear group is $\infty$.
149. If a matrix commutes with all matrices of an irreducible representation, then the matrix is a multiple of unit matrix.
150. Which of the following statements is wrong? To isomorphic groups need not have the same structure.
151. A system consists of 1000 particles with constraints expressed by 10 equations. Then, the number of degrees of freedom of system is 2990.
152. The products of inertia of a body about the principal axes are zero.
153. The number of Euler’s is 3.
154. Which of the following statements is wrong? In the case of Euler’s angles, the rotations are made clockwise and anti clockwise alternately.
155. If the external torque on rotating body is zero, the physical quantity which remains unchanged is angular momentum.
156. According to stirling’s theorem, $\log n!$ equals $n \log n - n$.
157. As the temperature of the filament is doubled, thermionic current increases 4 times.
158. In the case of liquid Helium, the $\lambda$ point corresponds to 2.186K
159. Which of the following statements is wrong? function is a constant in an adiabatic process
160. Choose the wrong statement from the following: The average kinetic energy of a diatomic molecule is 6.21X10^{-21} J at 300K


161. The electrostatic force between two charges separated by 3m distance is 0.075N. If the total charge is 20µC, the individual charges are 5µC, 15µC
162. The value of in $(\varepsilon_0\mu_0)^{-1/2}$ in ms^{-1} is 3X10^8
163. The value $\text{EXH}$ represents the intensity of the wave
164. The wave produced by an oscillating electric dipole is a spherical wave
165. If a light source moves with a velocity $\mathbf{v}$ towards an observer at rest, the velocity of light. (c) as observed by him is $\mathbf{C}$
166. If a sphere is carried by an observer in motion, it will appear for an observed rest as ellipsoid
167. Which of the following is correct? The means wavelength of Stokes’ and Anti-Stokes’ lines given the wavelength of the parent line.
168. The induced magnetic moment is opposite the direction of applied field in diamagnetic substance
169. The susceptibility is negative and independent of temperature in the case of bismuth
170. The ratio of thermal conductivity to electrical conductivity is proportional to the absolute temperature
171. The BCS superconductor is described by both annihilation and creation operators
172. The conditions for the heat flow are specified in second law of thermodynamics
173. The variables in Maxwell’s thermodynamic relations are temperature and pressure

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174. At constant temperature, the heat absorbed or liberated by a substance brings about a change in **volume**

175. Which of the following statements is wrong? The specific heat capacity by Debye’s law is **proportional to the temperature at low temperatures**

176. The width of the energy band gap is minimum in the case of **metals**

177. The total energy operator is \( \frac{-\hbar^2 \nabla^2 + V(r)}{2m} \) (or) \( \frac{-\hbar^2 \nabla^2 + V(r)}{8\pi^2 m} \)

178. If the operator \( d^2 \) operates on the eigen function \( \cos x \), the corresponding eigen value is \( -\frac{1}{\pi^2} \)

179. If \( \gamma \) is the frequency of a linear harmonic oscillator, is zero point energy is \( \frac{1}{2} \hbar \gamma \)

180. The eigen value corresponding to the eigen function \( L^2 \) is \( \frac{l(l+1)}{\hbar^2} \)

181. The differential scattering cross-section is defined as **the scattering per unit incident flux**


182. The first simple and logical explanation of the \( \alpha \)-ray spectra was given by **Gamow**

183. The \( \beta \)-decay us due to the decay of a neutron giving rise to **proton, electron and neutrino**

184. The upper limit of continuous \( \beta \)-spectrum corresponds to the case **neutrino is emitted with zero energy**

185. The density of a nucleus \( a > 10^{17} \text{ kg.m}^{-3} \)

186. The magic numbers are **2, 8, 14, 20, 28, and 50**

187. The binary equivalent of the hexadecimal number F8 is **1111000**

188. The Gray Code for the binary number 1011 is **1110**

189. Which is not correct in the following? The output of a 3 input AND gate is 0, if **all the inputs are 1**

190. Which of the following is correct by De Morgan’s theorem? **\( \overline{A}B = A+B \)**

191. The simplified form of \( \overline{A} \overline{B} + \overline{A}B + AB + \overline{A}B \) is **1**
192. Which is wrong in the following? An operational amplifier is a **device with infinite output resistance**

193. If $A_d$ and $A_c$ represent the gains of a differential amplifier for the difference signal and common mode signal respectively, then its CMRR is given by $\frac{|A_d|}{A_d}$

194. If the input signal is $V = \sin \omega t$ in an operational differentiator, the output will be $-RC \cos \omega t$

195. A comparator is **non-linear analog system**

196. Hartley oscillator is a type of **Harmonic oscillator**

197. The property that does not change in superconductivity transition is **elastic property**

198. In junction diode, if the reverse saturation current is 5nA at 25°C, then at 35°C it is 5nA

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199. A substance is anti-ferromagnetic when exchange integral $J$ is $J>0$

200. The magnetic susceptibility of a ferromagnetic material at $T>T_N$, $\chi = \frac{C}{T\pm\theta}$

201. Metal-semiconductor junction diode is **Schottky barrier diode**

202. The splitting up of the spectral lines in magnetic field is called **Zeeman effect**

203. The quantum of energy in an elastic wave is called **phonon**

204. $k/\sigma T=L$ is called **Wiedemann-Franz relation**

205. In an N-type semiconductor, the position of the Fermi level is **higher than the centre of energy gap**

206. The donor type impurities must have only three valence electrons

207. Which of the following molecules show a rotational spectrum? $\text{O}_2$

208. The study of interaction of the nuclear quadrupole moment with the electric field gradient is **NQR**

209. The effect chemical shift is explained by **NMR spectrum**

210. $\gamma$-ray emission and subsequent re-absorption results in **Mossbauer spectroscopy**
211. The diamagnetic behavior of a superconductor is known as **Meissner effect**

212. Law of addition of velocities applies only when the two velocities are in **perpendicular direction**

213. The mechanism of interaction in infrared spectrum is **change of electron distribution**

214. The selection rule for rotational transition is \( \Delta J = \pm 1 \)

215. A prolate symmetric top molecule has \( I_A \neq I_B \neq I_c \)

216. Which of the following statements is wrong? Raman effect is **coherent scattering**

217. In Galilean transformation **acceleration is invariant**

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218. The relativistic mass of particle moving with a velocity 0.9C is 3\( m_0 \)

219. Minkowski space is **four dimensional space**

220. How fast would a rocket have to go relative to an observer for its length to be contravted to 99% of its length at rest? \( 4 \times 10^7 \) m/sec

221. The relativistic energy of a particle is \( E^2 = C^2P^2 - m_0^2C^4 \)

222. Poisson’s equation in an electromagnetic theory is \( \Delta^2 V = -\frac{\rho}{\varepsilon_0} \)

223. Dielectric strength is **independent of temperature**

224. Maxwell’s equation relates electric field intensity with **electric displacement vector**

225. According to Poynting’s theorem \( J.E. = \frac{\partial u}{\partial t} + \nabla . S \)

226. Oscillating electric dipole produces **electromagnetic waves**

227. Micro-canonical ensemble describes **the systems which are perfectly insulated**

228. The spin of boson is **1 or -1**

229. The value of \( \frac{1}{4\pi\varepsilon_0} \) is \( 9 \times 10^9 \text{N} \cdot \text{m}^2/\text{Coul}^2 \)

230. The differential form of Gauss’law is \( \text{div} \ E = \rho/\varepsilon_0 \)

231. The unit of current density is **ampere/m**
232. The number of generalized coordinates required to describe the position of the simple pendulum is 2.

233. For non-conservative system, the generalized potential should be the function of $U(q', t)$.

234. Generalised force is expressed as $\sum F_i \delta r_i$.

235. The product of inertia coefficient is $I_{xx}$.

236. The total number of Euler’s angle is 3.

237. The Hamiltonian represents total energy.

238. The macrostate is defined by pressure, temperature and volume of the gas.

239. Bose-Einstein Statistics is applied to the system identical, indistinguishable and obeying Pauli’s exclusion principle.

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240. The distribution law according to Maxwell-Boltzmann statistics is $n_i = \frac{g_i}{f e^{BEi}}$.

241. The Hamilton Canonical Equation relates $p_j = -\frac{\partial H}{\partial q_j}$.

242. Under multiplication composition the set \{1, i, -1, -i\} is a group of order 4.

243. Every cyclic group is finite.

244. Which of the following is a wrong statement? Homomorphism exists between the two groups. There exist many to one correspondence.

245. The elements B and C are said to be conjugate elements if $ACA^{-1} = B$.

246. The representation by similarity transformation is reducible representation.

247. Fermi temperature $\theta_F$ is given by $\theta_F = E_F / K$.

248. Ideal gas molecule is explained by Maxwell-Boltzmann Statistics.

249. The displacements of all atoms in a linear triatomic molecule are equal and in the same direction if $\omega = \sqrt{k/m(1+2m/M)}$.

250. For electron the degeneracy factor is $Q = 2$.

251. In canonical ensembles sub-systems exchange energy but not particles.
252. \[ \int_0^\infty \sin \theta d\theta = \left[ \frac{\sin \theta}{\theta} \right]_0^\infty \]
253. The probability that student A solves a problem is \(\frac{3}{4}\) and that student B solves is \(\frac{2}{3}\). The probability that the problem will be solved is \(\frac{7}{12}\).
254. Four persons are chosen at random from a group containing three men, two women and four children. The chance that exactly two of them will be children is \(\frac{4}{9}\).
255. The variance of the 500 heights about the mean is 0.00095; then the standard error of the mean is \(0.014\).


256. A die is thrown 8 times and the probability that three will show up exactly two times is \(13\%\).
257. The Legendre polynomial \(P_n(x)\) has none of these (a) \(n\) real zeros between 0 and 1
(b) \(n\) zeros of which only one is between -1 and 1 (c) \(2n-1\) real zeros between -1 and 1.
258. If \(H_n(x)\) is the Hermite polynomial of order \(n\), then \(H_n(-x) = (-1)^n H_n(x)\).
259. If \(L_n(x)\) is the Laguerre polynomial of degree \(n\), then \(L_n(0) = n!\).
260. The value of \(\int 0\) is \(\infty\).
261. The property of \(\beta\) function is \(\beta(m,n) = \beta(n,m)\).
262. The necessary condition for \(\int F \cdot dr = 0\) is \(\nabla \cdot F\) is continuous.
263. A square matrix \(A\) is said to be unitary if \(A^{-1} = A^*\).
264. The rank of the matrix \[
\begin{pmatrix}
1 & 3 & 4 & 3 \\
3 & 9 & 12 & 3 \\
1 & 3 & 4 & 1 \\
\end{pmatrix}
\] is 3.
265. If the matrix \(A = \begin{pmatrix} 4 & 2 \\ -1 & 1 \end{pmatrix}\) then \((A-2I)(A-3I)\) is zero.
266. The eigen vector of the matrix A = \[
\begin{pmatrix}
1 & -1 \\
-1 & 1
\end{pmatrix}
\] is \[
\begin{pmatrix}
1 \\
1
\end{pmatrix}
\]
267. For AxB to be solenoidal \( \text{div}(\vec{A} \times \vec{B}) = 0 \)
268. The value of \( \nabla r \) is zero \( \frac{r}{r^2} \)
269. In cylindrical co-ordinates \( \phi = \tan^{-1}(x/y) \)
270. \( \vec{V}(r^n) \) is \( nr^{n-2} \)
271. According to Stokes’ theorem \( \int \int \int \int \int \int \int A \cdot d\vec{t} = \int \int \int \int \int \int \text{curl} \ A \cdot d\vec{s} \)
272. The Periodic Table shows all the known elements
273. Decibel is a unit that measures intensity of sound

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274. In a homogeneous reactor the moderator is cadmium
275. The decimal equivalent of 10011\(_2\) is 19\(_{10}\)
276. According to Boolean algebraic laws \( A \cdot 0 = 0 \)
277. \( A \cdot B = B \cdot A \) is called Commutative law
278. Which of the following is correct by de Morgan’s theorem? \( A \cdot B = \overline{A} + \overline{B} \)
279. A group of D flip-flops connected in parallel are Counters
280. The number of memory locations which the 8085 microprocessor can address is \( 2^{16} \)
281. The purpose for which the parity bit is added is error detection
282. The space between anode and cathode in magnetron oscillator is cavity
283. The simplest radiator is called yagi antenna
284. The nuclear stability is determined by neutron/proton ratio
285. The magic numbers are 2,8,20,50,82,126
286. All even-even nuclei have the same parity
287. The machine in which the magnetic field is kept constant and frequency of the applied voltage is varied is cyclotron
288. The counting efficiency of a G.M. counter is \( 1 - e^{-sp} \)
289. Stationary states are those for which \( \text{div} J = 0 \)
290. Which of the following statement is wrong? The uncertainty principle states that
\[ \Delta J \Delta x \geq h \] (Correct Answer \( \Delta x \Delta p_x \geq h \))

291. The zero point energy of a harmonic oscillator is \( \frac{1}{2} \hbar \omega \).

292. According to quantum theory, for the lowest energy state the probability is minimum near the ends.


293. An operator P is said to be Hermitian if its average value in any state is imaginary.

294. As pressure on a liquid increases, its boiling point remains constant.

295. At 2.19 k liquid helium has maximum density, specific heat and dielectric constant.

296. At absolute zero, the atomic heat of all solids tends to zero.

297. The normalized wave function of a particle is \( \Psi_n = \frac{2}{\sqrt{L}} \sin\left(\frac{n\pi x}{L}\right) \).

298. The certainty of finding a particle in a given volume is \( \int \Psi^2 \, dv = 1 \).

299. Susceptibility of diamagnetic materials is always negative.

300. The value of mechanical equivalent of heat is 4.18\( \times \)10³ J.

301. During adiabatic process the entropy of the system remains constant.

302. If reversible engine is working between 800K and 400K, its efficiency is 75%.

303. Gibb’s function is given by the equation \( G = U - TS \).

304. Nickel salt solution is ferromagnetic.

305. Soft magnetic materials show large coercivity and retentivity.

306. Superconductivity has never been observed in alloys of metals.

307. Which of the following statements is not correct? At the transition temperature there is a discontinuous change in specific heat.

308. The temperature at which the resistance of mercury drops to zero is 4.2K.

309. Laguerre’s differential equation may be written as \( xyv'' + (1-x)v' + \lambda y = 0 \).

310. The probability of a card being either red or king in a regular pack of 52 cards is 1/26.
311. A and B stand in a ring with 10 others. If the arrangement of the persons is at random, the chance that there are exactly 3 persons between A and B is \( \frac{3}{10} \).

312. The compound probability of two independent events is \( P(AB) = P(A) + P(B) \).

313. In Binomial distribution the probability of \( r \) success in \( n \) independent trials is \( nC_r p^r q^{n-r} \).

314. The Hamilton canonical equation relations is \( q_\dot{j} = \frac{\partial H}{\partial P_j} \).

315. Fermi-Dirac statistics is applicable to electrons of high concentration.

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316. In a linear triatomic molecule the motion is translational if \( \omega = \sqrt{\frac{K}{m \left(1 + \frac{2m}{M}\right)}} \).

317. Grand canonical ensemble is one which allows exchange of both.

318. The value of \( \varepsilon_o \) is \( 9 \times 10^{-12} \text{ N/M} \).

319. According to Born-Oppenheimer approximation electronic, vibrational and rotational energies of a molecule are dependent on each other.

320. In NMR the nucleus may be visualized as a rotating spherical charge with the magnetic moment pointing perpendicular to the axis of rotation.

321. The selection rule for transition in rotational spectra is \( \Delta J = \pm 1 \).

322. The normal modes of vibration referred to in IR spectroscopy are symmetric & asymmetric stretching, banding.

323. On increasing the temperature, the resistivity of an insulator remains constant.

324. If \( \mathbf{r} = x \mathbf{i} + y \mathbf{j} + z \mathbf{k} \), then \( \nabla \mathbf{r} = |\mathbf{r}| \).

325. If \( \phi \) is a Laplace function \( \nabla^2 \phi = 0 \).

326. \( \mathbf{A} \) is said to be solenoidal if \( \nabla \cdot \mathbf{A} = 0 \).

327. Gauss theorem states that \( \int \int \int \int \nabla \cdot \mathbf{A} \, dV = \int \int \mathbf{A} \cdot d\mathbf{S} \).

328. The greatest line integral when computed for unit area is called flux of the vector field.

329. The eigen values of matrix \( \begin{pmatrix} 5 & 4 \\ 1 & 2 \end{pmatrix} \) are \( 1, 6 \).

330. The eigen values of a skew Hermitian matrix are purely imaginary.
331. The value of $\Gamma (-n)$ is $\infty$.
332. The $\beta$ and $\Gamma$ functions are related $\beta(m,n) = \frac{\Gamma m \Gamma n}{\Gamma(m+n)}$.
333. If $P_n(x)$ is the Legendre polynomial of order $n$ then $P_n(-x) = (-1)^n P_n(x)$.
334. Under multiplication composition the set $\{1,-1\}$ is a group of order 2.
335. A group generated by a single element is called cyclic group.
336. Which of the following is a wrong statement? Isomorphism exists between two groups where exists many to one corresponds.
337. The identity transformation is represented by $D$.
338. A group that has only two normal subgroups, the group itself and the unit subgroup is called symmetric group.
339. The mechanism of interaction in microwave spectrum is change of spin.
340. A spherical top molecule is one in which $I_A=I_B=I_C$.
341. Pure vibrational spectra are observed only in solids.
342. Rule of mutual exclusion prevails between IR and Raman spectra.
343. Study of transition between magnetic energy levels of nuclei of a molecule is NMR.
344. The angular momentum of a rotating body is said to be conserved if external torque is zero.
345. Nutation is a rotation about line of nodes.
346. The microstate is defined by pressure, temperature and volume of the gas.
347. Fermi-Dirac statistics is applied to systems of identical and indistinguishable particles obeying Pauli’s exclusion principle.


348. The distribution law according to Bose-Einstein statics is $n_i = \frac{g_i}{fe^{\frac{BE}{T}}}$.
349. At absolute zero temperature, the semi-conducting materials have partially filled conduction band.
350. The diamagnetic behavior of superconductor is known as **Meissner effect**.

351. Of the following which is not paramagnetic? **NO**

352. Spin waves are **lattice vibration in solids**

353. In a PN junction diode, the depletion layer sets up **potential barrier**

354. Gauss law relates **flux and charge**

355. \( \mu_0 \) and \( \varepsilon_0 \) are related by \( \frac{1}{\sqrt{\varepsilon_0 \mu_0}} \)

356. The unit of electric susceptibility is **No unit**

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357. Dielectric constant of a medium is **greater than 1**

358. \( \text{ExH} \) represents **rate of flow of energy through unit area**

359. The rationship between Cartesian and spherical coordinates is \( x = r \sin \theta \cos \phi \)

360. If \([A]=[A']\) then the matrix is **symmetric matrix**

361. For a matrix \( AA^{-1} \) exists only if \( |A| \neq 0 \)

362. The rank of the matrix \[
\begin{pmatrix}
1 & 3 & 4 & 3 \\
3 & 9 & 12 & 9 \\
-1 & -3 & -4 & -1
\end{pmatrix}
\] is 1

363. The matrix \( A = \begin{pmatrix}
\cos \theta & \sin \theta \\
-\sin \theta & \cos \theta
\end{pmatrix}\) is **unitary**

364. A non–holonomic constraint can be expressed as \( r^2 - a^2 > 0 \)

365. Lagrangian \( L \) is expressed as \( L(q, \dot{q}, t) \)

366. The phase space is **6N dimensional space**

367. According to the principle of least action \( \delta \int \sum p_i q_i dt = \text{const} \)

368. The moment of Inertia coefficient is expressed as \( I_{xx} \)

369. Maxwell’s electromagnetic equation relates the magnetic intensity with **current density and electric displacement vector**

370. A moving rod of length 1m and velocity 0.6C appears for a stationary observer as **0.8m**
371. The energy released on conversion of 1 g matter into energy is \(0.9 \times 10^{14}\) J
372. Lorentz transformation approximates to Galilean when \(v \ll c\)
373. The momentum of an electron moving with a velocity \(1.8c\) is \(3.64 \times 10^{-23}\) kg m/s
374. Which of the following is incorrect for an adiabatic process \(PV=\text{const.}\)
375. The clausius equation is \(\frac{dp}{dT} = \frac{L}{(v_2-V_1)^T}\)
376. The Helmoltz function is given by the equation \(F=U-TS\)
377. As pressure on solids increases, its melting point decreases
378. According to Einstein-Debye theory atomic heat \(A_H=3R\)
379. Bloch wall denotes the transition layer which separates alternate domains magnetised in same direction
380. A nucleus in a chemical surround different from that of a source does not absorb the same frequency. This effect is referred to as Chemical shift
381. By BCS theory, in super-conductivity attractive electron interaction by means of phonon exchange dominates


382. \(\mathbf{J} = \frac{1}{\mu_0} \mathbf{A}\) is Lorentz equation
383. Lande g factor for pure orbital motion is lies between 1 and 2
384. The threshold energy required fission of Uranium by photon is 7 Mev
385. The process applied in hydrogen bomb is fission fusion
386. The system in which digits are expressed in powers of 10 is decimal
387. Conversion of Gray code 1011 to binary is 1101
388. According to Boolean algebra \(A+A=A\)
389. For a free particle energy and momentum are related as \(E=p^2/2m\)
390. The wave functions are said to be mutually orthogonal if \(\int \Psi_i^* \Psi_j d\tau = 0, i \neq j\)
391. The Symbol H represents the operator \(\hbar/2\mathbf{V}\)
392. The relation \(\nabla \times \nabla p\) is uncertainty principle
393. Of the following statement which is not correct? **nuclear forces are changes dependent force**

394. An α decay occurs in nuclei \( A > 200 \)

395. The theory which explains continuous \( \beta \)-ray spectrum is **Fermi theory**

396. The accelerator that works on the principle of synchronous acceleration is **Betatron**

397. Vapour Bubble forms from a superheated liquid in **bubble chamber**

398. Which of the following is correct by De Morgan’s theorem? \( A + B = \overline{A} \cdot \overline{B} \)

399. Wien-bridge oscillator is **AF oscillator**

400. Schmitt trigger converts irregular waveforms to **square**

401. The voltage gain of an ideal Op-Amp is **infinity**

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402. In a voltage follower \( V_0 = V_s \)

403. The purpose for which parity bit is added is **error detection**

404. In 8085 the data bus and address bus are **multiplexed in lower byte**

405. Which of the following is a zero address instruction? **JNZ 4150**

406. This radiation resistance of a half wave antenna is **80Ω**

407. Word comparator makes use of **XOR**

408. The expectation value of any quantity \( f \) is \( \langle f \rangle = \frac{\int \Psi^* f \Psi \ d\tau}{\int \Psi^* \Psi \ d\tau} \)

409. The eigen function for a particle in a box is \( \Psi_n = A^2 \sin n \pi x / L \)

410. The transition probability per unit time is **zero only between continuum states of same energy**

411. The operators which admit only real eigen values are called **Hermittian operator**

412. The value of one electron-volt is \( 1.6 \times 10^{-19} \text{ J} \)

413. A flip-flop is also called **bistable multivibrator**

414. The process of generating binary codes is **encoding**
415. A device which converts one from of energy into another is called **transducer**

416. The addressing mode in which the operand is specified within the instruction itself is **direct addressing**

417. The content of PROM can be erased using **U-V light**

418. The lightest metal is **Lithium**

419. A fuse wire is characterised by **low resistance and high melting point**

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420. When a radioactive nucleus emits a $\beta$ particle, the mass number of the atom **remains the same**

421. The mass equivalent of 931 MeV energy is **$1.66\times10^{-27}$ kg**

422. $^{92}\text{U}^{238}$ can be fissioned by **fast neutrons**

423. Which of the following is used as a moderator in nuclear reactor **Heavy water**

424. The average energy released per fission is **200 MeV**

425. The wave function $\Psi$ is said to be normalized, if $\int \Psi^*(r_1_t)\Psi(r_1_t)\, dv = 1$

426. Born approximation is best applied where the kinetic energy of colliding particles is **small in comparison with the interaction energy**

427. For a free particle, energy and momentum are related as $E = p^2/2m$

428. The average binding energy per nucleon of a nucleus in an atom is **8 MeV**

429. Nuclear forces are stronger than **all of these forces (gravitational forces, magnetic forces, electrostatic forces)**

430. The operators which admit only real eigen values are called **hermitian operators**

431. If $L$ represents the total angular momentum operator, then $L^2 = \sqrt{1(1+1)}\, \hbar$

432. Orthonormal functions are functions which are **orthogonal and normalized**

433. The transition probability per unit time is **zero only between continuum states of same energy**

434. The relation $\Delta x \Delta p \geq \hbar$ is **uncertainty principle**
435. By BCS theory, in superconductivity attractive electron interaction by means of phonon exchange dominates.

436. In AC Josephson effect, the frequency of the oscillating current is $2eV/h$.

437. Schrodinger’s time – independent wave equation is $\nabla^2 \Psi + \frac{2m}{\hbar^2} (E-V) \Psi = 0$.

438. The expectation value of any quantity $f$, when $\Psi$ is normalized, is

$$<f> = \int \Psi^* f \Psi d\tau$$

439. The eigen values of harmonic oscillator are $(n+1/2) \hbar \omega$ (or) $(n+1/2) \hbar \nu$.

440. Langevin’s theory applies only to gases.

441. The temperature above which ferromagnetic substance becomes paramagnetic is Curie temperature.

442. Which one of the following is not diamagnetic? Iron.

443. $J = ne^2/mc \Delta$ is London equation.

444. The diamagnetic behaviour of superconductor is Meissner effect.

445. The fundamental vibrational frequencies observed in IR spectrum $H_2O$ molecule are 3.

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446. For a metal, according to Wiedemann – Franz law $K/\sigma T = L$.

447. Of the following which is not ferromagnetic? $O_2$.

448. The Debye’s theory of specific heat treats the atoms of the crystal as harmonic oscillators and to be weakly coupled.

449. According to Deby’s theory of specific heat’ at low temperature $C_v \propto T^3$.

450. In Raman spectra, spectral lines will have frequencies greater and lesser than the incident frequency.

451. Which of the following is not true with respect to Raman Effect? Separation of charges.

452. Franck-Condon principle is used in electronic spectroscopy.
453. Frequency of vibration is **directly proportional to square root of force constant**

454. Chemical shift is used in **NMR** spectroscopy for structure determination of molecules.

455. The selection rule for transition in rotational spectra is **ΔJ=±1**

456. Which of the following will not give IR absorption spectrum? **CO**

457. Pure vibrational spectra are observed only in liquids

458. A linear molecule of N atoms has **3N-5** vibrational degrees of freedom

459. Which of the following is correct? **The vibration-rotation spectrum of a diatomic molecule will have both P and R branches each consisting of equidistant lines of separation 2B**

460. A metre scale moves with a velocity 0.6 C along its length relative to an observer. Its length will be **0.8 m**

461. A Particle of rest mass m moves with a velocity 0.6 C. What is the fractional changes in mass? **1/4**

462. The correct relativistic relation between energy(E), momentum (p) and mass (m) of a particle is **E^2=p^2c^2+m^2c^4**

463. Relativistic momentum of a body is **m_o \frac{v}{\sqrt{1-v^2/c^2}}**

464. According to special theory of relativity **mass length and time all are relative**

465. In terms of scalar and vector potentials, the electric field intensity (\( \vec{E} \)) is expressed as **E = - \nabla V + \frac{\partial A}{\partial t}**

466. The outward flux of **\( \vec{E} \) through any closed surface S** is equal to **1/ \( \epsilon_0 \) times the net charge inside**

467. **Magnetic induction B at a point (r, θ,φ) due to an oscillating dipole varies as sin θ**

468. **\( \vec{E} \times \vec{H} \)** represents rate of flow of energy through unit area

469. The total radiated power by an oscillating dipole varies **directly as square of the dipole moment and in versely as the square of wavelength**
470. Fermi-Dirac statistics is applied to system of identical and in distinguishable particles obeying Pauli’s exclusion principle.

471. Grand canonical ensemble is one which allows exchange of both.

472. Gauss’ law relates flux and charge.

472. Poission’s equation is \( \nabla^2 \vec{V} = -\frac{\rho}{\varepsilon_0} \).

473. Magnetic induction is expressed terms of vector potential as \( \vec{B} = \nabla \times \vec{A} \).

474. The general form of Lagrange’s equation is 
\[
\frac{d}{dt} \left( \frac{\partial T}{\partial \dot{q}_k} \right) - \frac{\partial T}{\partial q_k} = 0
\]

475. According to the principle of least action \( \int_{t_1}^{t_2} \sum_i p_i q_i dt = 0 \).

476. The phase space is \( 6N \) dimensional space.

477. The moment of inertia coefficient is expressed as \( I_{xx} \).

478. In Binomial distribution, the probability of \( r \) success in \( n \) independent trials is \( ^nC_r p^r q^{n-r} \).

479. The compound probability of two independent event is \( P(AB) = P(A)P(B) \).

480. Of the following statements, which is not correct? The elements do not commute with each other in an Abelian group.

481. A group generated by a single element is called cyclic group.

482. The number of irreducible representation is equal to the number of classes of the group.

483. If \( P_n(x) \) is the Legendre Polynomial of order \( n \), then \( P_n(-x) = (-1)^n P_n(x) \).

484. Hermite differential equation is given by \( y'' - 2xy' + 2xy = 0 \).

485. The value of \( \Gamma(-n) \) is \( \infty \).

486. A problem is given to three students A, B and C whose change of solving it are \( \frac{1}{3}, \frac{1}{4} \) and \( \frac{1}{2} \) respectively. The probability that the problem is solved is \( \frac{3}{4} \).

487. The eigen values of the matrix
\[
\begin{pmatrix}
1 & 0 & 0 \\
0 & 1 & 1 \\
0 & 1 & 1
\end{pmatrix}
\]
are \( 0, 1, 2 \).

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488. A square matrix \( A \) is said to be Hermitian, if \( A^T = -A \).
489. A Square finite matrix A is a unitary matrix, if \( A^+ A = I \)

490. If \( A^T A = 1 \) for a square matrix A, then the matrix is skew symmetric matrix

491. The matrix \( A = \begin{pmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{pmatrix} \) is unitary matrix

495. The relationship between Cartesian and spherical coordinates is \( X = r \cos \theta \cos \phi \)

496. The operator \( \widehat{\mathbf{\sum}} \) in orthogonal curvilinear coordinates is

\[
\hat{u}_1 \frac{\partial}{\partial q_1} + \hat{u}_2 \frac{\partial}{\partial q_2} + \hat{u}_3 \frac{\partial}{\partial q_3} \text{ divergence}
\]

497. Which of the following is Gauss’ Divergence theorem? \( \iiint \text{div} \, \mathbf{A} \, dV = \iint \mathbf{A} \cdot d\mathbf{r} \)

498. If \( \phi \) is a Laplace function, then \( \nabla^2 \phi = 0 \)

499. The rank of the matrix \( A = \begin{pmatrix} 2 & 1 & -1 \\ 0 & 3 & -2 \\ 2 & 4 & -3 \end{pmatrix} \) is 2


500. Instruction to clear the accumulator is SUB A

501) In immediate addressing mode the data is specified in the instruction itself

502) Which of the following is volatile memory? EPROM

503) ANA B is a logical instruction.

504) MOV B, C is an example for data transfer instruction

505) Array gain is given by 10 \( \log_{10} \left( \frac{P_0}{P_n} \right) \)

506) Radiation resistance of a quarter wave antenna is 80 ohms

507) 8085 microprocessor has 5 flags.

508) In 8085 microprocessor stack pointer is a 16 bit register

509) The highest interrupt priority in 8085 microprocessor is TRAP

510) Frequency of Wien bridge oscillator is \( \frac{1}{2\pi \sqrt{6 \, RC}} \)

511) Monostable multivibrator has one stable state and one quasi-stable state.
512) Clamping is the process of **raising positive half cycle of the signal**.
513) The performance of a magnetron depends on **all the three mentioned**.
517) The radiation resistance of the antenna depends on \( \frac{1}{\lambda} \).
514) In a JK master slave F/F, **while the clock pulse is high, the master is active and the slave is inactive**.
515) To design a mod-8 counter, the number of flip-flops required is 3.
516) Since the input impedance of an ideal Op-Amp is infinite its **output impedance is zero**.
517) In an Op-Amp integrator circuit, the feedback component is a **capacitor**.
518) In a Colpitts oscillator circuit **no tuned L.C. circuit is used**.
519) The binary equivalent of ED_{16} is \( 1110\ 1101_2 \).
520) In a two input (A and B) logic gate, when A = 0, B = 0 then output = 1 and when A = 0, B = 1 output = 1 It must be **NAND gate**.

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521) The following arrangement performs the logic function of **AND gate**.
522) According to Boolean algebra, A (A + B) is equal to AB.
523) Half adder is constructed using **one EXOR gate and one AND gate**.
524) A moderator is used in nuclear reactor to **slow down the speed of the neutron**.
525) **Sheel model** is able to account for magic numbers.
526) Cyclotron is used to **accelerate neutrons**.
527) According to the collective model **even-even nuclei** of the following will have spherical shapes.
528) Vapour bubble forms in a superheated liquid in a **bubble chamber**.

नीऽा भारती + क्रांतिमानिक तंत्र = नीव्ही जूनिक हार्फुनी वायुविज्ञानीजादी