First Year

1. A central force is that which cannot produce torque.
2. Two equal and opposite forces acting along the same line of action will result in translational as well as rotational equilibrium.
3. When two or more than two forces acting on a common point, the forces are called concurrent forces.
4. If a metallic bob is suspended by a string in the vertical plane, it will be in complete equilibrium.
5. When three forces acting at a point are in equilibrium, then each force is numerically greater than the difference of the two.
6. The minimum number of forces that keep the body in equilibrium are 2.
7. Whenever there is spin motion then force will act away or towards the centre.
8. Total weight of a body acts at its centre of gravity.
9. Real and apparent weight becomes equal in inertial frames, static frames and frames moving with uniform velocities.
10. A couple produces rotational motion.
11. Two astronauts in satellites must have the same apparent weights.
12. Centre of gravity of a body lies inside or outside a body.
13. If we move away from the surface of earth, the value of g will decrease.
14. Forces in nature occur in pair form.
15. Racing cars are made stable by lowering their centre of gravity.
16. The centre of gravity of the cylinder is the central point of the axis.
17. Centre of mass of a uniform circular ring is at the centre of the ring.
18. More viscous mobile oils are used in motorcycles in summer than in winter
19. because viscosity decreases with increase in temperature.
20. When a paratrooper attains a terminal speed then drag force is equal to weight.
21. At terminal velocity acceleration is zero.
22. In cold regions we prefer an engine oil of low viscosity.
23. A small and a large raindrops are falling through air then a large drop moves faster.
24. Applied on slow speed, apply on spherical object, do not apply on high
25. speed, d o not apply on ideal fluid are limitations of stokes law.
26. Laminar flow usually occurs at a speed which is low.
27. The velocity above which streamline flow changes into turbulent flow is called critical velocity.
28. Critical velocity of a fluid is maximum velocity upto which it remains steady.
29. The direction of streamlines is the same as the direction of velocity.
30. Dynamic lift is related to Bernoulli's equation.
31. Bernoulli's equation is applicable for laminar flow.
32. A man standing near a fast moving train may fall towards the train because of the high speed of the train.
33. Air is blown between two table tennis balls hung vertically side by side, they attract.
34. The velocity of the flow of liquid through an orifice at the bottom of a tank depends upon the height of liquid above orifice and gravity.
35. Rate of leak from a hole in a tank is more if situated near the bottom.
36. Area of the liquid surface does not affect the pressure at a point beneath the surface of a liquid.
37. Where the streamlines are closer, pressure will be low and velocity will be high.
38. Where the streamlines are far apart, pressure will be high and velocity will be low.
39. The speed of the fluid is maximum in the venturimeter at the convergent duct.
40. If a stream of air is blown under one the pans of a physical balance in equilibrium, then the pan will go down.
41. The blood flow is turbulent at systolic pressure.
42. The blood flow is laminar at diastolic pressure.
43. Blood pressure increases with age due to decrease in flexibility of vessel walls.
44. The signal to measure diastolic pressure is when external pressure is decreased and eventually becomes equal to diastolic pressure.
45. External pressure high=low blood flow
46. External pressure low=high blood flow

47. External pressure should be low.
48. Sphygmomanometer measures blood pressure dynamically.
49. Stethoscope detects blood pressure.
50. Displacement of a body in S.H.M is equal to amplitude when the body is at extreme position.
51. Instantaneous displacement is zero at mean position and maximum at extreme position.
52. A boy is swinging on a swing in a sitting position. Time period will decrease if he stands up.
53. Total distance travelled by a bob of simple pendulum in one vibration is equal to four times of amplitude.
54. Force responsible for vibratory motion of a simple pendulum is mgsintheta.
55. Time period of a simple pendulum on the surface of the moon is 2s.
56. The frequency of vibrating a simple pendulum is infrasonic.
57. Total energy of S.H.M at mean position =K.E
58. Ultrasonic waves are highly concentrated sound waves with a frequency greater than 20kHz.
59. Frequency of free vibrations is known as natural frequency.
60. Natural frequency depends upon the length of the pendulum.
61. Free oscillations → without external force.
62. Forced oscillations→ with external force.
63. Resonance is an example of forced oscillation.
64. Free oscillations are always produced by restoring force and inertia.
65. Swing is an example of mechanical resonance.
66. Tuning a radio is an example of electrical resonance.
67. Electrical resonance is observed in both radio and microwave ovens.
68. Such oscillations in which amplitude decreases with time are called damped oscillations.
69. The sharpness of the resonance curve of a rotating body depends on frictional loss of energy.
70. Sound waves are mechanical longitudinal waves.
71. Speed of sound in a gas depends upon density and elasticity of gas.
72. Gamma rays and infrared waves travel with the same speed in air.
73. Velocity of sound in vacuum at 0 degree centigrade is zero.
74. Speed of sound depends upon compressibility and inertia of medium.
75. Speed does not depend upon pressure.
76. Change in velocity with temperature is maximum in gases.
77. In Doppler shift, frequency does not depend upon distance of source from the listener.
78. Due to motion of an observer there is change in frequency due to change in relative velocity.
79. Due to motion of a source there is a change in frequency due to change in its wavelength.
80. When the observer is moving towards source frequency increases, velocity increases but wavelength remains the same.
81. When an observer is moving away from the source , frequency decreases, velocity decreases but wavelength remains the same.
82. When the source is moving towards the observer, frequency increases, wavelength decreases but velocity remains the same.
83. When the source is moving away from the observer, frequency decreases, wavelength increases but velocity remains the same.
84. If an aero plane approaches radar, the wavelength of waves reflected from the airplane would be shorter.
85. Stars moving towards the earth show a blue shift.
86. Stars moving away from the earth show a redshift.
87. Bats navigate and find food by echolocation.
88. An oil film floating on the water surface exhibits beautiful colour patterns.
89. This happens due to interference of light waves.
90. Phase difference between any two points of wavefronts is zero.
91. Spherical wavefront can be converted into a plane wavefront and vice versa.
92. In the case of point source, the wavefront is spherical in shape.
93. Light ray is perpendicular to the wavefront.
94. A usual way to obtain a plane wave is to place a point source of light at the focus of a convex lens.
95. Light from the sun reaches the earth with a plane wavefront.
96. In constructive interference, amplitude of resultant wave will be greater than either of individual waves and

vice versa in case of destructive interference.

97. Interference of light waves is not easy because of random emission of light from a source.
98. Sodium chloride in a flame gives out pure yellow light. This light is not a mixture of red and green.
99. Two waves are coherent if they are obtained from a single monochromatic source by division of amplitude only and by division of wavefront only.
100. In YDSE, interference pattern is obtained due to division of wavefronts.
101. Zeroth dark fringe is not possible in YDSE.
102. At the centre of screen always constructive interference and bright fringe is produced.
103. Constructive interference: crust-crust, bright fringe-maxima, path difference d'sin theta.
104. Destructive interference: crust-trough, dark fringe – minima,
105. d'sin theta=(m+1/2)wavelength.
106. Distance between two consecutive bright or dark fringes is called fringe spacing.
107. When light ray enters from rarer to denser medium: v decrease, wavelength decrease , f=same
108. When light ray enters from denser to rarer medium: v increase, wavelength increase, f=same
109. Refractive index is denser.
110. Refractive index is rarer.
111. $\Delta Y_{denser}=\Delta Y_{air}/n$
112. Interference in thin film depends upon: angle of incidence , nature of film and thickness of film.
113. If light transmits constructive interference →centre of the ring is bright.
114. If light does not transmit destructive interference →the centre of the ring is dark.
115. The centre of newton rings is dark due to destructive interference.
116. Wavelength zada f=kam (diffraction easily observable)
117. Wavelength kam f=zada (diffraction not easily observable)
118. A typical diffraction grating has 400 to 5000 lines per centimeter.
119. Wavelength of X-Rays is 10-10m.
120. Hemoglobin is an important constituent of blood and double helix structure of DNA.
121. Ordinary light has components of vibrations in all possible planes. Such a light is unpolarized.
122. If vibrations are confined to only one plane, the light is said to be polarized.
123. Polarization is not common in sound and light.
124. Light cannot be polarized by diffraction.
125. Light waves are electromagnetic transverse waves.
126. Light →dimmer (mutually perpendicular)
127. Light brightest → (parallel)
128. Quartz and sodium chlorate are optically active crystals.
129. Sugar and tartaric acid show optical rotation when they are in solution.
130. Sugar shows plane polarization.
131. When a Polaroid is rotated at an angle of 360 then intensity of light becomes 2 times maximum and 2 times minimum.
132. Converging lens →convex lens
133. Diverging lens →concave lens
134. The unit of power of the lens is the same as the Rydberg constant.
135. When convex lens is cut horizontally: focal length same , intensity of light becomes half
136. When a convex lens is cut vertically : power half, focal length double If the image is formed on the same side of the object then the image is called a real image.
137. If an image is formed on the opposite side of an object then the image is called a virtual image.
138. Physically exist→real image
139. Physically not exist→virtual image
140. Focal length of the convex lens is positive.
141. When an object is placed inside the principal focus, a double convex lens behaves as a simple microscope.
142. In a simple microscope: nature of image is virtual, erect and magnified.
143. If object is at 2F, magnification=1
144. If object is between F and 2F, magnification=1
145. M=1+d/f (applicable when image is formed at least distance of distinct vision)

146. M=d/f (applicable when image is formed at infinity)
147. If the length of the microscope decreases, magnification will decrease.
148. In compound microscope: nature of image is real, inverted and diminished.
149. Normal adjustment: If the image formed by an object lens is within the focal length of the eye piece then the compound microscope should be in normal adjustment.
150. In compound microscope: nature of intermediate image is real, inverted and magnified.
151. Graham Bell first invented the telephone then invented the photophone.
152. Conditions of total internal reflection:

- 1) rays of light should enter from denser to rarer mediums.
- 2) Angle of incidence should be greater than the critical angle.

153. An optical fibre with its protective case may be 6mm in diameter and yet it
154. can be replaced with a 7.62cm diameter bundle of copper wires to carry the same amount of signals.
155. Speed of light in a material medium depends upon the refractive index of the material.
156. When a light ray enters from rarer to denser medium, it bends towards the normal.
157. When a light ray enters from denser to rarer medium, it bends away from the normal.
158. Speed of light is greater in air than medium.
159. n=c/v (n=1, n>1, n not < 1)
160. sin (inverse)=n2/n1 hint: upper wala halka neeche wala bhari n2 for air=1, n for glass=1.5
161. Total internal reflection: If the angle of incidence is greater than critical angle, then light is totally reflected back in the denser medium. This process is called total internal reflection.
162. Short sightedness is called myopia or nearsightedness.
163. Long sightedness is called hyperopia or farsightedness.
164. Natural defect in lens alignment is called astigmatism.
165. In color blindness, we cannot differentiate between red and green.
166. Working principle of optical fibre is total internal reflection.
167. Single mode step index fibre:
168. 5 micrometre diameter Thin core Larger cladding
169. Strong monochromatic light source i.e. laser source has to be used to send light signals through it.
170. It can carry more than 14 TV channels or 14000 phone calls.
171. Multimode step index fibre:
172. Larger diameter of 50 micrometre diameter Mostly used for carrying white light
173. It is used for short distance only
174. n changes from 1.52 to 1.48 at the boundary with the cladding.
175. Multimode graded index fibre:
176. Diameter of 50 cto 100 micrometre
177. It has a core of relatively high refractive index and refractive index
178. decreases gradually from the middle to outer surface of the fibre.
179. It is useful for long distance applications in which white light is used.
180. The light emitted from LEDs has a wavelength in fibre optics system is 1.3 micrometre.
181. Mercury thermometers are used to measure temperature upto 360 degree centigrade.
182. Thermocouple thermometer is most suitable for measuring a temperature of 400 degree centigrade.
183. Mercury is used in liquid thermometer because it has less specific heat and
184. high conductivity.
185. For an ideal gas, inter particle interaction is zero.
186. The unit of thermodynamic scale is Kelvin.
187. P.E=0 for an ideal gas.
188. In elastic collision, kinetic energy is conserved.
189. At zero Kelvin, K.E of gas molecules becomes zero.
190. Average velocity of molecules of a gas in equilibrium is zero.
191. Area under P-V diagram and volume axis represents total work done.
192. Isobaric>isothermal>adiabatic
193. If we double velocity, the pressure of gas becomes four times.
194. Pressure exerted by the gas is directly proportional to the average translational kinetic energy of the gas molecules.

195. R=8.314Jmol-1K-1
196. K=1.38^10-23JK-1
197. Pressure everywhere inside the vessel will be the same provided the gas is uniform density is the statement of Pascal's law.
198. The internal energy of an ideal gas system is generally the sum of translational K.E of its molecules.
199. For an ideal gas U is directly proportional to temperature.
200. Internal energy is similar to gravitational P.E.
201. It is the change in internal energy and not its absolute value which is important.
202. First law of thermodynamics is according to the law of conservation of energy.
203. $Q=\Delta U+W$
204. Human metabolism provides an example of the first law of thermodynamics.
205. Work done by the system=internal energy decrease.
206. Work done on the system=internal energy increase.

207. Isothermal expansion:

- $+Q=+W$
- Work done by the system
- Heat entering the system

208. Isothermal compression:

- $-Q=-W$
- Heat leaving the system
- Work done on the system

209. Adiabatic compression:

- $-W=\Delta U$
- Temperature increases
- Work done on the gas

210. Adiabatic expansion:

- $+W=-\Delta U$
- Work done by the gas
- Temperature decreases

211. Isothermal process takes place slowly.
212. Adabiat is steeper than isotherm.
213. Work done is maximum at isobaric.
214. Work done is minimal at isochoric.
215. C=Jmol-1K-1
216. The value of molar specific heat of a gas which is undergoing isothermal process is infinite.
217. The value of molar specific heat of a gas which is undergoing an adiabatic process is zero.
218. On the basis of KMT, absolute zero is that temperature at which molecules of gas will come to stand still.
219. Heat engine converts thermal energy to mechanical work.
220. In a cyclic process, change in internal energy is zero.
221. Carnot's theorem is a consequence of the 2nd law of thermodynamics.
222. A device which causes heat to flow from a low temperature reservoir to a high temperature is called a refrigerator.
223. Theoretically, the efficiency of the Carnot engine is 100% when the temperature of sink (low temperature T_2) is at zero Kelvin.
224. 1 K is defined as 1/273.16 of the thermodynamic temperature of the triple point of water.
225. Efficiency of petrol engine=25% to 30%
226. Efficiency of diesel engine=35% to 40%

2nd Year

1. **Limitations of Ohms law:**
    - Temperature should not increase.
    - Physical state remains same
2. Mostly conductors are ohmic.
3. **The value of resistance depends upon:**
    - Nature
    - Dimensions
    - Physical state of the conductor
4. Unit of resistance is ohm.
5. In conductors resistance increases by increasing temperature.
6. In semiconductors resistance decreases by increasing temperature.
7. **In series combination:**
    - Current same
    - Voltage different
8. **In parallel combination:**
    - Voltage same
    - Current different
9. **Resistivity does not depend upon:**
    - Area
    - Length
    - Radius
    - Diameter
10. Silver and copper are two best conductors.
11. Mostly electric wires are made of copper.
12. Germanium and silicon have negative temperature coefficients.
13. The moving charge experiences a magnetic force because of the magnetic field.
14. Right hand rule is always used for cross products.
15. If we see from bottom to top then current is clockwise.
16. If we see from top to bottom then current is anti clockwise.
17. Weber=Tesla^m2
18. $1T=NA^{-1}m^{-1}$
19. Force is perpendicular to the plane containing L and B.
20. $1\ web/m^2=10^4$ gauss
21. Force is zero if the rod is placed parallel to the field.
22. Force is maximum when the conductor is placed at right angles.
23. The wires attract each other when currents are in the same direction.
24. The wires repel each other when currents are in opposite directions.
25. Tesla=impulse per coulomb per metre
26. In S.I units, unit B is Tesla.
27. The magnetic force acting on a unit positive charge moving at right angle
28. to the magnetic field with unit velocity is called magnetic induction.
29. Ampere's law:
30. The product of magnetic field to the length of closed path is
31. equal to u (mu) times current enclosed by the conductor.
32. The magnetic field inside a current carrying long solenoid is uniform and
33. steady.
34. The direction of the magnetic field inside the solenoid is S to N.
35. The direction of the magnetic field outside the solenoid is N to S.
36. Northpole=anti clockwise
37. Southpole=clockwise
38. Magnetic field is strong inside the solenoid because magnetic field lines are close to each other.

39. Magnetic field is weak outside the solenoid because magnetic field lines are far apart from each other.
40. Right hand rule is not applicable on negative charges.
41. Magnetic force is only a deflecting force.
42. A strong magnetic field is applied to a stationary electron then remains stationary.
43. A free charged particle moves through a magnetic field. The particle may undergo a change in direction of motion.
44. Work done by magnetic force is zero acting on charge particles moving in a magnetic field.
45. Right hand palm rule is used to find the direction of force.
46. The magnitude of force on moving charge is maximum when angle between velocity and magnetic field is 90.
47. **An electron gun consists of:**
    - Filament
    - Cathode
    - Grid
    - Three anodes
48. In C.R.O anode w.r.t cathode is highly positive. C.R.O works on both A.C and D.C
49. In C.R.O waveform created sweep or time base generator is sawtooth wave.
50. The brightness of the spot on the C.R.O screen is controlled by a grid.
51. C.R.O contains three anodes and one cathode.
52. The screen of the C.R.O is coated with zinc sulphide and it emits green light.
53. In C.R.O the screen is at ground potential.
54. In C.R.O, electrons are emitted by thermionic emission.
55. Grid of C.R.O control number of electrons by electrostatic repulsion.
56. In C.R.O when a beam of electrons falls on a screen it makes a visible light because the screen is fluorescent.
57. By increasing negative potential on the grid in C.R.O, the brightness will decrease.
58. In C.R.O, when electrons pass through anode, no force acts on them.
59. From C.R.O we can measure:
    - Voltage
    - Frequency
    - Phase
60. Ceramics,Ionic compounds and Metals are crystalline solids:
    - Copper
    - Iron
    - Zinc
61. The cohesive forces between atoms,molecules or ions in crystalline solids maintain the strict long-range order in spite of atomic vibrations.
62. Atoms, molecules or ions in a crystalline solid are not static.
63. Polymeric solids have low specific gravity as compared with lightest metals.
64. Amorphous solids have no definite melting point.
65. Plastics and synthetic rubbers are polymeric solids.
66. Polymers can be classified as partially or poorly crystalline solids.
67. Formula for natural rubber is (C5H6) n.
68. NaCl has a cubic structure.
69. Examples of polymers:
    - Polythene
    - Polystyrene
    - Nylon
70. For liquids and gases, young's modulus is equal to zero.
71. Tension is independent of length.
72. During twisting of wire, strain produced is tensile.
73. **Solid possesses:**

    Young's
    modulus Bulk
    modulus Shear
    modulus

74. The change in volume is inversely proportional to bulk modulus.
75. Shear modulus is also called modulus of rigidity.
76. Reciprocal of bulk modulus is called compressibility.
77. Water has only bulk modulus.
78. Bulk modulus is maximum for solids.
79. Bulk modulus is minimum for gases.
80. In liquids and solids only bulk modulus is present.
81. Y depends upon:
- Nature of material
- Temperature

82. Stress strain curve explains different mechanical properties of solids when they are deformed.
83. Nominal strength of the material is called ultimate tensile strength.
84. Specific gravity has no unit.
85. Aluminium has the same young modulus and bulk modulus.
86. Concrete has only young modulus.
87. Mercury has same young's modulus and shear modulus.i.e. zero
88. Water has same young's modulus and shear modulus.i.e.zero
89. Brittle substances:
- Glass
- High carbon steel

90. Ductile substances:
- Lead
- Copper
- Wrought iron

91. Diamond has maximum young modulus.
92. Young's modulus for a perfectly elastic body is zero.
93. Modulus of rigidity of a liquid is zero.
94. Perfectly rigid body has a young modulus infinity.
95. A logic gate is a digital circuit which follows certain relationship between
96. input and output voltages.
97. Calculations in digital systems are based on Boolean algebra.
98. Two NOT gates cancel eachother.
99. Boolean variables are 1 and 0.
100. Boolean algebra is based on 3 basic operations:
- AND
- OR
- NOT

101. NOT gate has only one input.
102. NOR gates and NAND gates are called universal gates.
103. Series combination→AND gate
104. Parallel combination→OR gate
105. Thermistor is a sensor for temperature.
106. Microphone is a sound sensor.
107. Level sensors give an electrical signal when the level of liquid in a vessel attains a certain limit.
108. LDR is a sensor for light because it can convert changes in the intensity of
109. light into electrical voltage.
110. Characteristic X-Rays obey Moseley’s law.
111. Energy of inner shell transitions depends upon the nature of the target.
112. Electric field can deflect alpha particles.
113. Gamma rays differ from X-Rays in respect of their origin.
114. Production of X-Rays is the reverse process of photoelectric effect.
115. X-Rays are electromagnetic waves travelling at the speed of light.
116. Heavy elements have large atomic numbers and high melting points.
117. Collidge tube contains anode and tungsten filament connected to the cathode.

118. Intensity of X-Rays can be increased by increasing the potential difference
119. between cathode and anode.
120. Penetrating power of X-Rays depends upon the nature of the cathode.
121. Brightness on X-Ray is inversely proportional to intensity.
122. Intensity of X-Ray photons depends upon filament current.
123. CAT=Computerized Axial Tomography
124. Shadow of the bones appears lighter than the surrounding flesh.
125. X-Rays can cause cancer.
126. Lasers are used for producing an intense, monochromatic, and unidirectional coherent beam of visible light.
127. Underlying principle of the laser is stimulated emission.
128. For each incident photon, we will have 2 photons going in the same direction.
129. In spontaneous emission, an atom emits a photon of energy in any arbitrary direction.
130. The incident photon of energy induces the atom to decay by emitting a photon that travels in the direction of the incident photon.
131. In population inversion, high energy state has more number of electrons
132. than a lower energy state.
133. Excited state=10^{-8}s
134. Metastable state=10^{-3}s
135. Neon is a lasing or active medium.
136. Helium is a pumping medium.
137. Laser beams are used as surgical tools for welding detached retinas.
138. Helium neon laser beams are being used to diagnose diseases of the eye.
139. Z greater than 82 are unstable.
140. Marie Curie and Pierre Curie discovered polonium and radium.
141. **Alpha particles:**
    - Positively charged particles
    - Bends towards negative plate
142. Beta particles are fast moving electrons.
143. Charge on alpha particles is +2e. Mass is 4u.
144. **Beta particles:**
    - Negatively charged particles
    - Bends towards positive plate
145. Alpha particles are helium nuclei.
146. Gamma rays like X-Rays are electromagnetic waves.
147. When a beta particle is emitted from the nucleus, the effect on its neutron proton ratio is decreased.
148. **In alpha decay:**
    - Atomic mass decreases by 4
    - Atomic number decreases by 2
149. **In beta decay:**
    - Mass number remains same
    - Charge number increases by 1
150. **In gamma decay:**
    - Mass number remains same
    - Atomic number remains same
151. Gamma rays are electromagnetic radiations which are produced by deexcitation.
152. Gamma rays are extremely penetrating particles.
153. The ratio of fraction of atoms per second is called decay constant.
154. Unit of decay constant is s-1
155. Half life of uranium(238) is 4.5^109 years.
156. Half life of radium (226) is 1620 years.
157. Half life of radon is 3.8 days.
158. Half life of uranium (239) is 23.5 minutes.
159. Ionizing ability of beta particles is 100 times less than that of alpha particles.

160. Range of beta particles is 100 times greater than that of alpha particles.
161. An Alpha particle is 7000 times more massive than an electron.
162. Path of beta particles is straggling and scattering.
163. Beta particles are more easily deflected by collisions than heavy alpha particles.
164. Ionization is inversely proportional to range.
165. Alpha particles leave thick, straight and continuous tracks due to intense ionization produced by them.
166. Beta particles form thin and discontinuous tracks extending in erratic manner showing frequent deflections.
167. Gamma rays leave no definite tracks along their path.
168. In Wilson cloud chamber, the length of cloud tracks has been found
169. proportional to the energy of the incident particle.
170. Potential difference in Wilson cloud chamber is
1Kv. 171.Potential difference for G.M tube is 400 V.
172. Atmospheric pressure is 0.1 atm.
173. Quenching gas is bromine.
174. Quenching gas must have an ionization potential lower than that of inert or
175. principal gas.
176. Electron pulse takes place less than 1 microsecond.
177. Deadtime→10^{-4}s

178. Cosmic radiation consists of :

- High energy charged particles
- Electromagnetic radiation

179. Radioactive radon gas enters buildings from the ground.
180. Chest X-Ray and dental X-Ray may do more harm than good.
181. One Becquerel is one disintegration per second.
182. The S.I unit of radioactivity is Bq.
183. The S.I unit of absorbed dose is Gray (Gy).
184. $1Gy=1Jkg^{-1}$
185. 1 rad=0.01 Gy
186. De=D^RBE
187. Old unit of absorbed dose is rad.
188. Old unit of equivalent dose is rem.
189. S.I unit of equivalent dose is Sievert (Sv)
190. 1Sv=1Gy^RBE
191. 1rem=0.01Sv
192. Alpha particles are 20 times more damaging than X-Rays.
193. Alpha and beta particles can cause redness and sores on the skin.
194. Neutrons are more damaging to eyes than other parts of the body.
195. Half life of Pu is 24000 years, it remains dangerous for about 1,92,000 years.
196. Carbon -14 releases beta radiations.
197. Half life of sodium is 15 hours.
198. Sodium-24 is used to study circulation of blood.
199. Radio-iodine is absorbed mostly by the thyroid gland.
200. Phosphorus by bones.
201. Cobalt by liver.
202. A diseased or hyperactive gland absorbs more than twice the amount of
203. normal thyroid gland.
204. For skin cancers, phosphorus-32 and strontium-90 can be used. They produce beta radiation.
205. All types of food also contain a little radioactive substance. The most
206. common are potassium-40 and carbon-14 isotopes.

2nd Year

Electrostatics

Q=ne e=1.6x10-19C
Q=it

$F = \frac{kq_1q_2}{r^2}$

K=1/4π€. $K=9\times10^{9}Nm^{2}C^{-2}$
$€^{o}=8.85\times10^{-12}C^{2}N^{-1}m^{-2}$

- By adding another medium K value decreases and F also..
- €° for insulator is greater than 1
- For metals it is infinity
- So if b/w two charges a conductor is placed then F will be zero as Er is Infinity
- Gravitational force is weak as compared to electrostatic force
- Both are for long range..
- Both are parallel to their field
- Fe is medium dependent while Fg is independent of medium (€° is epsilon not)

Then formula will be after adding another medium
$F=1/4\pi€^{o}€r\ q_1q_2/r^2$

€r=relative permittivity of dielectric constant
€r=Fvac/Fmed=Kvac/Kmed
Fmed=Fvac/€r
(vac or air)
€r=€/€°

Electric field,electric intensity electric flux density:
E=F/q it also depends upon medium
Er=Emed/Evac
For isolated charge null point lies at infinity

Electric field due to infinite sheet:
E=Σ/2€°
(Σ is charge density)
And E b/w two capacitor is=Σ/€°

F=ma
qE=ma
E units F/q=NC-1
E=ΔV/r=V/m

Electric field due to infinite line:
E=2Kλ/R

Electric flux:
∅=E.A
(note angle b/w E and area vector)
∅=EACos∅

Net flux when charge is kept outside then closed surface
∅in=∅out thus net flux=0

Net flux when charge is enclosed a surface
∅=Q/€°

Note if there are three charges two are inside closed surface and one outside then flux will be due to all but for outside charge it is Zero..
Flux is independent of gaussian surface size and shape..

V=kq/r=U/q
:..W=qΔV=U V=E.dr
(W=U=Fr=kq1q2/r)
(ΔV) Potential difference is analogous to pressure difference or temperature difference which flows from higher to lower.
For two point in equipotential surface w is zero is w=qΔV=ΔV=0 thus W=0
Electric field is perpendicular to equipotential surfaces

- When a charge is moving towards an opposite charge then it will gain K.E energy and loose the P.E because while moving a negative charge toward a positive charge ‹positive and negative charge will attract each other and increase in Velocity and thus gain K-E and loose P-E
- If a charge is moving towards same charge it will gain potential energy and loose K.E due to repulsion velocity of charges will decrease tus lose K-E and gain P-E
- Note potential for a hollow surface inside is same like just potential at surface
- If surface potential is 10V then inside potential will be 10v also note V is constant thus ΔV is zero
- And E inside for any closed surface is zero..
- Note electric potential goes from higher to lower potential thus closer will be more potential..
- For an equipotential surface b/w two point ΔV can be zero but E is not zero
- For two different equipotential surfaces ΔV us nt zero and E is not zero also..

Electric dipole=p=qd
It's direction from negative to positive Torque =PxE
P is an electric dipole..

Q=it

Energy=1/CV2
Energy density=energy/volume
Energy density in a capacitor is
Ed=1/€°€rE2
E2=is Electric field

C=€°A/d
C=€°€r/d Er=Cmed/Cvac,air
Capacitor/condenser stores electric potential energy in its electric field due to electrostatic induction

- ➔ By placing dielectric b/w capacitors
- ➔ E decreases V also decreases but C increases
- ➔ Note=Q is same

- ➔ For Dc f=0 T=infinity
- ➔ I=0 mean ideal DC can't flow in capacitive circuit
- ➔ But pulsating DC can flow..
- ➔ AC can flow in capacitive circuits also.
- ➔ As f isn't zero t isn't zero and I isn't zero as well

- ➔ Q max is Q=CV
- ➔ Time constant (RC)
- ➔ Rc is time constant is duration of time for the capacitor in which 63.2% of its max value charge is deposited on plates

q/q°=63.2%

q=q°(1-e*t/RC)=charging
q=q°e*-t/RC discharging

When t=0 q=q°
When t=RC magnitude of charge remaining each plate is
q=q°(0.367)
q/q°=36.7%

Note:less will be the time constant more rapidly will be charged and discharged

Current electricity

Q=ne e=1.6x10-19C
ne=it
I=Q/t=ne/t=Qf=nef
f=1/t

Conventional current:
- Is due to positive charges,Cations,protons
- Moves from higher potential to lower potential
- And moves along electric field

Electronic current:
- Is due to negative charges(specially electrons)
- Moves from lower to higher potential
- And moves against the electric field

In a conductor electron moves due to thermal velocity whose net current is zero
Thermal Velocity can be several hundred meter per second
And current flows in a conductor by connecting a battery is due to force on charges of Electric field
And gains drift velocity.

Drift velocity is in order of mm/s (millimeter per second 10-3m/s)
Note:there is force,E,V of electrons but no acceleration.....

I=VenA (V:drift Velocity, e charge on electron (n:no of electron, A cross sectional)

Drift velocity=i/enA=v/RenA (i=v/R)

Ohm's law
V=IR R =Constant
- ➔ For ohmic conductors slope=R=V/i= constant
- ➔ For metals ohmic law is applicable in low temp..

Series combination
V1=R1V/R1+R2
V2=R2V/R1+R2
Series combination increases resistance

Parallel combination
I1=R2I/R1+R2
I2=R1I/R1+R2

In parallel V is constant

Parallel combination decreases the resistance

R=V/I
1/R=I/V=conductance

Resistance depends:

- Material of wire
- dimension(Area,Length)
- Temperature

R=pL/A

If wire is stretched n time its R will be
Note by stretching wire L n time increases and Area also n time decreases...
So for this kind of question.

L'=nL==>R'=n^2R (n is no of time length increase or decreases)
A'=A/n==>R'=n^2R
r'=r/n==>**R=n^4R**

R=pL/A=pL/πr^2
p: resistivity A= Cross area

Note resistivity depends upon material of wire and temperature not the dimensions
For conductors =R is directly proportional to temperature

Alpha is +ve alpha=ΔR/R(ΔT)
For semiconductors=R=is inversely proportional to temperature
Alpha is-ve...

G=1/R=I/V

Conductance=1/R= it depends on what R depends

Conductivity=1/p=it depends on same what depends
Electric power and power dissipation; P=IV=I^2R=V^2/R

In series current is constant
P=V^2/R
$P_{consumed}$=I^2R for series Brightness<>$P_{consumed}$
In series Smaller R will glow brighter.

P=V^2/R

In parallel larger R will glow brighter

Electromotive force, terminal
p.d: As W=qΔV so ΔV=W/q=E
V=E=IR+ir
I=E/R+r
Internal resistance is due to electrolytes

For open circuit:
R is infinite
I=0,E=V across terminals of battery
And E=0 across resistor or capacitor

For close circuit:
V=E-ir V<E
Short circuit:
R=0 I= infinity $V_{terminal}$ is zero..
When cell is being charge;
$V_{terminal}$ =E+ir Vt>E...

Series of cell,batteries:
When same side supporting each other
E=E1+E2

When opposing each
other E=E1-E2

Max power output;
P=I2R
P_{max}==>R=r
P_{max}=E2/4Rr
P=Energy/time
Energy=power×Time

Kirchoff 1st current law
KCL
£I=0 conservation of charges
Kirchoff 2nd law KVL
£V=0
Conservation of Energy

P.d by potentiometer
V=E.r/R
r<>l
R<>L
V=E.l/
L

E1/E2=l1/l2

B for solenoid

By potentiometer we can measure:

- ➔ Potential difference
- ➔ Find emf of a cell
- ➔ Compare emf of two cell
- ➔ Find internal Resistance of cell

Magnetism

If charge at rest or I=0 B=0 but E=isn't zero whenever there is charge electric field exists
Magnetic field in a long current carrying wire;
B=u°I/2πr
When a magnetic compass is placed in a uniform B field only torque will be applied on it
(Couple.)

u°=4πx10-7Ns2/C2
u°=4πx10-7W(A/m)
u°=4πx10-7T/A
1weber=Nm/A

When the Wheel is placed in a non uniform B field Force and torque will be applied on it..

Force on a current carrying conductor;
F=ilBsin∅=i(LxB)
B unit=B=F/iL=NA-1m-1=Tesla
B=magnetic field, magnetic flux density, magnetic induction....

1Guass=10^{-4}Tesla
1Tesla=10^{4}gauss

Two same direction current carrying wire will attract each other opposite current direction wire
will repel each other..
F for both wire=F=u°i1i2/2πr

Ampere circuital law:
B.Δl=u°i
u° is the permeability of a conductor to produce a B field..
u=u°ur

ur>>>1=>for ferromagnetic substances
ur>1=>for paramagnetic substances
u<1 fir diamagnetic substances

B outside=0
B inside=u°ni n=N/L
B at edges=u°ni/2=Binside/2

Cutting of Solenoid doesn't effect the B
But compression or stretching can affect as L increases or decreases...

If a solenoid is placed inside a solenoid having same direction of flow of current they will
support each other B=2u°ni
If current is opposite inside placed solenoid then B=0

Magnetic force on a charge moving in a magnetic field:
F=q(VxB)=qvBsin∅
Magnetic force is a centripetal

It can't perform any work

It can't produce any torque
It can change K.E thus can't change speed

Note it only changes direction
Thus it can produce impulse ,momentum and change in velocity

Lorentz force:
F=Fe+FB=qE+q(vxB)
$F_{magnitude}=F_{electric}+F_{magnetic}$

F=q(E+VxB)
V=E/B
qvB=mv 2 R
R=mv/qB

Note:there is no force exerted by the magnetic field on a Neutral atom or Neutron..

As F=qVBsin∅ q=0 thus F=0..

Charge to mass ratio:(specific charge)
R=mv/qB if q is electron thus q=e
e/m=v/BR

Charge to mass ratio for electron is
$1.75x10^{11}$C/Kg

K.E=1/mv²
K.e=qΔV=eV
qe=1/2mv²

v=2eV/m
e/m=2V/B²r²

e/m ratio:electron>proton>alpha particle> neutron
e/m of the neutron is zero as Charge is zero..

R=mv/qB
R=p/qB

When a charge particle enters into a magnetic field if angle is 90° b/w VxB then it will follow a circular path

And for other than angle less than or more than 90 it will follow a helical path...

VT=S
T=S/v=2πr/v=2πmv/qBv=2πm/qB

f=qB/2πm
2πf=qB/m
w=qB/m

(Magnetic filed by earth is S to N)

By placing thum in the direction of current in a wire curling of Finger will Show N direction.

Electromagnetic induction

Magnetic flux=∅=B.A=BAcos∅
Units=weber=Tm²=Nm/A=kgm²s-²A-¹ 1wb=10⁸maxwell

Magnetic flux density=B=Δ∅/A=u°i/2πr
Unit=Tesla=Nm⁻¹A⁻¹=wbm⁻²
IT=10⁴guass

Induced emf is produced by change in flux Whose magnitude is rate of change of flux $E_{induced}$=Δ∅/Δt

Note induce emf doesn't depend upon resistance
But induced current inverse relation with R
The induced current loop should be completed..

Motional emf
$E_{motional}$=-VBL
E=-VBLsin∅
I=V/R=VBLsin∅/R

Faraday's law of electromagnetic induction
E=-NΔ∅/Δt=-NΔBA/Δt
= I=V/R=-NΔ∅/RΔt
Q=IΔt=-NΔ∅/RΔt=-NΔ∅/R

∅=Li
∅/t=Li/dt
ΔV=-Li/dt
∅=Mi
ΔV=Mdi/dt
Energy in inductor=U=1/2Li²
Lenz's Law:
Conservation of energy
Direction of induced current is so as to oppose the change which causes the current
N==>anticlockwise
S==>clockwise
Loop of current behave like a fenton bar magnet

Transformer;
Which changes a given alternating emf to a smaller or a larger alternating emf
Note:not a Direct current or a battery‹cell

Core:,soft iron =>increase max absorption of flux..
Vp=primary emf
Vs=secondary emf

Vp=NsΔ∅/Δt
Vs=NpΔ∅/Δt

Step-up transformer
Vs/Vp=Ns/Np=Ip/Is=>for step-up transformer
Ns/Np>1
Vs>Vp
Is<Ip
Pin=Pout

Step-down transformer Vp/Vs=Np/Ns=Is/Ip=
Step-down transformer Ns/Np<1
Ns<Np
Vs<Np
Is>Ip
Pin=Pout

Note: ideally in transformer both up and down (Pin=Pout) , fin=f(out)

But practically only frequency input = frequency output conserved...

Pin=Pout=IpVp=IsVs
==>Vs/Vp=Ip/Is
pin=IpVp Pout=$I_{out}V_{out}$

Thermal loss:$H=i^2Rt$

Eddy current:
Due to current induced in core perpendicular to B
Cause=>heating losses
Reduce=>laminated layers

Hysteresis losses:
Energy losses in magnetizing and demagnetizing core..
To reduce it=>iron core

Efficiency:n=Pout/Pinx100

Electronics

Intrinsic semiconductor having no impurities
Extrinsic semiconductors impurities by doping of pentavalent and trivalent atom

Extrinsic=>P-type trivalent atom
doping Majority of charges are holes
N-type=>doping by pentavalent atom majority of charges are electrons

A diode is combination of P and N type semiconductors
middle region is called pn junction
depletion region, potential barrier,
Imobiles are present in diode

Potential barrier for Si=>0.7V(s for seven si)
Potential barrier for Ge=>0.3V

A diode is neutral as a whole
Having immobile ions but no charge carriers

Forward biasing of diode is when P is connected to positive or high voltage terminal and N is connected to negative or low terminal and vise versa for Reverse biasing

Forward biasing:
P=>high
potential
N=>low
potential
Forward current=>milliAmpere.. due to majority carriers
Forward Resistance=>in order of ohm..

Reverse Biasing:
P=>low
potential
N=>high
potential
Reverse current=>order of micro Ampere
Due to minority carriers..
Reverse Resistance=>in order of Mega Ohm

In forward biasing Diode behave as a conductor
resistor of diode is negligible
And in reverse Biasing diode behave as an insulator
Resistance is max

Rectification;
Process of converting AC to DC

Half wave Rectification;
One diode is required.
Output in half wave rectification;
Vrms=V°/2
Tout=Tin
fin=fout

Full wave Rectification:
Vrms=V°/2
fout=2fin
Tout=Tin/2

Full wave Rectification max 4 diode and minimum 2 diode are required

Full wave Rectification with centre tapped transformer 2 diodes are required
Process of converting Ac to Dc is rectification by rectifier
And process of converting DC to AC is Inversion by inverter

Rectifier

Half wave rectifier conducts current only during half cycle (positive or negative) of the input whereas
a full wave rectifier conducts both positive as well as the negative half cycle of the input.

Output frequency of half wave rectifier is equal to the frequency of input whereas in full
The wave rectifier output frequency is twice of the input.

Only one diode is required for half wave rectifier whereas two diode are required for full wave rectifier.

For half wave rectifier, there is no need for center tapped transformer whereas center tapped transformer is required for full wave rectifiers.

Efficiency of half wave rectifier is 40.6% whereas efficiency of full wave rectifier is 81.2%

Dawn of modern physics

E=hf
$h=6.63\times10^{-34}$js its unit like angular momentum
E=hc/λ
P=mc=h/
λ
E=nhc/λ

Long radio waves,radio waves(Fm,am), microwaves , IR,Visible,Uv,Xray,Y ray
(From left to right E ,f,P increases While wavelength decreases...)
But Velocity remains constant...
V=C

$E=1.24\times10^{-6}$eV/λ

Interaction of matter:
Photoelectric effect=>E<0.51MeV Comptons effect=>0.51MeV<E<1.02MeV Pair production=>E>=1.03MeV

Photoelectric effect is Reverse of X-Ray production

f°=>Threshold frequency is the minimum frequency below which no Photoelectric effect is shown

Threshold wavelength is the maximum wavelength above which no Photoelectric effect is shown

K.Emax=eV°=vmax=
2eV°/m $1/2mv^2$max=eV°

Effect of intensity of light:
Intensity of light is directly proportional to No of electrons

K.Emax and V° are independent of Intensity of light
Graph of K.Emax,V° vs intensity vis straight line...

Effect of frequency of light:
Photoelectric current is independent of frequency
Frequency is directly proportional to V°, K.E max

Graph of intensity,current vs frequency is straight line no change....

Result of photoelectric effect:
Electron are ejected with different energies

$hf=E_2-E_1$

No photoelectric effect will occur below f threshold or work function ∅

$E=E_1+E_2$
$hf=\varnothing+K.E_{max}$
∅=work function only depends upon metal
$f=f^o$=>K.Emax=>of ejected electron is zero thus no current

$\varnothing=hf^o$
$hf=hf^o+1/2mv^2max$

Sodium and potassium=>visible Cesium coated oxidised silver=>IR

Photoelectric effect discovered by Hertz explained by Einstein and the Einstein gave theory of Quantum...

Note:if UV rays fail to photoelectric effect use X-rays or Y-Rays....

De-Broglie hypothesis;
$\lambda=h/mv=h/p=h/mc$
$\lambda=h/ 2mke=h/ 2meV$
$\lambda=2d\sin\varnothing/n$

Atomic spectra

In spectra scattering of electromagnetic waves is inversely proportional to wavelength
And directly proportional to energy and frequency

Spectroscopy:
Investigation of lambda,wavelength,and intensities of emitted radiation or absorbed by atoms...

Types of spectra:
Discrete,Line spectra=> Atomic spectra
BAND spectra=>Molecular spectra

Continuous spectra=> Black body spectra $1/\lambda=Rh=(1/P^2-1/n^2)$
P=>first shell n from where it is jumping Rh=>$1.0974\times10^7 m^{-1}$

Lyman series:
$1/\lambda=Rh(1/^2-1/n^2)$ n=2,3,4 so on
It falls in Ultraviolet region

Balmer series:
$1/\lambda=Rh(1/2^2-1/n^2)$ n=3,4,5 so on
It falls in Visible region
656 nm to 365nm...

Paschen series:
Falls in IR
$1/\lambda=Rh(1/3^2-1/n^2)$ n=4,5,6 so on

Bracket series:
It falls in IR
$1/\lambda=Rh(1/4^2-1/n^2)$ n=5,6,7....

Pfund series:
$1/\lambda=Rh(1/5^2-1/n^2)$
n=6,7,8....

λ, Wavelength minimum When n= Infinite

λ, Wavelength maximum When n=p+1
For maximum transition: Max transition=n(n-1)/2

Angular momentum=L=nh/2π

1st excited state=2nd shell Because it is excited from the ground state 1st shell...

$r1=n^2x0.53A°$ $rn=n^2r1$
(r1=0.53A°
$rn=n^2/zx0.53A°$

$V1=2.18x10^6m/s$
$Vn=Z/n \times 2.18x10^6m/s$

E1=-13.6ev
$E2=E1/n^2=E1/4=-3.4ev$

1st excited state energy=-3.4ev 2nd shell energy=-3.4ev
3nd excited state energy=1.5ev

K.En/T.En=-1/1

T.En/P.En=1/2

P.En/K.En=-2/1

T.E=P.E+K.E
$K.E=13.6\ z^2/n^2\ ev$

$P.E=-2x13.6z^2/n^2\ ev$
$T.E=-13.6z^2/n^2$

X-Ray=>by electron transition
Y-Ray=>by nuclear transition

Nuclear physics

Nucleus=>Rutherford
Proton=>Goldstein
Electron=>J.J Thomson
J.Chadwick=>Neutron

Atomic nucleus=>$10^{-15}m-10^{-14}m$ fermimeter About 105m less than radius of atom

Mass of proton=$1.673x10^{-27}kg$ =1.00726u Mass of Neutron=$1.67x10^{-27}kg$ =1.00866u Mass of electron=$9.1x10^{-31}kg$ =0.0055u

1amu=1u= 931MeV
A=>atomic mass
Z=atomic number
N=A-Z=Neutron

Isotope=same Z different A
Have same chemical but different physical properties

Isobars=same A different Z
Have different chemical and physical properties

Isotones=different A different Z same N
Have different chemical and physical properties

Binding Energy=$E=\Delta mC^2$
Which increase with increase in atomic number upto Fe(iron) and then decreases
B.E/nucleon,A of Iron is 8.8MeV B.E/A of Uranium=7.6MeV B.E/A of H=0
B.E/A of Deuterium=2.23MeV

He,C,O not smooth curve in B.E graph because relatively more stable than elements in their vicinity

Radioactivity=>Z>82=>discovered by Henry Becquerel in 1896

Alpha Decay:(Alpha)+ve nucleus of Helium
Parent and daughter nuclei after alpha decay are called isodiapher

Isodiapher=>nuclei with the same excess of neutrons..

Beta Decay:(electron is emitted out)
Parent and daughter are called isobars

In Beta decay a Neutron is disintegrated by a proton,Beta particle(having charge same as an electron but negligible mass) and an antineutrino (zero mass and charge)

Neutron/proton ratio decreases in Beta decay as a neutron is disintegrating

Anti-Beta Decay:(a positron is emitted out)
Parent and daughter nuclei are isobars

By radiating gamma ray no change in mass and charge number of a nuclei

Gamma ray=>mass less and charge less
Are photons(electromagnetic radiation)
Photons=>chargeless massless particle

Note :gamma rays are emitted only when the transition of Nucleus takes place..
While X rays are emitted by electrons..
Main difference of X ray and gamma rays is Origin=>X rays by transition of electron and Gamma ray by the transition of Nucleus

In anti-Beta decay a proton is disintegrated by a neutron a positron (charge same as a proton but negligible mass) and an antineutrino

Note:in Beta decay increase of 1 atomic number,charge takes place no change in mass

While in Ant-Beta decay decrease in 1 charge or atomic number takes place no change in mass

$\lambda=-\Delta N/N/\Delta t$
λ=>decay constant unit=>S-1

$\Delta N=-\lambda N\Delta t$
(N=>initial no ΔN=>initial-final N)

$T1/2=0.693/\lambda=\ln 2/\lambda$
$N=N^{o}e^{-\lambda}$ x t
Activity=$A=\lambda N^{o}$

Activity=>units=>Bq=>1 disintegrate/s
Curie=3.7x1010Bq

Undecayed
Atoms= $N=N^{o}/2^{n}$

Decayed Atoms=
$'N=N^{o}-N=N^{o}-N^{o}/2$
n

Mean Life/Average Life:
$T_{mean}=1/\lambda$

$T^{1/2}=0.693T_{mean}$
$T^{1/2}=0.693/\lambda$

When Time is given $T^{1/2}$
$t=nT^{1/2}$
$N/N^{o}=1/2n$

Half life
Uranium238=>$4.5x10^{9}$Year
s Radium226=>1620years
Radon=3.8days
Protactinium 6.66hours

Photons=>massless,chargeless elementary particle of electromagnetic radiations

Leptons=>elementary particle=>do not experience Strong Nuclear Force
Examples=electronsmuons,neutrinos are leptons

Hadrons=>not elementary particle,but composed of elementary particles
Eg=>protons,Neutrons, Meson are hadrons

Baryons:are hadrons whose mass is equal or greater than that of proton
3 Quarks make a Barryons

Mesons:are hadrons whose mass is less than that of proton, A pair of Quark and antiquark makes a mesons

6 kind of Quarks: **CUT**: Charge +2/3e Charm quark +2/3e Up Quark +2/3e Top quark +2/3e **BDS**: Charge -1/3e Bottom quark -1/3e Down quark -1/3e Strange quark -1/3e And also 6 antiquarks having same mass and opposite charge Example anticharm quark -2/3e, Antidown quark +1/3e so on.	

PHYSICS FORMULAS

1st Year Physics

Measurements

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

θ = s/r
2π rad = 3600 = 1 revolution

1 radian = 57.30
1 degree = 60 minute

1 minute = 60 seconds
Angle at the circle is 2π radian. Angle at the sphere is 4π steradian. Volume of solid cylinder = $\pi r^2 l$

Area of sphere = $4\pi r^2$ Volume of sphere = $4/3\ \pi r^3$

Dimension of velocity = $[LT^{-1}]$ Dimension of acceleration= $[LT^{-2}]$ Energy of photon; E = hf
Time period of pendulum; $T = 2\pi\sqrt{l/g}$

Motion and Force

v = s/t a = v/t

vf = vi +at
s = vit + ½ at²
2as = vf² − vi² S = v_{ave} x t
V_{ave} =(vi + vf)/2

g = 9.8 ms^{-2} = 32 ft^{-2}
F = ma, P = mv, P = F t Impulse; J = F x t = ΔP

Law of conservation of momentum; Δp = 0
Elastic collision in one dimension; [v1 + v2] = [v1’+ v2’]
Magnitude of projectile velocity; $Vf = \sqrt{V_{fx}^2 + V_{fy}^2}$
Height of projectile; H = vi²sin²θ/2g Time of flight; T = 2 vi sinθ/g

Time of summit or time to reach to highest point; T = vi sinθ/g
Range; R = vi² sin 2θ/g Rmax

$= v_i^2/g$ R = Rmax at 45°

Work and Energy

$W = Fd \cos\theta$
Power; $p=W/t$ or $p = Fv$ 1
watt = Js^{-1}
1 hp = 746 watts
K.E = $\frac{1}{2} mv^2$
P.E = mgh
Efficiency = output/input = W x D/P x d

Absolute potential energy =Fr = - GmMe/Re (- because work is done against gravity) Gravitational potential = E/m = GMe/Re

For escape velocity compare K.E with Absolute potential energy;
Vesc = Vesc = $\sqrt{2GMe/r_e}$
$\sqrt{2gr_e}$

$G = 6.67 \times 10^{-11}\ Nm^2\ Kg^{-2}$
$Re = 6.4 \times 10^6$ m
$Me = 6 \times 10^{24}$ kg
$V_{esc} = 11.2 \times 10^3$ ms-1

Wh = K.E + fh → (Wh = loss in potential energy) Loss in P.E = Gain inn K.E + work done against friction

$E = mc^2$ →($c= 3 \times 10^8$ ms-1)

Rotational and circular motion

Angular velocity; $\omega = \Delta\theta/\Delta t$
Angular acceleration; $\alpha = \Delta\omega/\Delta t$ → a = α
x r v = r ω
F_c =
mv^2/r
a_c =
$-(v^2/r)$

Centrifugal force=
mv^2/r F sin θ = mv^2/r
F cos θ = mg
Tan θ =
v^2/gr

Torque = r F = rma = rm (rα) =(r^2m)α = I α
Moment of inertia; $I = mr^2$

Ring or thin walled cylinder inertia(I) = MR^2
Disc or solid cylinder inertia = $\frac{1}{2} MR^2$
Disc inertia = $\frac{1}{2} M (R2^2 + R1^2)$
Solid sphere inertia = $2/5\ MR^2$
Solid rod or meter stick inertia = $1/12\ Ml^2$
Rectangular plate inertia = $1/12\ M (a^2+b^2)$

Angular momentum = L = r x
p
= r mv = rmrω =r^2mω = Iω
L = rmv → L/t = rmv/t = rma = rF =
τ L/t = τ
Linear kinetic energy = $\frac{1}{2} mv^2$
Rotational kinetic energy = ½
$I\omega^2$

Lift at rest → T =w
Lift moving downward → T = w –
ma Lift moving upward → T = w +
ma Lift falling freely = T mg-ma =
0

Oscillation

Frequency → f=1/T
Angular frequency → ω = 2πf
Time period → T = 2π/ω
Velocity of projection → $v_y = \omega\sqrt{r^2-x^2}$

Simple pendulum time period → $T = 2\pi \sqrt{L/g}$
Simple pendulum potential energy = $\frac{1}{2} kx^2$
Simple pendulum kinetic energy = $\frac{1}{2} kx0^2 - \frac{1}{2}$
kx^2 Total energy of simple pendulum = $\frac{1}{2} kx0^2$

Resonance frequency = Fn = nf1
Phase → θ =ω t

Waves	
Transverse wave speed → V= √T x L/M or V= √T/m Longitudinal waves speed → V= √E/ρ Phase change→ 2π = λ Phase difference → δ = 2π/λ Speed of sound by newton → v= 281 ms-1 Laplace correction → v = 332 ms-1	

Important Physics Constants

- Planck constant h = 6.63×10^{-34} J.s = 4.136×10^{-15} eV.s
- Gravitation constant G = 6.67×10^{-11} m^3 kg^{-1} s^{-2}
- Boltzmann constant k = 1.38×10^{-23} J/K
- Molar gas constant R = 8.314 J/(mol K)
- Avogadro's number NA = 6.023×10^{23} mol^{-1}
- Charge of electron e = 1.602×10^{-19} C
- Permittivity of vacuum 0 = 8.85×10^{-12} F/m
- Coulomb constant $1/4\pi\varepsilon_0$ = $8.9875517923(14) \times 10^9$ N m^2/C^2
- Faraday constant F = 96485 C/mol
- Mass of electron m_e = 9.1×10^{-31} kg
- Mass of proton m_p = 1.6726×10^{-27} kg
- Mass of neutron m_n = 1.6749×10^{-27} kg
- Stefan-Boltzmann constant σ = 5.67×10^{-8} W/(m^2 K^4)
- Rydberg constant R_∞ = 1.097×10^7 m^{-1}
- Bohr magneton fl_B = 9.27×10^{-24} J/T
- Bohr radius a_0 = 0.529×10^{-10} m
- Standard atmosphere atm = 1.01325×10^5 Pa
- Wien displacement constant b = 2.9×10^{-3} m K .