IMPORTANT PHYSICS_FORMULAS

Measurements

1. Smallest unit of measurement by;

Measurement tape → 1 cm or 1mm

Meter rule or half meter rule → 0.1 cm or 1 mm

Vernier caliper → 0.01 cm or 0.1 mm

Screw gauge → 0.001 cm or 0.01 mm

2. $\theta = s/r$
3. 2π rad = 3600
4. 3600 = 1 revolution
5. 1 radian = 57.30
6. 1 degree = 60 minute
7. 1 minute = 60 seconds
8. Angle at circle is 2π radian.
9. Angle at sphere is 4π steradian.
10. Volume of slid cylinder = $\pi r2l$
11. Area of sphere = $4\pi r2$
12. Volume of sphere = $4/3\ \pi r3$

13. Dimension of velocity = [LT-1]
14. Dimension of acceleration= [LT-2]
15. Energy of photon; E = hf
16. Time period of pendulum; T = 2π

Vectors_and_equilibrium

17. Commutative property of vector= A+B = B+A
18. Fx =F cosθ
19. Fy = Fsinθ
20. F =
21. A.B = AB cos θ
22. A x B = AB sin θ
23. Scalar product; work and power
24. Vector product; torque
25. τ = r x F
26. First condition of equilibrium; ∑F = 0
27. Second condition of equilibrium; ∑τ = 0

#Motion_and_Force

28. v = s/t
29. a = v/t
30. vf = vi +at

31. $s = vit + ½ at2$
32. $2as = vf2 – vi2$
33. $S = vave \times t$
34. $Vave = (vi + vf)/2$
35. $g = 9.8\ ms-2 = 32\ ft-2$
36. $F = ma$
37. $a = v/t$
38. $P = mv$
39. $P = F t$
40. Impulse; $J = F \times t = \Delta P$
41. $J = \Delta P$
42. Law of conservation of momentum; $\Delta p = 0$
43. Elastic collision in one dimension; $[v1 + v2] = [v1' + v2']$
44. Magnitude of projectile velocity; Vf =
45. Height of projectile; $H = vi2\sin2\theta/2g$
46. Time of flight; $T = 2\ vi \sin\theta/g$
47. Time of summit or time to reach to highest point; $T = vi \sin\theta/g$
48. Range; $R = vi2 \sin 2\theta/g$
49. $Rmax = vi2/g$
50. R = Rmax at 450

Work and Energy

51. $W = Fd \cos\theta$

52. Power; $p=W/t$ or $p =Fv$

53. 1 watt = Js^{-1}

54. 1 hp = 746 watts

55. K.E = ½ mv^2

56. P.E = mgh

57. Efficiency = output/input = W x D/P x d

58. Absolute potential energy =Fr = - GmMe/Re (- because work is done against gravity)

59. Gravitational potential = E/m = GMe/Re

60. For escape velocity compare K.E with Absolute potential energy; vesc = $\rightarrow$ vesc =

61. G = 6.67×10^{-11} Nm^2kg^{-2}

62. Re = 6.4×106 m

63. Me = 6×1024 kg

64. Vesc = 11.2×103 ms^{-1}

65. Wh = K.E + fh $\rightarrow$ (Wh = loss in potential energy)

66. Loss in P.E = Gain inn K.E + work done against friction

67. $E = mc^2$ $\rightarrow$($c= 3 \times 108$ ms^{-1})

Rotational and circular motion

68. Angular velocity; $\omega = \Delta\theta/\Delta t$
69. Angular acceleration; $\alpha = \Delta\omega/\Delta t \rightarrow a = \alpha \times r$
70. $v = r\,\omega$
71. $Fc = mv2/r$
72. $ac = -(v2/r)$
73. Centrifugal force= $mv2/r$
74. $F \sin\theta = mv2/r$
75. $F \cos\theta = mg$
76. $\text{Tan}\,\theta = v2/gr$
77. Torque = $r\,F = rma = rm\,(r\alpha) = (\,r2m)\alpha = I\,\alpha$
78. Moment of inertia; $I = mr2$
79. Ring or thin walled cylinder inertia(I) = $MR2$
80. Disc or solid cylinder inertia = ½ $MR2$
81. Disc inertia = ½ $M\,(R22 + R12\,)$
82. Solid sphere inertia = 2/5 $MR2$
83. Solid rod or meter stick inertia = 1/12 $Ml2$
84. Rectangular plate inertia = 1/12 $M\,(a2+b2)$
85. Angular momentum = $L = r \times p = r\,mv = rmr\omega = r2m\omega = I\omega$
86. $L = rmv \rightarrow L/t = rmv/t = rma = rF = \tau$

87. $L/t = \tau$

88. Linear kinetic energy = ½ mv2

89. Rotational kinetic energy = ½ Iω2

90. Velocity of hoop = v =

91. Velocity of disc = v =

92. Critical velocity = v = 7.9 km2

93. The orbital velocity = v =

94. Lift at rest ⟶ T =w

95. Lift moving downward ⟶ T = w – ma

96. Lift moving upward ⟶ T = w + ma

97. Lift falling freely = T mg-ma = 0

98. Frequency for artificial satellite ⟶ f =

Fluid dynamics

99. Drag force ⟶ Fd = 6 πη r v

100. Terminal velocity ⟶ vt =

101. Continuity equation ⟶ A1 v1 = A2 v2

102. $Av=\Delta V/\Delta t$ = constant

103. $\Delta m/\Delta t = \rho\ \Delta V/\Delta t$

104. Bernoulli's Equation = P + ½ ρv2 + ρgh = constant

105. Torricelli's Theorem ⟶ v =

106. Flow meter or the venture meter → v1 =

Oscillation

107. Frequency → f=1/T

108. Angular frequency → ω = 2πf

109. Time period → T = 2π/ω

110. Velocity of projection → vy = ω

111. Simple pendulum time period → T = 2π

112. Simple pendulum potential energy = ½ kx2

113. Simple pendulum kinetic energy = ½ kx02 -½ kx2

114. Total energy of simple pendulum = ½ kx02

115. Resonance frequency = Fn = nf1

116. Phase → θ =ω t

Waves

117. Transverse wave speed →

118. Longitudinal waves speed →

119. Phase change→ 2π = λ

120. Phase difference → δ = 2π/λ

121. Speed of sound by newton → v = = 281 ms-1

122. Laplace correction → v = = 332 ms-1

Chap No.11 ELECTROSTATICS

123. 1 e = 1.602 x 10-19 C

124. Q = ne

125. Coulomb's Law; F = k

126. K =

127. K = 9.0 x 109 N m2 C-2

128. εo = 8.85 x 10 -12 C2 N-1 m-2

129. εr =

130. Fmed =

131. E = = = K

132. Φ = E A cos θ = N m2 C-1

133. Φ =

134. E due to sheet of charge; E =

135. E due to charge palates; E =

136. V = Volt = Joule / Coulomb

137. Electric potential energy; U =

138. Electric potential; V = = =

139. Potential Gradient = E = -

140. 1 eV =1.602 x 10-19 C x 1V → (1 eV = 1.602 x 10-19 J)

141. C = = C V-1 = farad

142. Charge density; σ =

143. Cvac = = =

144. εr = Cmed / Vvac

146. Capacitors In Series;

147. Q = Q1 = Q2 =Q3

148. V =V1 + V2 + V3

149. 1/Ce = 1/C1 + 1/C2 + 1/C3

150. Capacitors In Parallel;

151. Q = Q1 = Q2 = Q3

152. V = V1 + V2 +V3,

153. Ce = C1 + C2 + C3

154. Electric dipole; P = q d

155. Energy = U = = (Ed)2

156. Energy density; E2

157. Maximum charge on capacitor = C x e.m.f

158. q/q0 = 63.2 % →for charging

159. q/q0 = 36.7 % →for discharging

160. q = q0 (1-e-t/RC) →for charging

161. q = q0 e-t/RC →for discharging

Chap No. 12 CURRENT ELECTRICITY

162. Current, $I = Q/t \rightarrow C\ s^{-1} = A$

163. Drift velocity order = 10-5 m/s.

164. $V = IR$

165. $\tan \theta = I/V = 1/R$

166. Resistance, $R = V/I \rightarrow 1\Omega = 1V/1A$

167. $R = \rho\ L/A \rightarrow \Omega.m$

168. Conductance, $G = 1/R \rightarrow$ Siemen(S) or mho

169. Conductivity, $\sigma = 1/\rho = L/RA \rightarrow$ mho/m or S/m

170. Pure metals R inc with T inc.

171. Electrolytes and insulators, R dec with T inc.

172. $\Delta R = \alpha R0\ T \rightarrow RT = R0\ (1+\alpha T)$

173. Temperature co-efficient of Resistance, $\alpha = RT - R0/R0T \rightarrow K^{-1}$

174. Resistivity, $\rho\ T = \rho\ 0\ (1+\alpha T)$ OR $\alpha = \rho\ T - \rho\ 0/\rho\ 0T \rightarrow K^{-1}$

175. Electromotive Force, $\varepsilon = W/q \rightarrow 1$ volt = 1 joule/coulomb

176. Open circuit, $I = 0$ so $V = \varepsilon$

177. Terminal Voltage, $Vt = \varepsilon - Ir$

178. Power, $P = W/t = VI \rightarrow 1$ Watt = 1V x 1A

179. 1 kWh = 1 unit of electrical energy

180. 1 J = 1W x 1s

181. Maximum output power, $(P_{out})_{max} = \varepsilon^2/4r = \varepsilon^2/4R$

182. Thermo emf, $\varepsilon = \alpha T + \frac{1}{2}\beta T^2$

183. KCL, $\Sigma I = 0$

184. KVL, $\Sigma\varepsilon = \Sigma V = \Sigma IR$

185. KCL based on L.O.C.O.CHARGE

186. KVL based on L.O.C.O.ENERGY

187. Wheatstone Bridge, $X = PQ/R$

188. Potentiometer, $\varepsilon_2/\varepsilon_1 = I_2/I_1$

189. $\tan\theta = I/V = 1/R$

Chap No. 13 ELECTROMAGNETISM

190. Force on current carrying wire, $F=BIL\sin\theta$.

191. Magnetic field or magnetic induction, $B = F/IL \rightarrow 1$ tesla $= 1\ NA^{-1}m^{-1} = 1\ Wb\ m^{-2}$

192. 1 T = 104 G

193. Magnetic Flux, $\Phi = B\,A\cos\theta \rightarrow 1\ Wb = 1\ N\ m\ A^{-1}$.

194. Ampere's Law, $B\ I/r = \mu_0 (I/2\pi r)$ OR $\Sigma B.\Delta L = \mu_0 I$

195. $B_{net} = B_1 + B_2$

196. Magnetic field due to current carrying solenoid, $B = \mu_0 n I \rightarrow n=N/L$

197. Motion of charge particle in uniform magnetic field, $F=q\,v\,B\sin\theta$

198. Centripetal Force = Magnetic force $\rightarrow mv2/r = qvB$

199. Time period of charge particle in B, $T = 2\pi m/qB$

200. Frequency of charge particle in B, $f = qB/2\pi m$

201. Velocity selector, $FE = FM \rightarrow qE = qvB \rightarrow v = E/B$

202. Torque on current carrying coil, $\tau = NBIA \cos \theta$

203. Pestoring torque, $\tau = C \theta$

204. Galvanometer, $NBIA \cos \theta = C \theta \rightarrow I = C\theta/NAB \rightarrow I \ \theta$

205. Conversion of galvanometer into ammeter, small R connected in parallel

206. Conversion of galvanometer into voltmeter, large R in series are connected

207. Ammeter, $Rs = Rg\ Ig / (I - Ig)$ → Ideal ammeter → 0 R

208. Voltmeter, $Rh = (V/Ig) - Rg$ → Ideal voltmeter → infinite R

Chap No. 14 ELECTROMAGNETIC INDUCTION

209. Faraday's Law, $\varepsilon \ N (\Delta\Phi/\Delta t) \rightarrow \varepsilon = N (\Delta\Phi/\Delta t)$

210. Lenz Law, $\varepsilon = -N (\Delta\Phi/\Delta t)$

211. Flux motional emf, $\varepsilon = Blv \sin \theta$

212. Rate of work done, $W = Bilv$

213. Rate of production of electrical energy, energy $= \varepsilon I$

214. W = energy $\rightarrow Bilv = \varepsilon I \rightarrow \varepsilon = Blv$

215. Power, $P = F v$

216. $\varepsilon = L \Delta I/\Delta t$ or $\varepsilon = N \Delta\Phi/\Delta t \rightarrow LI = N\Phi$

217. Self-Inductance, $L = N\Phi / I$

218. $\varepsilon = M \Delta I/\Delta t$ or $\varepsilon = N \Delta\Phi/\Delta t \rightarrow MI = N\Phi$

219. Mutually inductance, $M = N\Phi / I$

220. $F = 1/T$

221. Induced emf, $\varepsilon = NAB \cos\omega t$ or $NAB\, \omega \sin\omega t$

222. $\varepsilon = \varepsilon_{max} \sin \omega t$

223. Back emf, $V = \varepsilon + IR$

224. $Ns / Np = Vs / Vp = Ip / Is$

Chap 16 PHYSICS OF SOLIDS

225. Elastic modulus =

226. Tensile stress =

227. Tensile strain =

228. Young modulus = = Nm-2

229. Shear stress =

230. Shear strain = = $\tan \theta$

231. Shear modulus = rigidity modulus = =

232. Bulk or volume stress =

233. Bulk modulus (in fluids) = Δp =

234. Volume strain =-

235. Bulk modulus = =

236. Stress strain (Hook's law)

237. A = r2

238. W = ½Fe (work done on stretching wire).

239. Strain energy = ½ F e

240. Strain energy per unit volume = = ½ (stress) (strain)

Chap 18 DAWN OF MODERN PHYSICS

241. E = m0 c2

242. L= L0

243. T = t0

244. M = m0

245. λmax T = 0.2898 x 10-2 m k (Wein's displacement law)

246. E = σ T4 (Steffan-Bolts Law)

247. σ = 5.67 x 10-8 Wm-1 K-4

248. E = n h f

249. K.Emax = e V0

250. K.Emax = h f – Φ

251. H f0 = Φ =

252. K.Emax = hf - Hf0

253. Hf = K.E +hf’

254. P=

255. Δλ = 1-

256. = + 1-

257. Ephoton = Eelectron + Epositron

258. Photon rest mass energy = 2m0c2 = 1.02 MeV

259. = mve- + mve+

260. λ = =

261. Δp = and Δx = λ

262. (Δp)(Δx) = h

263. (ΔE)(Δt) = h

Chap 19 ATOMIC SPECTRA

264. = R (-)

265. R =E0 / hc = 1.097 x 107m-1.

266. mvr = nh/2π.

267. h = planks constant = 6.6256 x 10-34 j s.

268. E = hf = En – Ep

269. rn =

270. En = -

271. En = = 2.17 x 10-18 j/ n2 = +13.6 ev/ n2

272. rn = n2 r1 ⟶ r1 = 0.53 0A.

273. 1 0A = 10- m

274. 2πr=nλ

275. eV ⟶ hfmax = hc/λmin

276. λmin = hc/eV

277. excited state for 10-8 s.

278. metastable state for 10-3 s

Chap 20 NUCLEAR PHYSICS

279. Nuclear size is of the order of 10-14 m.

280. The mass of the nucleus is of the order of 10-27 kg.

281. ½ mv2 = Vq

282. Bqv = mv2/r

283. Bqv = mv2/r ⟶ m = Bqr/v

284. ½ mv2 = Vq ⟶ v2 = 2Vq/m

285. So m = qr2B2/2V

286. Δm = Zmp + Nmn – M(A,Z)

287. The binding energy in MeV is 931 x Δm.

288. The binding energy per nucleon = Eb/A.

289. 0n1 ⟶ 1H1 + -1β0 + antineutrino 12 MIN

290. $\Delta N/\Delta t = -\lambda N$

291. $R = -\Delta N/\Delta t = \lambda N$

292. $N = N0e-\lambda t$

293. 1 Bq = 1 decay per second

294. 1 Ci = 3.70 x 1010 decay/s

295. $\lambda T ½ = 0.693$

296. The charge on u,t and c, in term of electron is +2/3e.

297. The charge on s,t and b in term of electron is -1/3e.

298. proton =2U→D.

299. neutron=A-Z