BOM-PHYSICS

BOOSTER DOSE

FOR ETEA 2022

150 MCQs Matched with ETEA 2019 &
176 MCQs Matched with ETEA 2021 with BOM.

Chap#3 Motion and force

1.	When force is applied on body its mass remains	Constant
2.	Displacement-time graph is called	Velocity
3.	Displacement-time graph may be	Negative
4.	Distance-time graph can never be	Negative
5.	Slope or gradient of v-t graph is called	Acceleration
6.	Area under v-t graph is called	Distance traveled
7.	Free fall motion is	9.8 ms^{-2} or 32 $ft\ s^{-2}$
8.	Newton's first law of motion is also known as	Law of inertia
9.	Newton's second law of motion	F=ma
10.	Newton's third law of motion	$F_{AB} = -F_{BA}$
11.	Linear momentum was called quantity of motion by	Newton
12.	The rate of change of momentum is equal to	Force acting on body
13.	The product of F and t is called impulse of force, represented by	J
14.	In an elastic collision both kinetic energy and momentum is	Conserved
15.	In an inelastic collision momentum is conserved but kinetic energy is	Conserved

	not	
16.	The type of collision in which before and after collision appear on singe line	Head-on collision
17.	The relative speed of approach is equal to relative speed of separating for two	Bodies colliding elastically
18.	Projectile motion is two dimensional under an action of	Gravity
19.	The vertical component of velocity in projectile in highest is	Zero
20.	The horizontal component of velocity of projectile remains	Constant
21.	In projectile motile motion the upward quantities are taken	Positive
22.	In projectile motile motion the downward quantities are taken	Negative
23.	Height of projectile	$V_i^2 \sin^2 \theta/2g$
24.	Range of projectile	$V_i^2 \sin 2\theta/g$
25.	Time of projectile	$2V_i \sin \theta/g$
26.	If kinetic energy of body is increased by 300%, the increase in momentum is	100%
27.	The vertical velocity of projectile at its maximum height is	Zero
28.	The velocity of projectile at its maximum height is	Minimum
29.	Two equal, anti parallel and non concurrent forces that produce only angular acceleration are	Couple
30.	The minimum number of equal forces that keep the body in equilibrium are	2
31.	The minimum number of unequal forces that keep the body in equilibrium are	2
32.	A ball of mass 5 kg is dropped from a height of 78.4m the time taken by the ball to hit the ground is	4 sec
33.	A ball is thrown from window of moving train, It hit the ground by	Parabolic path
34.	A man throws a ball vertically in accelerated train, he ball will fall in	His hand
35.	A jet drops a bomb when it is above the target but it miss it due to	Horizontal component of the velocity of bomber
36.	To jump long, a jumper should jump at	45^0
37.	The range of projectile is the same for two angles which are mutually	Complementary
38.	The path of projectile is parabolic in shape and is called	Trajectory
39.	Everything in the vastness of space is in state of	Rotatory motion
40.	The change in position of body is called	Displacement
41.	Inertia of body is measured in terms of	Mass
42.	If velocity is increasing, the acceleration is	Positive
43.	When bullet is fired by the gun, the gun moves backward with velocity	Less than bullet
44.	The three equations of motion are useful for	Linear motion
45.	Newton's laws are applicable in	Inertial frames only
46.	If two objects are moving with the same velocity, it's difficult to stop the	Massive of the two
47.	Acceleration of bodies of different masses are	The same
48.	Rate of change of momentum is called	Impulse
49.	The product of force and duration of impact is called	Impulse
50.	A system in which no external agency exerts any force is called	Isolated system
51.	A collision in which both K.E and momentum is conserved is called	Elastic collision
52.	a collision in which momentum is conserved but K.E is not, is called	Inelastic collision
53.	The laws of motion show the relation between	a and F
54.	Inertial mass and gravitational mass are	Identical
55.	A frame of reference stationed on earth is called	Inertial frame
56.	The relation between range and maximum range	$R=R_0 \sin 2\theta$

57.	Newtonian physics does not hold true in case of	Atomic particles
58.	The conservation of linear momentum holds true in case of	Atomic physics
59.	The ballistics missiles are used only for	Short range
60.	The collisions between atomic particles, nuclear particles and fundamental particles are	Truly elastic collision
61.	A 5kg mass is falling freely, the force acting on, it will be	Zero
62.	Dimension of momentum is similar to that of	Impulse
63.	The vertical height and horizontal range will be equal, if angle of projection is	76^0
64.	If the line of action of force F passes through the origin. The torque is	Zero
65.	In rotational motion the analogue of force is	Torque

Chap#4 Work and energy

66.	If $\theta<90^0$ then work done will be	Positive
67.	If $\theta=90^0$ then work done will be	Zero
68.	If $\theta>90^0$ then work done will be	negative
69.	The gravitational force per unit mass on the body is known as	Gravitational field constant
70.	In closed path when work done is zero then it is called	Conservative
71.	The space around the earth in which it exerts a force of attraction on bodies	Gravitational field
72.	Sin0=	0
73.	Cos0=	1
74.	Sin90=	1
75.	Cos90=	0
76.	The work done is independent to the path followed by a body in	Close path
77.	Frictional force is	Non-conservative
78.	Amount of work done by a body in one second	Power
79.	The product of force and velocity(f x v) is called	Power
80.	The unit of power is called	Watt (1 watt=Js^{-1})
81.	1kwh = 1000 watts x 3600 sec =	3.6 mega joule
82.	1hp =	746 watts
83.	The ratio of output and input of machine is called	Efficiency
84.	Ideal machine is that of which	Output = Input
85.	K.E is the work done against	Frictional force
86.	P.E is the work done against	Gravity
87.	The value of escape velocity from earth is	11.2×10^3 m s^{-1}
88.	The value of escape velocity from moon is	2.3×10^3 m s^{-1}
89.	The velocity of light(c) is	3×10^8 m s^{-1}
90.	The softest coal(50% carbon) which has lowest energy output is called	Lignite
91.	Crude oil is also called	Liquid petroleum
92.	The center of the earth is approximately	4000^0 C
93.	The electricity provided to the world by nuclear energy is	16%
94.	Gravitational, Electric and Magnetic fields are	Conservative
95.	One hollow and one solid cylinder of same radius are rolling down on inclined plane, which one will reach first to plane?	Solid disc
96.	A 2kg object is moving with 3m/s. A force of 10N is applied on it and removed when body moved by 5m. The work done is	50J
97.	In order to change momentum of an objective there must be	Force applied
98.	A cyclist moves 4km toward east and then 3km towards north,	5km

	how he far from initial point	
99.	If work is done at rate of 240watt in minute, its power is	4 watt
100.	The work done by an electron revolving with 50m/sec is	Zero
101.	A car of mass 1000kg first travel on 25ms and then on 5ms,the change in K.E is	300kj
102.	Train apply brakes from 1 km far from where it stops if its maximum deceleration is 0.2m/s its safe speed now	20m/s
103.	A body of mass 1kg is suspended in elevator which is accelerating downward.With an acceleration of $4ms^2$, reading of the balance will be	5.8N
104.	The property of moving object by virtue of which it exerts force on the objects that tries to stop it is	Inertia of the body
105.	If velocity of body becomes half, the K.E of body becomes	One fourth
106.	A two meter tank is full of water, a hole in its middle is made, the speed of effect is	4.42ms
107.	A body has mass 72kg on earth, its mass on moon is	72kg
108.	The moment arm of force of 0.6 N to produce maximum torque of 0.48 Nm is	0.8 m
109.	Bodies which fall freely under an action of gravity is an example of	Uniform acceleration
110.	The dimension of torque are	$[M L^2 T^{-2}]$
111.	Centripetal force cannot do	Work
112.	1hp =	746 watts
113.	The dot product of force and velocity is called	Power
114.	Coal, oil, natural gas	Non-Renewable natural Sources
115.	energy from biomass and waves, electrical energy, geothermal energy, nuclear energy, tidal energy, solar energy, wind energy	Renewable Energy Sources
116.	Newton's first law of motion provides	1^{st} condition of equilibrium
117.	The dimension of work is similar to that of	Torque
118.	The dimension of impulse are similar to	Surface tension
119.	The dimension of Plank's constant are similar to	Angular momentum
120.	When the drag force of an object becomes equal to its real weight then the object will fall	With terminal velocity
121.	When a body moves against force of friction on plane the work done is	Negative
122.	Newton 2^{nd} law of motion establishes relationship between	Force and acceleration
123.	The dimension of gravitational constant is	$[M^{-1} L^3 T^{-2}]$
124.	Work is often thought in terms of	Physical effort
125.	Work is	Scalar quantity
126.	Work done by constant force is	$W= (F \cos \theta)d$
127.	Work done by moving electron in revolving around the circle is	Zero (d=0)
128.	Work done by a man pushing the wall is	Zero
129.	**Conservative fields are:** Electric field Magnetic field Gravitational field	
130.	SI unit of power is	Watt
131.	1 Kwh is equal to	3.6 MJ
132.	Basic form of energy are	2
133.	Work on the body is equal to change in	P.E and K.E
134.	When the body is taken out of the earth's gravitational field, it's P.E is	0 (U=-GMm/r)
135.	A 1kg mass has K.E of 1 joule when it's speed is	1.4m/s

136.	1 Lb =	4.45 N
137.	1 ft=	0.3048 m
138.	the body falls from height h, it's height decreases and P.E	Decreases
139.	Tidal energy and wind energy is used to generate	Electricity
140.	The rate of dong work is known as	Power
141.	Solar energy reaching the earth surface is	1 Kw/m^2
142.	Solar cells are thin cells made from	Silicon
143.	One Mega watt hour =	38 x 10^8 J
144.	Bio-mass is potential of	Renewable sources
145.	The consumption of energy by 60 watt bulb in 2 sec is	12 j (p=w/t)
146.	When body falls freely, its total mechanical energy remains	Constant
147.	Work done against the force due to gravity is stored as	Potential energy
148.	Work done by the force due to gravity is gained as	Kinetic energy
149.	Work done is closed path is	Zero
150.	If two bodies having same momentum have mass x:y then their velocity are	Y:x
151.	The relation between the escape velocity and the orbital velocity is	$V_{esc}=\sqrt{2}\ v_0$
152.	Energy released during fission of one atom of uranium is	1.8 x 10^{18} j
153.	Power has	No direction

Chap#5 Circular motion

154.	Centripetal force is also called	Seeking force
155.	Moment of inertia or rotational inertia(I) is equal to	mr^2
156.	In absence of external torque the angular momentum of system remains	Constant
157.	The minimum required velocity to put a satellite into the orbit is called	Critical velocity (7.9 km^{-1})
158.	The speed of satellite is inversely proportional to its	Radius
159.	The time which is taken by geostationary satellite or geosynchronous to complete round around the earth is	24 hours
160.	The geostationary orbit has an altitude of	22,240 miles (35,790 km)
161.	The geostationary orbit has an speed of	6,880 mph (11,070 kmh^{-1})
162.	The radius of geostationary satellite from center of the earth is	4.23 x 10^4 km
163.	The radius of the earth is	6.4 x 10^6 m
164.	A body weight in upward moving lift	Increases
165.	A body weight in lift at rest is	Constant
166.	A body weight in downward moving lift	Decreases
167.	In absence of an external torque, the angular momentum of rotating body is	constant
168.	The dimension of angular acceleration is	$[T^{-2}]$
169.	Motion of the bob of the simple pendulum is slowest at the	Equator of earth
170.	If the coplanar forces acting on the body keep it in the equilibrium then these forces are	Concurrent
171.	The angle between linear and angular velocity is	90^0
172.	If the area of the circle is equal to its circumstance , the radius of the circle is	1
173.	A body weight in freely falling lift is	Zero
174.	When satellite is falling freely everything in this appears to be	Weightless

175.	Momentum is conserved providing no external force act	Principle of conservation of momentum
176.	A body in equilibrium must have not	Acceleration
177.	The escape velocity from the earth gravitational field depends on	Radius of earth and g
178.	The geostationary satellites are rotating with the speed of	Earth
179.	The magnitude of periodic force, which the simple pendulum exert on the suspension point depends on	Value of g
180.	Angular acceleration is produced by	Torque
181.	The escape velocity of any mass from earth is	$11x\ 10^3\ m\ s^{-1}$ Or $11km\ s^{-1}$
182.	The escape velocity from any planet depends on radius and mass of that	Planet
183.	The gravitational potential energy per unit mass is called	Gravitational potential
184.	The orbital velocity of satellite in an orbit around the earth depends upon	Radius of the orbit
185.	The value of G at the moon as compared to earth is	Smaller (one sixth)
186.	The time period of communication satellite is	24 hour
187.	The displacement of a body in circle is called	Angular displacement
188.	1rev=	2π radian
189.	1 radian =	57.3^0
190.	Longitude of the place does not affect the value of	G
191.	The value of g is affected by the	Latitude of place
192.	The value of g is affected by the	Depth of place
193.	The value of g is affected by the	Attitude of place
194.	SI unit of angular displacement is	Radian
195.	SI unit of angular velocity is	Radian/sec
196.	The direction of angular velocity of a body moving in a circle is	Along the tangent
197.	The dimension of angular velocity is	[T]
198.	The direction of angular velocity is given by	Right hand rule
199.	The rate of change of angular velocity is called	Angular acceleration
200.	SI unit of angular acceleration	$Rad\ sec^{-2}$
201.	The dimension of angular acceleration are	$[T^{-2}]$
202.	The relation between linear and angular acceleration are	$a = r\ \alpha$
203.	The vectorical form of angular acceleration is	$-\omega^2\ r$
204.	The force headed to keep to keep the body in acceleration is called	Centripetal force
205.	The centripetal force is always directed	towards the center
206.	Angular momentum is conserved under	Central force
207.	When the body is moving with uniform acceleration in circle, here constant is	Magnitude
208.	The direction of body moving with uniform acceleration is	Variable
209.	K.E and angular momentum of a body is related by	$K.E = ½\ L\omega$
210.	If a body movies in a straight path. Its motion is	Rectilinear
211.	The moment of inertia of body depends upon mass and	Distribution with respect to axis of rotation ($I=mr^2$)
212.	Centripetal acceleration is always directed towards the	Center of circle
213.	In a gymnast rotating on rotating stool with his stretched arms, he lowers his arms. The angular speed will	Increase ($L=I\omega$)
214.	Centripetal force performs	Zero work (d=0)
215.	When body is whirled in vertical circle at the end of the string tension in the string is maximum	At the bottom ($T=F_c$ + w)
216.	the mud flies off the wheel of a moving bicycle in the direction	Tangent to the wheel

217.	The angular speed for daily rotation of earth in rad s^{-2} is	7.5×10^{-5}
218.	When external force acting on a system is constant, angular momentum is	Conserved
219.	When the body moves in circular path, its velocity remains	Changes continuously
220.	A body can have constant velocity when it follows	Rectilinear path
221.	The dimension of moment of inertia	$[ML^{-2}]$
222.	The law of gravitation was introduced by	Newton
223.	According to Einstein's theory space time is	Curved
224.	The angle between r and ω of circular moving body	90^0
225.	Angular momentum is a	Vector quantity
226.	Dimension of angular momentum is	$[M\,L^2\,T^{-1}]$
227.	Angular momentum of spinning of a body is	Spin angular momentum
228.	In rotational motion, the quantity which play the same role as the inertia in rectilinear motion is	Moment of inertia
229.	If no external torque acts on a system the total angular momentum of the system remains constant. This is according to	Law of conservation of angular momentum
230.	Artificial gravity is produced by spinning the spaceship	Around its own axis
231.	Minimum number of satellites required to cover the earth is	3
232.	A satellite moving around the earth constitutes	An inertial frames
233.	When body moves in circular path in clock wise direction, the direction of its angular velocity is	Out of plane of the paper
234.	The apparent weight of man moving in elevator which is moving downward with acceleration of "a"	T = mg + ma
235.	A man in elevator when ascending downward will observe his weight	Increased
236.	A man in elevator when descending downward will observe his weight	decreased
237.	The planet closer to the sun is	Mercury
238.	Pull of the earth on 20kg mass is	196 N
239.	Free falling body have	Zero weight

CHAP#7 Oscillation

240.	When a particle execute repeated movement about a mean position, it is	Harmonic motion
241.	If a motion is repeated at regular intervals, it is called	Periodic motion
242.	The number of vibration completed by a body in one second is called	Frequency
243.	The unit of frequency is	Hertz / 1Hz / $1cs^{-1}$ / cps
244.	The number of revolution per second of a body is called	Angular frequency $(\omega = 2\pi f)$
245.	In S.H.M the negative sign shows that both acceleration and displacement are	Oppositely directed
246.	Length of string + length of radius of metallic bob =	Length of simple pendulum
247.	The longer the pendulum the greater will be its	Time period
248.	The time period of simple pendulum is independent to the	Mass of the bob
249.	At extreme position K.E is	Zero
250.	At mean position K.E is	Maximum
251.	At extreme position the P.E is	Maximum
252.	At mean position the P.E is	Zero
253.	Law of conservation of energy is conserved in case of	S.H.M
254.	The angle θ= ωt which specifies the displacement x as well as the direction of the motion of the point oscillating S.H.M is called	Phase
255.	Oscillations where amplitude becomes smaller and smaller with time are called	Damped oscillations

256.	If the length of simple pendulum becomes fore times, its time period will become	Two times
257.	To find time period of simple pendulum we keep amplitude	Small
258.	Time period of simple pendulum is one second its length is	0.25 m
259.	When the length of simple pendulum is increased four times, the frequency of its oscillation will	Half
260.	If the length of simple pendulum is halved and mass is doubled then its time period	Decreased by 4
261.	Elastic collision involves	No gain no loss of energy
262.	If tunnel is bored through center of earth and stone is dropped it will	Simple harmonic motion
263.	The SI unit of spring constant (k) is identical to	Surface tension

CHAP#8 Waves and Physical Optics

264.	The mechanism by energy is transferred from one point to another point is	Wave motion
265.	Waves which required medium like sound and water waves are called	Mechanical waves
266.	Waves which required no medium like heat, light and radio waves are called	Electromagnetic waves
267.	Particles of waves vibrate perpendicular to the direction of the propagation of waves in	Transverse waves
268.	Particles of waves vibrate parallel to the direction of the propagation of waves in	Longitudinal waves
269.	In transverse waves the particle vibrate with the period and frequency of the	Source
270.	Mechanical waves cannot propagate through	Gases
271.	The time for one vibration is called	Time period
272.	In nature sound waves are	Compressional
273.	$v = \frac{\sqrt{T\ x\ L}}{\mathrm{M}}$ or $v = \frac{\sqrt{T\ x\ L}}{\mathrm{M}}$	Speed of transverse wave
274.	$v = \frac{\sqrt{E}}{\rho}$	Speed of longitudinal waves
275.	Speed of sound founded by Newton	281 m s^{-1}
276.	Speed of sound of Laplace's correction	332 m s^{-1}
277.	Theoretical value of sound is 16% less than	Experimental value
278.	Propagation of sound waves through air or gas is an	Adiabatic process
279.	Increase in speed of sound for each degree rise above 0^0 C is	0.61 m s^{-1}
280.	Speed of sound is directly proportional to the	Moisture and temperature
281.	Speed of sound is inversely proportional to the	Density
282.	Speed of sound is independent to the	Pressure
283.	The effect produced by the superposition of waves from two coherent sources, passing through same region is called	Interference
284.	In case of transverse waves constructive interference will occur if crest of one waves meet with another	Crest of another wave
285.	In case of longitudinal waves constructive interference will occur if compression of one waves meet with another	Compression of another wave
286.	If two waves arrive at same place at the same time but are out of phase(180^0)	Destructive interference occur
287.	The difference between frequencies of two waves is called	Beat frequency(N)

288.	N =f =	1/T
289.	The phenomenon of beats is used in finding unknown	Frequencies
290.	Perceived fundamental frequency of sound is	Pitch
291.	In reflection of mechanical waves the angle between incident and reflected pulse is	$\lambda/2$ or π or 180^0
292.	When transverse wave on string is reflected from a denser medium, there is a	phase change of 180^0
293.	When transverse wave on string is reflected from a rare medium, it suffers	No phase change
294.	The reflection of original sound from a certain object is received at 0.1 sec later than the direct sound is called	Echo
295.	The effective distance for echo is	17m
296.	Stationary waves is also called	Standing waves
297.	The distance between two successive nodes or anti-nodes is equal to the	$\lambda/2$
298.	The lowest characteristics frequency of vibration f_1 is called 1^{st} harmonic or	Fundamental frequency
299.	When source moves towards stationary listener, then the frequency of sound	Increases
300.	When source of sound moves away from stationary listener, then frequency	Decreases
301.	When the listener moves towards stationary source, then frequency of sound	Increases
302.	When the listener moves away from source, then the frequency of sound	Decreases
303.	When source and listener both moves towards each other, then the frequency	Increases
304.	When source and listener moves away from each other, then the frequency	Decreases
305.	Doppler effect is not confined to	Sound waves
306.	Doppler effect is applicable for	Light waves
307.	When ultrasonic waves are focused on a small space in liquid , the liquid is rapidly volatilized and large number of bubbles are formed this process is called	Cavitaions
308.	The transverse nature of light is verified with the phenomenon of	polarization
309.	The phase changes of 180^0 is equivalent to	$\lambda/_2$
310.	When water reach to an obstacle in the medium, they bend around in obstacle the region behind it, this is the evidence of the phenomenon of	Diffraction
311.	Electromagnetic waves do not require medium for their	Propagation
312.	When longitudinal waves propagate through a medium , the particle of the medium	Vibrate parallel to the direction of wave
313.	The wavelength of sound made from a tuning fork of frequency 330 Hz is nearly	330m ($v=f\lambda$)
314.	Two waves of same frequency and amplitude traveling in opposite direction along same position the waves is	Stationary waves
315.	If tension in a string remains constant and diameter becomes double its speed	Will become half
316.	In transverse waves the distance between consecutive crust and trough is	$\lambda/2$
317.	To find speed of wave we use	$V = f\lambda$
318.	Constructive interference occur if path difference between two monochromatic light is	Integral multiple of wavelength
319.	γ- rays have high energy photons than x-rays, Ultra violet and	Visible light
320.	The radio waves of constant magnitude are called	Carrier waves
321.	The world seismology stands for, An instrument used for detecting	earthquakes

322.	The motion of the source of sound with respect to stationary listener cause change in	Frequency of sound
323.	One light year is equal to	9.46×10^{15} m
324.	Sound waves move faster in	Hydrogen medium
325.	The velocity of earth satellite can be measured from the change in frequency or radio waves by using	Doppler effect
326.	Frequency of light does not change with	Nature of medium
327.	The phase change of 180^0 is equal to path difference	Half the wavelength
328.	If the width on the young's double slit experiment becomes double, the fringe spacing will become	Half
329.	Doppler effect is applicable to	Sound and light waves
330.	When a wave comes across an obstacle, it bands around an obstacle. This phenomenon is called	Diffraction
331.	Polarization of light shows that the nature of light is	Transverse waves
332.	The net exchange of heat between two bodies of same temperature is	Zero
333.	Temperature determines the direction of	Heat flow
334.	The temperature of body can be increased by	Work and heat
335.	Intense, Coherent and monochromatic beam of light are produced by	Laser
336.	Critical angles of the medium depends on the	Refractive index of the medium
337.	Newton's rings are formed due to	Polarization of light
338.	LASER light is the result of	Stimulated emission
339.	Hook's law correlates the force and	Extension
340.	MRI works on principle of	Resonance
341.	In a stationary wave, the distance between a consecutive node and antinode is	$\frac{\lambda}{4}$
342.	When a wave comes across an obstacle, it bands around the obstacle. This phenomenon of bending around of a wave is called	Diffraction
343.	Sound waves cannot be	Polarized
344.	Longitudinal waves cannot be	Polarized
345.	When sound moves from one medium to another its frequency remains	Constant
346.	The device which can be used for measuring precise wavelength is	Michelson interferometer
347.	Photons can move with a speed of	Light
348.	Propagation of light in optical fiber, the light should	Totally confined
349.	The least accurate of the volumetric measuring device is the	Graduated cylinder
350.	the colour of sky is blue due to	Scattering of light
351.	If green light in young double slit experiment is replaced by monochromatic light of the same intensity, Then fringe width will	Increases
352.	Speed of sound in independent to	Pressure
353.	The number of loops in stationary waves depends upon	Frequency of waves
354.	When the light enters from air to glass, it suffers a change in the	Wavelength and speed
355.	Sound around the corner can be hear but cannot be seen due to	Diffraction
356.	Two waves of the same frequency and amplitude, traveling in opposite direction along the same path will form	Standing waves
357.	Frequency of light does not depend on	Nature of medium
358.	If speed of moving particle increases its wavelength associated with it	Decreases
359.	As the pressure of medium increases the speed of sound in medium	Remains constant
360.	Radio, M.R.I, Microwave oven works on phenomenon of	Resonance

CHAP#9 Thermodynamics

361.	1 cal =	4.18 J
362.	The process in which a system goes a change of state at constant volume is called	Isochoric
363.	The process in which a system goes a change of state at constant pressure is called	Isobaric
364.	The process in which a system goes a change of state at constant temperature is called	Isothermal
365.	The process in which a system goes a change of state where no heat can enter or leave is called	Adiabatic
366.	First law of thermodynamics($\Delta Q = \Delta U + \Delta W$) is particular form of	Law of conservation of energy
367.	A device which convert heat energy into mechanical energy	Heat engine
368.	Heat cannot be converted into useful work during a	Complete cycle
369.	2^{nd} law of thermodynamics :Efficiency of heat engine is always less than 100%	Lord Kelvin Statement
370.	2^{nd} law of thermodynamics :It is impossible to cause heat to flow heat from a cold body to hot body without	Expenditure of energy
371.	Efficiency of heat engine is always less than	Carnot heat engine
372.	Efficiency of Carnot heat engine is	100%
373.	The efficiency of carnot engine of hot and cold temperature depends upon only	temperature of two reservoirs
374.	The process in which heat neither enter nor leave the system but still temperature of the system change is	Adiabatic process
375.	The standard molar enthalpy of formation is denoted by	ΔH^0_{298}
376.	Process of applying Hess's law to the standard enthalpy changes in the formation of ionic compounds	Born Haber Cycle
377.	The process which is performed quickly is	Adiabatic process
378.	The work done against friction will	Increase the entropy of system
379.	If an ideal gas allowed to expand adiabatically the work done by the gas is equal to	The loss of internal energy
380.	If the temperature of source of heat increase, The efficiency of carnots engine	Increases

Chap No.10 ELECTROSTATICS

381. 1 e = **1.602 x 10-11 C**

382. Charge is quantized → **q=ne**

383. Coulomb measure force between electric charges using an apparatusCalled **torsion balance**

384. The constant k depends upon **units used andMedium between charges**

385. For like charges the product q1q2 will be positive and force of repulsion will be **F21**

386. For unlike charges the product q1q2 will be negative and force of repulsion will be **F12**

387. F21 =-F12

388. The permittivity of material medium compared with vacuum permittivity is called Relative permittivity or Dielectric constant

389. Fmed < Fvac

390. SI units of electric field intensity are NC-1 or Vm-1

391. The strength of electric field is proportional to the magnitude of Source charge
392. The direction of resultant intensity is Tangent to the field
393. At some points resultant intensity is zero which is called Neutral points
394. The fields such as ends of plates are called Fringing field
395. Field lines starting from charge are always Perpendicular to the surface
396. The electric field lines cannot pass through a Conductor
397. In inside a conductor, electic field is Zero
398. The concept of field theory was introduced by Michal Faraday
399. The existence of electric field can be proved by bringing a Test charge (qo)
400. A single vector quantity that contains information about field strength and direction is Electric field intensity
401. Intensity of an electric field at any point is the force per unit Charge
402. Electric field strength is a Vector quantity
403. The SI unit of electric field intensity is N C-1 or V m1
404. Heart of photocopier is drum, made of aluminum and coated with Selenium
405. The strength of the electric field is proportional to the Magnitude of the source charge
406. The electric field in vicinity of charge is represented by imaginary lines called Electric lines of force
407. The direction of electric field lines for positive charge is radially Outward
408. The direction of electric field lines for negative charge is radially inward
409. The resultant intensity is the sum of intensities due to positive and negative charge and their direction is along the Tangent to the field
410. The points where resultant intensity are zero these points are called Neutral points
411. The field ate the end of plates which bulging out are Fringing field
412. Electric field lines of forces on metal are always Perpendicular to the metal surface
413. The electric field lines of force cannot pass through the Conductor
414. A photocopier is a machine that makes quickly and easily Copies of documents
415. In photocopier the aluminum cylinder coated with a layer of Selenium
416. Last, the paper and adhering toner pass through Heated pressure rollers
417. The dry copying process is based on electrostatics
418. Aluminum is an excellent electrical conductor while selenium is Photoconductor
419. Electrode of photocopier is called Corotron
420. Dark areas in the photocopier retain their Positive charge
421. Dry black colour powder in the photocopier is called Toner
422. To transfer the toner into, the paper is given the Positive charge
423. Laser printer works due the process called Xerography
424. In laser printer the drum is charged by Corona wire
425. The area which are not exposed to light make up the Printed image
426. In its operation the inkjet paper uses Electric charges
427. In inkjet printers, not to be inked area ,the charging control is Turned on
428. The electric field due to a charge sphere has Spherical symmetry
429. Number of lines of force that pass through area placed in electric field Electric flux ($\varphi = EA \cos \theta$)
430. The unit of electric flux is N m2 C-1
431. If area is placed perpendicular to electric field, then electric flex is Maximum ($\cos \theta = 1$)
432. If area is placed parallel to electric field, then electric flex is Zero ($\cos 90 = 0$)
433. Source of field lines is in the closed surface, so the electric flux is Positive
434. There is sink of field lines in the closed surface, so the electric flux is Negative

435. There is no field lines intercepting the surface, so the electric flux is Zero
436. The electric flux is positive if net numbers of electric field lines are Leaving the surface
437. The electric flux is negative if net numbers of electric field lines are Entering the closed surface
438. If more field lines are entering than leaving the surface, then flux is Negative
439. If the numbers of field lines entering = number of field lines leaving The flux is zero
440. Net electric efflux through closed surface is equal to total charge (q) divided by permittivity of free space (ε0) Guass's law statement
441. (q/ε0)
442. Over sphere the electric field intensity is Constant
443. q/ε0 , this equation does not depends upon the Shape or geometry of closed surface
444. The electric flux through any closed surface is 1/ε0 times of the Total charge enclosed in it
445. ΦE = q/ε0 , equation shows that electric flux does not depends upon Shape/geometry of closed surface
446. Electric flux depends upon the medium and Charge enclosed by surface
447. ΦE = Q/ε0 or total electric flux=1/ε0 x (charge enclosed by closed surface) Gauss's law
448. In conductor the electric field is zero due to Electrostatic equilibrium in conductor
449. On a conductor , flat or curved, all the charges are Repelled to the outer surface
450. If there is charge (q) inside hollow conductor, a charge appear on surface which is equal to Charge(q) inside conductor
451. Airplane fly in storm but no one is injured because there is No electric field and no potential difference inside a metal shell
452. The formula of surface charge density is $\sigma = Q/A$
453. Electric field intensity due to infinite sheet of charge $E = \sigma/2\ \varepsilon_0$
454. We assume infinite length of two oppositely charge plates to find electric field To avoid fringing field at end
455. Electric field intensity between two oppositely charged parallel plates are $E = \sigma/\varepsilon_0$
456. The magnitude of electric field between two parallel plates are independent to Position between plates
457. The work done by force in carrying the charge from one point to another against electric field is called Potential energy (ΔU)
458. ΔU = W
459. $V=W/q \rightarrow V= \Delta U /q$ ($\Delta U = W$) $\Delta U = Vq$
460. Potential difference is joule per coulomb which is termed as volt
461. If one joule of work is done in moving one coulomb of charge from one point to another is called One volt potential
462. The formula for electric potential energy at distance r from Q is $U = k Q q /r$
463. The formula for electric potential at distance r from Q is $V=W/q \rightarrow V = k Q /r$ (for point charge)
464. Every charge has electric field which theoretically expands up to Infinity
465. The closer the test charge to the charge +Q the higher will be the Electric potential energy
466. The equation for electric field intensity is $E= k Q/r2$
467. The work done to move a test charge q from infinity to distant r from Q is $W = k Q q/r$
468. An equipotential line connects points in space where the potential of an Electric field is same
469. Potential can be positive and negative and it is Scalar quantity
470. In an electric field, the force acting is equal to Charge times the field strength (F=qoE)
471. The strength of the field is equal to the Potential gradient
472. The rate of change of electric potential (ΔV) with respect to displacement (Δr) is known as $V = -\Delta V / \Delta r$

473. The relationship between field strength and potential gradient is analogus to Gravitational field
474. The electron volt is unit of Energy 1eV=1.602 x 10-19 J
475. Δ(K.E) = 1eV= qΔV
476. A device which is used for storing electrical charges is called Capacitor
477. The medium of capacitor is called Dielectric constant
478. The capacitors area commonly charged by connecting its plates for a while to Opposite terminals of battery
479. In capacitor charging the battery transferred electrons from Positive to negative plate
480. Charge in capacitors remains after removing battery due to Mutual attraction of plate
481. The capability of capacitor to store charge is called Capacitance
482. Q=CV →C=Q/V, here C is Capacitance of capacitor, the value of Capacitance of capacitor depends upon the Plates area, distance between plates and medium of capacitor
483. Ratio of magnitude of charge to potential difference produced between plates Capacitance of capacitor
484. The SI unit of Capacitance is Farad (F)
485. Cvac = ε0 A/d and Cmed = ε0 εrA/d εr = Cmed /Cvac
486. εr is a dimensionless quantity which is always greater than Unity for dielectric
487. εr is independent of the Size and shape of dielectric
488. Ratio of capacitance of capacitor of given material (Cmed) to same capacitance of capacitor (Cvac) when space is evacuated Relative permittivity (εr)
489. Combination of capacitors
490. Series combination Parallel combination
491. V = V1 + V2 + V3 V = V1 = V2 = V3
492. Q = Q1 = Q2 = Q3 Q = Q1 + Q2 + Q3
493. 1/Ce = 1/C1 + 1/C2 + 1/C3 Ce = C1 + C2 + C3

494. The equivalent capacitance of a series combination is always Less than individual capacitance
495. The equivalent capacitance of a parallel combination is always Larger than individual capacitance
496. Insulating material with relative permittivity when inserted in charged capacitor Electric polarization occur
497. When dielectric is polarized in capacitor conditions, the charges on dielectric faces are called Induced charges
498. The electric field of free charge and induced charge are Opposite in direction
499. As electric field due to induced charges is opposite to the external electric field so it Reduces the intensity of external field
500. When a non polar dielectric material is placed is an external field, it gets Polarized
501. The system in which two charges of equal magnitude but of opposite sign separated by the distance are present is termed as Dipole
502. Electric dipole (vector quantity) moment us represented by P ●P = |qd|
503. When capacitor is uncharged, the potential difference between the plates is Zero
504. The average voltage on the capacitor during the charging process is V/2
505. Energy is being stored in the electric field between the plates rather than the Potential energy of charge on plates
506. Energy stored in the capacitorU = ½ εr εo E2 x (Ad)
507. Energy density of charged capacitor is μ=U/Ad or U=1/2 εr εo E2
508. Charging of capacitor will stops the P.D between the capacitor plates Is equal to emf of the battery

509. Maximum charge on capacitor = Capacitance x e.m.f of battery
510. Charging process of capacitor q=qo (1-e-t/RC) ●e=2.182
511. The factor RC is called Time constant
512. The time taken to charge capacitor in a given circuit is determined by the Time constant of the circuit
513. The bigger the capacitance, the longer it takes to charge
514. The larger the resistance, the smaller the current, which also Increase the charging time
515. The time constant is the duration of time for the capacitor in which 63.2% of its maximum value charge is deposited on plates
516. Charge left on either plate on capacitor is called q=qo e –t/RC
517. Smaller value of RC constant lead to a More rapid discharge an discharge
518. The magnitude of charge remaining on each plate is 36.7% if T=RC ●q=qo (0.367)

Chap No. 11 CURRENT ELECTRICITY

519. High voltage of power stations in Pakistan is 5 x 105 volts
520. In Pakistan, in homes the electricity has been transformed to 220 volts
521. The electric eel is an electric shock which generate electrical shocks of 600 volts
522. The continuous flow of electrons is called Steady current
523. When electric field or voltage is applied to conductors the electrons moves Towards the positive terminals
524. The directed flow of free electrons is called Electric current
525. An electric current is Matter in motion
526. The actual direction of current is from Negative terminal to positive
527. Flow of current from positive to negative terminal of the cell via the circuit Conventional current
528. Those substances which have free electrons and permit current flow easily Conductors
529. In metals moving charges are always Electrons
530. In gases the moving charges are Negative and positive ions
531. In semiconductors the moving charges are Electrons and vacancies or holes
532. The net charge flowing through per unit area is called Current ● I=Q/t
533. The unit of current is Coulomb/second or ampere(A)
534. Current is scalar quantity as it does not follow Vector law of addition
535. The average speed of electron is 105 m s-1
536. The drift velocity of the free electron is 10-5 m s-1
537. Due to random motion of all free electrons there is no net flow of charges In particular direction
538. The electrons experience a force in a direction Opposite to electric field
539. The average velocity in which free electrons get drifted in a metallic conductor under the influence of electric field is called Drift velocity
540. Propagation of electric field takes place with the Speed of light
541. Electroencephalography(EEG) is a neurological test for brain
542. EEG measures the voltage fluctuation from ionic current flows through the Neurons of brain
543. The most important basic law of electricity is Ohm's law

544. The relation between V, I and R was first discovered by German scientist George Simon Ohm in 1826 in D.C current
545. The magnitude of the current in metals is proportional to the applied Voltage ● T= constant
546. Dimension depends upon nature, dimension and physical state of Conductor
547. For conductors that obey ohm's law, a graph of I and V is Straight line passes through origin
548. The slope of line for ohmic conductor is Tan θ = I/V = I/R
549. The ohm law is not valid for all Conducting materials
550. Those materials which do not follow ohm law are called non-ohmic materials
551. Filament bulb, thermistor and semiconductor diode are non-ohmic materials
552. The slope decrease for increase of voltage for Filament bulb
553. Resistance decrease sharply as temperature rises for Thermistor
554. The I-v graph of semiconductor diode shows that it also Non-linear graph
555. In semiconductor diode the current passes when the voltage is applied in one direction but when it act in opposite direction the current is almost Zero
556. A given change V causes smaller change in I at larger value of V Filament bulb
557. A given change V causes larger change in I at larger value of V Diode / Thermistor
558. Resistance is opposition offered by the substances to the flow of Free electrons
559. Resistance is electric friction to electron flow & with flow of current causes Production of heat
560. The SI unit of resistance of resistance is ohm and represented by symbol Ω (omega) ● 1Ω = 1V/1A
561. Larger the length of wire, larger will be the Resistance ● R∝ L
562. Thicker wires have less resistance per meter and will cause Less energy loss ● R ∝ 1/A
563. Resistance is directly proportional to the Temperature
564. Resistance is given by a formula as R = ρ L/A
565. The unit of resistivity(ρ) is Ω.m ● R = ρ L/A → ρ = RA/L
566. The resistivity of some metals:
567. Metals Resistivity Metals Resistivity
568. Brass 0.06-0.09 Iron 0.1
569. Silver 0.163 Tin 0.114
570. Copper0.178 Lead 0.219
571. Aluminium 0.285
572. The resistivity of metals and alloys are very Small, so these are Good conductors
573. The reciprocal of resistance of conductor is called Conductance (G) ● G=1/R
574. The SI unit of conductance is mho and Simon(S)
575. The reciprocal of resistivity of conductor is called Conductivity (σ)
576. If a conductor has resistivity (ρ = RA/L), then its conductivity is σ =1/ ρ → L/RA
577. The SI unit of conductivity is Mho m-1 or S.m-1 ●σ=L/RA
578. With increase in temperature, the resistance of pure metal Increases
579. With increase in temperature, the resistance of electrolytes, insulators & Semiconductor Decreases
580. The increase in resistance is directly proportional to the Initial resistance & temperature rise
581. RT – Ro= α Ro T, Here α is constant and called Temperature co-efficient of resistance
582. Temperature co-efficient of resistance depends upon nature of material & Temperature
583. Increase in resistance per ohm original resistance per degree rise in temperature is called Temperature co-efficient of resistance which are as α = RT – Ro / Ro T
584. The SI unit of Temperature co-efficient of resistance(α) is K-1 ●α=RT – Ro / Ro T
585. The resistance of metals rise with rise in temperature, they have Positive value of α
586. The resistance of semiconductors fall with rise in temperature, they have Negative value of α

587. Equation for Temperature co-efficient of resistivity is $\alpha = \rho T - \rho o / \rho o T$
588. Frictional change in resistivity per kelvin is called Temperature co-efficient of resistivity (α)
589. The resistivity of metals rise with rise in temperature, they have Positive value of α
590. The resistivity of semiconductors fall with rise in temperature, they have Negative value of α
591. High stability and high accuracy resistors are always Wire wound
592. Wire wound is enclosed in Insulator
593. Nickel chromium is used in Wire wound because of its small value of Temperature co-efficient of resistance (α)
594. Wire wound resistors can safely operate at higher temperature than Carbon type resistors
595. In Rheostats, adjusting the resistance in the circuit control the Current in the circuit
596. A potential divider provides a convenient way to getting a Variable P.D from fixed P.D
597. vBC = RBC v/R, the value of friction RBC/R can be Varied from 0-1
598. A resistor made of semiconductors having resistance that varies rapidly and predictably with temperature is known as Thermistor
599. A thermistor is short form of Thermal resistor
600. The temperature co-efficient of a thermistor is Very high
601. The resistance of thermistor changes very rapidly with change of Temperature
602. The temperature co-efficient of thermistor can be Both positive and negative
603. Thermistor are made from semiconductor oxides of Iron, nickel and cobalt
604. Semiconductors in thermistor are in form of Disks or rods
605. Platinum pairs leads are attached at the two ends for electrical connection In thermistors
606. The arrangement of thermistor are enclosed by Glass bulb and sealed
607. A thermistor with negative temperature co-efficient of resistance may be used as alarms and to safeguard against Current surges in a current
608. If thermistor are used in series with heaters of the radio valves are Harmful
609. Device which converts non-electrical energy to electrical energy Electromotive force (emf)
610. emf of a source is equal to the work done in carrying one coulomb of charge through the source $\varepsilon = W/q$
611. The potential at the ends of the battery when circuit is open is called Electromotive force (emf)
612. the unit of the emf is the J/C or volt 1 ● $\varepsilon = W/q$
613. The influence that makes current flow from lower to higher potential Emf
614. The chemical energy is converted to electrical energy by Batteries
615. The mechanical energy is converted to electrical energy by Electrical generators
616. The heat energy is converted to electrical energy by Thermocouples
617. The sunlight energy is converted to electrical energy by Radiant or solar cell
618. If the cell is delivering no current then P.D across the terminal = e.m.f (ε)
619. When some load resistance are connected the terminal voltage available will Less than emf ● $Vt = \varepsilon - Ir$
620. The rate at which work is done is an electric circuit is called Electric power ● ($p = w/t$)
621. The work done in moving the charge in unit time is also called Electric power
622. $p = w/t \rightarrow p=VQ/t \rightarrow p= VIt/t \rightarrow p =VI$
    - $p = w/t \rightarrow W=pt$
623. $P = VI$ $W=VIt$ $I=P/V$
624. $P = I2 R$ $W= I2 R t$ $I=\int P/R$
625. $P = V2 /R$ $W= V2 t/R$ $V=\int PR$
626. The SI unit of power is watt 1 Watt = 1V x 1A ● P=VI
627. One commercial unit of electrical energy is One kilowatt-hour

628. 1kWh = 3.6 x 106 J ● 1J = 1W x 1s
629. If the load resistance is less or greater than the source resistance, then the power delivered to the load will be Minimum
630. When internal resistance of a source of the emf = load resistance then power is Maximum
631. When internal resistance of a source of the emf = load resistance then power is
632. When internal resistance of a source of the emf = load resistance then power is maximum Maximum power transfer theorm
633. The value of maximum power output is (Pout)max = ε2 /4r or P= ε2 /4R
634. Thomas Seebeck find relation between heat and electricity in 1821, is called Seebeck Effect
635. The emf generated in thermocouples or Seebeck effect is called Thermoelectric emf
636. The resulting emf in Seebeck effect is called Thermoelectric current
637. The two junction circuit is called Thermocouple
638. In thermocouple the heat is directly converted into Electricity
639. Thermocouples are widely used as Temperature sensors
640. The Seebeck effect is Reversible
641. The thermo-emf in Seebeck effect s very small, of the order of mV per every degree of temperature difference
642. The greater separation of the metals forming the couples in the series, the emf Produced is greater
643. In thermocouples, when the cold junction is at 0 c the temperature dependence is given by $\varepsilon=\alpha T+1/2\ \beta T^2$
644. The thermoelectric coefficient (α and β) depends on Nature of medium
645. The thermo emf increase with temperature and become maximum at certain temperature called Neutral temperature (Tn)
646. In thermoelectric emf, when both junction are at same temperature, there is No emf
647. The value of neutral temperature is constant for a thermocouple, depends on nature Of material
648. The value of neutral temperature is independent of the Temperature of cold junction
649. The particular temperature at which the thermo emf becomes zero is called Inversion temperature
650. Resistance thermometers are also called Resistance temperature detectors(RTDs)
651. Common RTD has unique and repeatable and predictable Resistance vs temperature relationship
652. Amount of resistance change of the sensor per degree of temperature change R vs T relationship
653. The best metal for RTD is Platinum
654. Platinum is best for RTD because of linear temperature resistance relationship & Highly repeatable manner
655. The platinum is temperature standard for over range of -185o C to 630o C
656. RTSs are slowly replacing thermocouples in industries below 600o C
657. When more than one emf and resistors are connected in complicated manner Complex circuits
658. In order to solve complex circuits, German physics Gustar Robert Kirchoff's (1824-1887) gaves two laws known as Kirchoff's law
659. Algebraic sum of all currents meeting at a junction in an electrical circuit is zero Kirchoff's current law (KCL)
660. Signs of current flowing toward the junction are taken as Positive
661. Signs of current flowing away the junction are taken as Negative
662. Sum of incoming current= sum of outgoing current Kirchoff's current law (KCL)
663. Kirchoff's current law (KCL) is based on and according to Law of conservation of charge

664. In any closed electrical circuit, the algebraic sum of all electromotive forces and voltage drops is equal to zero Kirchoff's voltage law (KVL)
665. Algebraic sum of emf + algebraic sum of voltage drops = 0 Kirchoff's voltage law (KVL)
666. In Kirchoff's voltage law (KVL)
   a. A rise in potential is taken as Positive
   b. A drop in potential is taken asNegative
   c. For batteries, the positive end is always at Higher potential
   d. Current flows from Higher to lower potential
   e. Direction of current can be Clock or anti-clock
667. Kirchoff's voltage law (KVL) is a statement of Law of conservation of energy
668. Sum of all emf = sum of all IR voltage drops Kirchoff's voltage law (KVL)
669. In Kirchoff's voltage law (KVL), if wrong direction is chosen, it will be indicated by Negative sign in result
670. An instrument used to measure an unknown resistance Wheatstone bridge
671. In Wheatstone bridge, the point at which the bridge is balanced is called Null point
672. In Wheatstone bridge the value of resistance is varied until galvanometer shows Zero result
673. The principal of determining unknown resistance by Wheatstone bridge is $X=RQ/P$
674. A potentiometer is null type resistance network for measuring Potential difference
675. An unknown e.m.f or P.D is measured by balancing it , wholly or in part, against a known Potential difference
676. For the accurate measurement of potential difference, current and resistance Potentiometer is useful instruments
677. Small emf measurement, comparison, high emf measurement, resistance and current measurement, and calibration of ammeter and voltmeter Applications of potentiometer
678. Potentiometer $E2 = I2 / I1 \times \varepsilon 1$
679. Potentiometer measure small emf up to 2V
680. Potentiometer measure high emf up to 250V

Chap No. 12 ELECTROMAGNETISM

681. The property of magnet to other ferromagnetic material is that of Pull
682. The property of magnet to other magnetic material is that ofPull or push
683. Credit, debit and atom cards have a Magnetic strip on one side
684. The study of magnetism started with the discovery of the mineral called Loadstone
685. The direction of the magnetic field around a current carrying wire by Right hand rule
686. In right hand rule, fingers show the direction of the Magnetic field
687. In right hand rule, thumb show the direction of the Current (I)
688. The magnetic field is the region around a magnet or a current carrying wire in which it attract or repel other Magnetic materials
689. Magnetic field is a vector quantity and represented by a vector B called Magnetic induction
690. The force on current carrying conductor is $F = B I L \sin\theta$
691. The force on current carrying conductor in uniform magnetic field depends on Length, current of wire, magnetic induction and Angle(θ) between B and L
692. The force on current carrying conductor in scalar form $F = I (L \times B)$
693. The direction of force on current carrying conductor is determined by

694. thumb gives the direction of Force (F)
695. first finger gives the direction of Magnetic field (B)
696. second finger gives the direction of Current (I)
    a. Fleming's left hand rule
697. The SI unit of magnetic induction (B) is Tesla (T) 1T = 1N A-1 m-1 ● B=F/IL
698. Another unit used for magnetic induction (B) is Gauss (G) 1G = 10-4 T or 1T = 104 G
699. Magnetic flux is the product of the magnetic induction & vector area element $\Delta\varphi = B.\Delta A$ or $\Delta\varphi = B\ \Delta A \cos\theta$
700. Direction of the vector area element ΔA is Normal to the surface area
701. The total flux through the surface is given by $\Phi = \Sigma B\ .\ \Delta A$ or B.A or B A cos θ
702. The unit of magnetic flux is weber 1W b = 1 N m A-1 ● Φ=B.A
703. Ampere's circuit law, discovered by Andre Marie Ampere in 1826
704. Relation of integrated magnetic field around a current carrying wire to the current passing through the wire Ampere's law
705. $B = \mu_o I/2\pi r$ or $B\ 2\pi r = \mu_o I$ or $B.\Delta L = \mu_o I$ or $\Sigma B.\ \Delta L = \mu_o I$ is Ampere's law
706. The magnetic field of solenoid is strong Along its axis
707. The magnetic field of solenoid is weaker or negligible Outside
708. Magnetic field due to a current carrying solenoid $B = n\ \mu_o I$ ● n=N/L
709. Cranes, electromagnetic lock and doorbell ringer Application of magnetic field
710. For positive charge q moving with velocity v in magnetic field B, the force is F=q (v x B) or $f = qv\ B \sin\theta$
711. The direction of force on charge in magnetic field can be found by
712. thumb gives the direction of Force (F)
713. first finger gives the direction of Velocity (v)
714. second finger gives the direction of Current (I)
715. Force is always perpendicular to direction of velocity Fleming's left hand rule
716. When charge move along a magnetic field line then the charge move Spiral on spiral path ●θ =0-90
717. Charged particle in magnetic field move along Circular path
718. Frequency of electron in magnetic field or cyclotron frequency is $F= q\ B/2\pi m$ & $T=2\pi m /q\ B$
719. Radius of electron can be found by colliding with gas like hydrogen and helium Placed in uniform magnetic field and its de-excitation gives us Visible blue light
720. e/m ratio of an electron is e/m=2V/B2 r2
721. Mass of electron 9.109 x 10-31 kg
722. Formula of velocity vector V = E/B
723. The force on sides of coil in magnetic field F = NBIa
724. The torque on coil produced by torque is $\tau = F\ (b \cos\theta)$ or $\tau = NBIa \cos\theta$
725. The maximum torque on current carrying coil BINA ●θ = 0
726. When the plane of the coil is perpendicular to the magnetic field or normal to it is parallel to the field then Toque = 0
727. Strong magnetic field and radio waves to produce an image of inside body Magnetic resonance imaging(MRI)
728. By applying short radio frequency (RF) the protons in the slice spin Perpendicular to magnetic field
729. An instrument uses for detection and measurement of small electric current Galvanometer
730. Most modern galvanometer are of the moving-coil type called d'Arsonval galvanometer
731. A cylinder of soft iron in galvanometer is used to Give more inertia to the coil
732. The deflecting torque is equal to the restoring torque if coil is In equilibrium

733. Galvanometer may be made more sensitive by making deflecting angle θ Large for certain value of current
734. A sensitive galvanometer is that which show a large deflection for a Small value of current
735. The angular displacement in galvanometer is being proportional to the current
736. Lamp and scale arrangement galvanometer is More sensitive
737. Pivoted coil galvanometer is Less sensitive
738. In Pivoted coil galvanometer, the angle of the deflection of the coil is given By light aluminum pointer
739. In less sensitive galvanometer the coil is pivoted between Two jeweled bearings
740. The conversion of galvanometer to an ammeter is done by connecting a Low resistance in parallel
741. The conversion of galvanometer to an volt meter is done by connecting a High resistance in series
742. The low resistance connected with the galvanometer is called Shunt resistance
743. When galvanometer are converted to ammeter the scale is marked in ampere
744. The value of the shunt resistance depends upon the friction of the total current required to be passes through the Galvanometer
745. An ideal ammeter has Zero resistance
746. An ideal voltmeter has an Infinite resistance
747. The value of the resistance in voltmeter depends upon the Range of the voltmeter
748. Voltmeter has high resister due to it must not draw Current from the circuit
749. An instrument used to measure current, voltage and resistance Avometer - Multimeter
750. An Avometer – Multimeter is Amperemeter, voltmeter & ohmmeter (AVO)
751. In current measurement on Avometer – Multimeter, circuit has series of shunt resistance called Universal shunt
752. The added highly resistance converts the galvanometer to a voltmeter of A specific range
753. Amount of the current through the galvanometer depends upon the External resistance
754. The amount of the deflection on the ohms scale indicate directly the magnitude of the resistance
755. Commercial AVO meter provides resistant measurement from less than One ohm to megaohms
756. Modern multimeters are often digital due to accuracy, Durability & extra features
757. In a digital multimeter the signal under test is converted to a voltage and an amplifier with electronically controlled gain Precondotions the signal
758. A digital multimeters give result as a number which eliminate the Parallax error

Chap No. 13 ELECTROMAGNETIC INDUCTION

759. The two aspects of single electromotive force are Electricity & magnetism
760. Moving electric charge produce Magnetic force
761. Moving magnetic force produce Electric force
762. When the magnetic flux linking the conductor changes, an e.m.f is induced in the current this phenomenon is called Electromagnetic induction
763. The product of number of turns of the coil and magnetic flux linking the conductor is called Flux linkage ●Flux linkage =Nφ
764. Electromagnetic induction is also produced in two soils by motion of Primary coil toward/away to secondary coil
765. The primary coil connected to A.C source
766. Magnitude of e.m.f induced in coil is directly proportional to the rate of change of flux
767. Equation of Faraday's law of electromagnetic induction is ● $\varepsilon = N(\Delta\varphi)/\Delta t$
768. In a conductor a charging magnetic field induces an Electromagnetic force

769. The electromagnetic force is proportional to the Rate of change of field
770. The induced emf always Opposes the change in the flux
771. The direction of induced emf is given by Lenz's law ● $\varepsilon = -N (\Delta\varphi)/\Delta t$
772. An earthquake is a shaking of the earth surface, known as the Crust
773. The device used to measure earthquakes are called Seismometer
774. One kind of seismometer is called inertial because it is based on Newton's 1st law
775. The location where rupture begins and energy is released is called Focus of an earthquake
776. Some seismometer works on principal of Electromagnetic induction
777. The magnitude of emf in seismometer is proportional to the velocity of relative motions and strength of magnet used and Number of turns in coil
778. Lenz's law is convenient method to find Direction of induced emf or current
779. Lenz's law explain us Faraday's law
780. Induced current will flow in such direction that oppose the cause that produce it Lenz's law statement
781. Lenz's law is the consequence of the Law of conservation of energy
782. The mechanical energy spent in over coming of opposition is converted into Electrical energy(appears on coil)
783. To find the direction of the induced e.m.f we use Fleming's right hand rule
784. The lenz's law refers to induce currents not to Induced emf
785. Current carrying coil produce magnetic field similar to that of Bar magnet
786. By faraday's da whenever a conductor is placed in a varying magnetic field, EMF is induced in the conductor and this EMF is called Induced EMF
787. Induced emf Is of two types, dynamically induced EMF and Statically induced EMF
788. When the conductor is moved in a stationary magnetic field in such a way that the flux linking it changes its magnitude, this EMF is called Dynamically induced EMF
789. When the conductor is stationary and the magnetic field is moving or changing then the EMF induced is called Statically induced emf
790. An example of dynamically induced emf is Dc generator
791. An example of induced emf is Transformer
792. Rate of production of electrical energy = εI
793. The emf induced in the coil due to the change of its own flux linked with it is called Self-induced emf
794. The self-induced emf opposes the change of current in the coil which is known as Self-inductance or inductance
795. the self-inductance or inductance is given by $\varepsilon = -(\Delta N\Phi)/\Delta t$ and $\varepsilon = -L(\Delta I)/\Delta t$
796. The unit of Self-inductance is given by $L = \varepsilon(\Delta t)/\Delta I) = L = N\Phi/I$ L=1H= VAs-1
797. If induced emf is caused by increasing current the its direction is always opposite to increasing the current
798. Direction of self-induced emf is opposite to that of the Applied voltage
799. If emf is induced due to decreasing current then its direction is always Same is that of applied voltage
800. In fact, that affects magnetic field is also effects the Inductance of the coil
801. Inductance of the coil is increased by increasing the Number of turns
802. Inductance is increased by substituting an iron core for Air core
803. The property of the two neighbouring coils to induce voltage in one coil due to change of current in the other is called Mutual inductance
804. The magnitude of mutually induced emf is given by $\varepsilon = (\Delta N\Phi)/\Delta t$

805. The emf induced in a coil due to the changing current in the neighbouring coil is called Mutually induced emf
806. Mutually induced emf in coil B is directly proportional to the rate of current in coil in Coil A
807. The mutually induced emf is given by $M=N\Phi /I$
808. A force resisting the rotation would be generated is called Eddy currents
809. Heat would be generated by the induced current in cylinder is called Eddy current

Chap No.16 ELECTRONICS

Semi-Conductor

810. The basis of integrated circuit is transistor.
811. A Perfect, pure semiconductor crystal containing no impurities is called an intrinsic semiconductor.
812. A semiconductor is considered to be pure when there is less than one in a billion host atoms.
813. Free electrons does not exists in semiconductors
814. Semiconductor near OK cannot conduct electricity and behave as a perfect insulator.
815. The electrons completely occupy the valence bond leaving the conduction band vacant.
816. The band gap energy Eg is the minimum amount of energy required to excite an electron from valence bond to conduction band.
817. The band gap energy is the characteristic of the material.
818. The number of electrons excited to the conduction band depends on the amount of thermal energy received by the crystal.
819. The charge on hole is +e and its mass is equal to that of an electron me.
820. In pure semiconductor, a single event of bond breaking leads to two carriers, namely an electron and a hole.
821. The thermal generation is one of the possible generation for the pair generation.
822. The number of electron generated is equal to number of hole generated, N=P=Ni.
823. Ni is called intrinsic density or intrinsic concentration.
824. In intrinsic semiconductor, free electrons and hole are generated by excitation of electrons from valence band to conducting band.
825. An addition of impurity to intrinsic semiconductor is called doping.
826. The impurity added is called dopant.
827. A semiconductor doped with impurity is called extrinsic semiconductor.
828. Pentavalent and trivalent atoms are used as dopant.
829. The impurities do not cause any distortion in the original crystal lattice structure.
830. The two types of extrinsic semiconductors are;
    a) N-Type semiconductor → electrons in majority → pentavalent dopant
    b) P-Type semiconductor → holes in majority → trivalent dopant
831. The impurity atoms which contribute electrons to the conduction band inn N=type semiconductor is called donor atoms.
832. The impurity atoms which accept electrons from the valence band are known as acceptor atoms in P=type semiconductor.
833. The impurity is immobile and hole and electron can move freely.

PN Junction

834. Junction diode is formed by placing P=type semiconductor with N=Type semiconductor.
835. PN junction has special properties like rectification.
836. At the junction, electrons from N=type fill the vacancies in P=region, thus negative and positive ions are formed.
837. The electric field is from positive to negative ions and from N to P type region.
838. The junction in PN junction is also called depletion region or depletion layer or potential barrier or region with potential or potential wall or potential barrier.

839. When P is connected to and N to negative then potential increases and junction decreases.
840. At knee voltage, majority charge carriers cross the junction and the current flows, this is called forward bias and current is called forward bias.
841. When P is connected to negative and N to positive then the depletion increases.
842. The biasing in current flows due to minority charge carriers is called reverse bias and current is called reverse current .
843. The reverse current is in order of few micrometer.
844. The knee voltage for germanium ad silicon is 0.3V and 0.7V.
845. If voltage is increased, due to available energy, covalent bond break and large number of electrons are released, this cause sudden increase in current called Zener effect.
846. If reverse bias is increased further, minority charge carriers attain high velocity and knock down the bound electrons from covalent bond and the current increases, this is called Avalanche effect.
847. Using Zener effect and Avalanche effect, zener diodes are formed.
848. Electric field across the junction prevent the diffusion of majority carriers.
849. However electric field has right direction for the minority carriers.
850. Electrons arriving at the junction from the bulk of P-region are assisted by the electric field to move into N-region.
851. Holes of N-region are also helped to move into P-region.
852. The current caused by electric field is called drift current.
853. Idrift = Ie + Ih
854. The minority charge carriers are generated through breaking of covalent bonds.

Rectification

855. The conversion of AC into DC is called rectification and the device used is called rectifier.
856. Diode provide inexpensive mean of rectification.
857. When diode is in forward bias it allows the current to pass, but when in reverse bias it stops the flow of current.

Half wave rectifier

858. Transformer coupling provides two advantages;
    a) For knee voltage
    b) Prevent shock hazard
859. Only one half of wave is rectified in half wave rectifier.
860. Peak inverse voltage (PIV) is the maximum voltage Vmax that the rectifying diodes has to withstand, when it is reversed biased.
861. Half wave rectifier allows current through the load only during one half of the cycle.
862. PIV = Vmax

Full wave rectifier

863. One type of full wave rectifier, called center-tap design, uses transformer with center-tapped secondary winding and two diodes in alternate switching mode.
864. A full wave rectifier allows unidirectional or one way current through entire input cycle.
865. One disadvantage of center taped full-wave rectifier design is necessity of trnsoermer with center-tapped secondary winding.

Transistor

866. A transistors consist of three region of doped semiconductors on which the current flowing is modulated by the voltage or current applied to one or more electrodes.
867. Modern transistors are of two types;
    a) Bipolar
    b) Unipolar
868. The function of bipolar depends upon both majority and minority carriers.
869. The function of unipolar transistors depends upon majority charge carriers.

870. Field effect transistor is example of unipolar transistor.

871. Bipolar transistor is also called bipolar junction transistor (BJTs).

872. The transistors may be;

a) PNP → holes in majority

b) NPN → electrons in majority

873. The three regions of transistor are;

a) Emitter → highly doped

b) Base → lightly doped

c) Collector

874. The base is usually thin.

875. The emitter junction is forward biased and collector junction is reverse biased.

876. Most of the charges are collected by collector.

877. Some charges which cannot reach to collector move via base.

878. IE = IB + IC

879. NPN transistor is preferred because mobility of electrons is three times more than that of holes and therefore the operation is faster.

Types of configuration

880. In a transistor circuit, one electrode is common to both input and output circuits.

881. There exists three types of configuration;

a) Common base configuration (CB)

b) Common emitter configuration (CE)

c) Common collector configuration (CC)

Common Base Configuration

882. Input characteristics = ΔIE /ΔVBE const. VCB

883. Output characteristics = ΔIC /Δ VCB const. IE

884. The output characteristic has three regions of characteristics;

a) Saturation region

b) Active region

c) Saturation region

885. Alpha factor; αstatic = IC / iE → αdynamic = ΔIC / ΔiE

886. Beta factor/current gain/current amplification factor; βstatic = = IC / iB → αdynamic = ΔIC / ΔiB

Chap 17 DAWN OF MODERN PHYSICS

887. $E = m_0 c^2$

888. $L = L_0 \sqrt{\frac{1=v2}{c2}}$

889. $T = t_0 \sqrt{\frac{1=v2}{c2}}$

890. $M = m_0 \sqrt{\frac{1=v2}{c2}}$

891. $\lambda_{max} T = 0.2898 \times 10^{-2}$ m k (Wein's displacement law)

892. $E = \sigma T^4$ (Steffan-Bolts Law)

893. $\sigma = 5.67 \times 10^{-8}$ $Wm^{-1} K^{-4}$

894. E = n h f

895. $K.E_{max} = e V_0$

896. $K.E_{max} = h f - \Phi$
897. $H f_0 = \Phi = \frac{hc}{\lambda}$
898. $K.E_{max} = hf - Hf_0$
899. $Hf = K.E + hf'$
900. $P = \frac{E}{c}$
901. $\Delta\lambda = \frac{E}{m0\ c}$ 1-cos θ
902. $\frac{1}{f'} = \frac{1}{f} + \frac{E}{m0\ c}$ 1-cos θ
903. $E_{photon} = E_{electron} + E_{positron}$
904. Photon rest mass energy = $2m_0c^2 = 1.02$ MeV
905. $\frac{h}{fc} = mv_{e-} + mv_{e+}$
906. $\lambda = \frac{h}{p} = \frac{h}{mv}$
907. $\Delta p = \frac{h}{\lambda}$ and $\Delta x = \lambda$
908. $(\Delta p)(\Delta x) = h$
909. $(\Delta E)(\Delta t) = h$

Chap No.18 ATOMIC SPECTRA

910. The electron stays in higher energy state after excitation for 10^{-8}s and fall back to its lower energy state.
911. A photon is a particle of light having wave characteristics.
912. The frequency of emitted radiation or photons is equal to the frequency with which the electron bounces back and forth between the higher and the lower energy state.
913. Solid, liquids and dense gases gives us line spectrum.
914. The emission spectrum of gas is, discrete, having line spectrum.
915. The wavelengths contained in a given line spectrum are characteristics of the elements emitting light.

The Spectrum of Hydrogen Atom

916. The hydrogen gives bluish-red light in discharge tube.
917. The spectrum of hydrogen atoms consists of a series of lines.
918. The line spectrum of hydrogen includes in;
    - Lyman
    - Balmer
    - Paschan
    - Bracket
    - Pfund
919. The wavelength of line spectrum is given by; $\frac{1}{\lambda} = R\left(\frac{1}{P2} - \frac{1}{n2}\right)$
920. $R = E_0 / hc = 1.097 \times 10^7 m^{-1}$.

Bohr Model of the Hydrogen atom

921. The centripetal force is equal to coulomb force.
922. Only those angular orbital is possible for which angular momentum is an integral multiple of $h/2\pi$.

$\rightarrow mvr = nh/2\pi$.

923. h = planks constant = 6.6256×10^{-34} j s.

924. $E = hf = E_n - E_p$

Energy and Radius

925. $r_n = \frac{n2\ h2}{4\ \pi\ k\ m\ e2}$

926. $E_n = -\frac{2\ \pi2\ \ 2\ k\ m\ e4}{n2\ h2}$

927. $E_n = -\frac{E0}{n2} = 2.17 \times 10^{-18}$ j/ $n^2 = +13.6$ ev/ n^2

928. $r_n = n^2 r_1 \rightarrow r_1 = 0.53\ ^0A$.

929. $1\ ^0A = 10^-$ m

930. $2\pi r = n\lambda$

931. Bohr's Model explains hydrogen, single ionized helium and doubly ionized lithium.

932. A spectral line was found to split into a number of lines under the influence of magnetic field (Zeeman Effect) and electric field (Stark Effect).

933. Bohr's Model can't explains Zeeman Effect and Stark Effect.

Excitation and Ionization Potential

934. The energy required to move electrons from its ground state to an excited state is known as excitation energy.

935. The first excitation energy is $E_2 - E_1$ which is 10.2 eV_0.

936. The second excitation energy is $E_3 - E_1$ which is 12.1 eV_0.

937. The third excitation energy is $E_4 - E_1$ which is 12.75 eV_0.

938. The potential difference V in volts applied to an electron in its round state to get an amount of energy equal to the excitation energy of the electron in the atoms is called excitation potential of the atom.

939. The first and second excitation potential of H-atom are respectively 10.2 V and 12.1 V.

940. The ionization energy of the atom is numerically equal to the ground state energy of the atom.

941. The ionization energy for H-atom is 13.6 eV. $(0-(-E_0))$.

Inner shell Transition and Characteristic W-Rays

942. The transitions of the electron in hydrogen atoms results in the emission of spectral lines in the infrared, visible or ultraviolet region of electromagnetic spectrum due to small energy difference in the transition levels.

943. When a heavy target material is bombarded with a beam of electrons, that has been accelerated by several k eV. Some electrons will collide with inner-shell electrons of the target and knock them out of their respective atoms.

944. An x-ray photon due to transition from L-shell to the vacancy in the K-shell is called K_α characteristic x-rays.

945. The transition from N-shell and K-shell gives rise to K_β and K_γ characteristics x-rays respectively.

946. According to classical theory of electromagnetism, an accelerated charge emits radiation called Bremsstrahlung, a German word meaning braking radiation.

947. The Bremsstrahlung is called continuous x-ray.

948. When an electron losses all of its energy in a single collision. $eV \rightarrow hf_{max} = hc/\lambda_{min}$

949. $\lambda_{min} = hc/eV$

Lasers

950. The term laser means Light Amplification by Stimulated Emission of Radiation.
951. Laser produces an intense and highly parallel beam of coherent light.
952. The first laser was fabricated by T.H.Maiman in 1960.

Spontaneous and Stimulated Emission

953. The excited atom wait for a brief period of about 10^{-8} s and then spontaneously back to its lowest energy state, emitting light or photon of energy exactly equal to ΔE.
954. The photon can stimulate the excited electron to fall back to the lowest energy state, instead of the excited electron waiting for 10^{-8} s for its spontaneous transition.

Population Inversion and Laser Action

955. The atom can reside in excited state for 10^{-8} s.
956. The atom can reside in metastable state for 10^{-3} s
957. A metastable state is an excited state electron in unusually stable and form which the electron spontaneously falls to lower state only after relatively longer time.
958. Instead of direct excitation to metastable state, the electrons are excited to higher level for spontaneous falls to metastable state.
959. Metastable state contains more electrons than excited state and this situation is called population inversion.
960. Once the population inversion has been reached, the lasing action of a laser is simple to achieve.
961. The atoms in the metastable state (E_2) are bombarded by photons of energy $hf = E_2 - E_1$, resulting in an induced emission, giving an intense, coherent beam in the direction of the incident photon.

Chap No.19 NUCLEAR PHYSICS

Atomic Nucleus

962. Nucleus and protons are about 1840 times more massive than electrons.
963. Protons and neutrons are collectively called nucleons.
964. The nucleus was first discovered in 1922 by Rutherford and his student Geiger and Marsden.
965. Nuclear size is of the order of 10^{-14} m.
966. The mass of the nucleus is of the order of 10^{-27} kg.
967. The diameter of atomic nucleus is 10,000 times smaller than the diameter of the atoms.

Isotopes

968. All atoms of the same element contain the same number of protons in the nucleus of each atom.
969. Uranium has two isotopes:
    - $_{92}U^{235} \rightarrow 0.7\%$
    - $_{92}U^{238} \rightarrow 99.3\%$
970. Carbon atoms has four isotopes:
    - $_{6}C^{11}$
    - $_{6}C^{12}$
    - $_{6}C^{13}$
    - $_{6}C^{14}$
971. Hydrogen has three isotopes:

- $_1H^1$
- $_1H^2$
- $_1H^3$

972. Chemical properties of an element are the same for all the isotopes of the elements.

Mass Spectrograph:

973. Spectrograph is a device which not only the isotopes of any elements can e separated from one another but their masses can also be determined quite accurately.
974. A mass spectrograph is based upon the principle that a beam of ions moving through electric and magnetic fields suffers a deflection that depends upon the charge and masses of the ions.
975. One electron is removed from the particles, leaving with a net positive charge.
976. The positive ion is accelerated through a potential difference V applied between two slits.
977. The kinetic energy of charged ion is given by:
→ $½ mv^2 = Vq$
978. The centripetal force applied by magnetic fields is given by:
→ $Bqv = mv^2/r$
979. The detector records the number of ions arriving per second.
980. $Bqv = mv^2/r \rightarrow m = Bqr/v$
981. $½ mv^2 = Vq \rightarrow v^2 = 2Vq/m$
982. So $m = qr^2B^2/2V$
983. Ions of different masses will strike the photographic plate at different places, so, therefore, different isotopes, can be separated from one another.

Mass defect and binding energy

984. The protons and neutrons in a nucleus are held together by a strong attractive force that prevents the protons pushing away from one another.
985. The work needed to separate a nucleus into separate neutrons and protons is referred to as the binding energy of the nucleus.
986. The greater the binding energy of a nucleus, the greater the work that would be needed to separate the neutrons and the protons in the nucleus from each other.
987. The mass of a nucleus is less than the mass of the same number of separate neutrons and protons.
988. The difference is called the mass defect of the nucleus and is due to the protons and neutrons binding together when nucleus was formed.
989. Binding energy = mass defect x c^2.
990. The binding energy per nucleon of a nucleus is the binding energy of a nucleus divided by the number of nucleons in the nucleus.
991. The mass defect of the nucleus is;
→ $\Delta m = Zm_p + Nm_n - M_{(A,Z)}$
992. The binding energy in MeV is 931 x Δm.
993. The binding energy per nucleon = E_b/A.
994. Greater the bond energy, more stable the nucleus is.
995. Binding energy increases with increase in mass number (A).
996. Binding energy is maximum at mass number 50-60.
997. The binding energy per nucleons is increased when light nuclei are fused together.
998. When uranium breaks into fragments, the binding energy per nucleon increases from about 7.5 MeV per nucleon for Uranium to about 8.8 MeV per nucleon for the fragments.

Radioactivity

999. The phenomenon of the spontaneous disintegration of heavier elements Z > 82 in to lighter elements along with the emission of three types of radiations is called radioactivity.
1000. Radioactivity was discovered accidentally discovered by Henry Becquerel in 1986 in Paris.
1001. Marie curie and her husband Pierre had discovered Radioactive radium and polonium.
1002. The three types of radiation are:
    - Alpha → α
    - Beta → β
    - Gamma → δ
1003. Alpha particle consists of two protons and two neutrons.
1004. Alpha particles are positively charged helium nuclei.
1005. Alpha radiation is easily stopped by clipboard.
1006. Alpha particle has a range in air of no more than a few centimeters.
1007. Alpha particle ionizes air molecules much more strongly than the other two types.
1008. Beta particles consist of electrons, each emitted when nucleus with too many neutrons disintegrate.
1009. A neutron decays into proton and electron.
1010. Beta particle is stopped by 5-10 mm of metal.
1011. Beta particle has range of about 1m.
1012. Beta particle ionize air molecules less stronger than alpha particle.
1013. Gamma radiation consists of high energy photons.
1014. A photon is a packet of electromagnetic waves.
1015. A gamma photon is emitted from a nucleus with surplus energy after it has emitted an alpha and beta particle.
1016. Gamma radiation is stopped only by a several cm or lead.
1017. Gamma radiation has infinite range in air.
1018. Gamma radiation ionizes air molecules very weakly.

Alpha Emission

1019. ${}_{z}X^{A} \rightarrow {}_{z-2}Y^{A-4} + {}_{2}He^{4+} + Q$
1020. ${}_{92}U^{238} \rightarrow {}_{90}Th^{234} + {}_{2}He^{4+} + Q$
1021. ${}_{88}U^{226} \rightarrow {}_{86}Rn^{226} + {}_{2}He^{4+} + Q$

Beta emission

1022. The process of beta emission involve no change in mass number.
1023. Beta particle may be negative electron or positive positron.
1024. ${}_{z}X^{A} \rightarrow {}_{z+1}X^{A} + {}_{-1}\beta^{0}$ + antineutrino + Q
1025. ${}_{z}X^{A} \rightarrow {}_{z-1}X^{A} + {}_{+1}\beta^{0}$ + neutrino + Q
1026. ${}_{90}Th^{234} \rightarrow {}_{91}Pa^{234} + {}_{-1}\beta^{0}$ + antineutrino + Q
1027. The prototype of beta decay is the decay of neutron itself.
1028. The proton decays into proton and electron with a half life of 12 minutes.
1029. ${}_{0}n^{1} \rightarrow {}_{1}H^{1} + {}_{-1}\beta^{0}$ + antineutrino

1030. Naturally occurring decay:
$\rightarrow {}_6C^{14} \rightarrow {}_7N^{14} + {}_1\beta^0$ + antineutrino
$\rightarrow {}_6C^{14} \rightarrow {}_5B^{11} + {}_{+1}\beta^0$ + neutrino

Gamma emission

1031. Most frequently the alpha and beta emission leaves the daughter nuclide in an excited state. Such a nuclide may go to stable state by emitting one or more gamma rays.
1032. Gamma rays are massless photons.
1033. ${}_zX^A \rightarrow ({}_zX^A)^* \rightarrow {}_zX^A + \gamma$

Half-life and rate of decay

1034. Polonium 212 is half-life of 3×10^{-7}s.
1035. Lead 204 is half-life of 1.4×10^7s.
1036. Half-life of radioactive C-14 is 5730 years.
1037. Half-life of radioactive U^{238} is 4.5×10^9 years.
1038. C-14 is leass stable than uranium-238.
1039. $\Delta N/\Delta t = -\lambda N$
1040. λ is called decay constant and is constant of proportionality.
1041. The value of λ for any isotope determines the rate at which that isotopes will decay.
1042. The decay rate or activity R, of a sample is defined as the number of decay per second.
1043. $R = -\Delta N/\Delta t = \lambda N$
1044. The number of nuclei present varies with time: $N = N_0 e^{-\lambda t}$
    - N → nuclei present
    - N_0 → nuclei at time t=o
    - e → 2.718
    - Process that obey this equation are said to undergo exponential growth. This is decay law of radioactive element.
1045. The unit of activity is curie(Ci), defined as: 1 Ci = 3.70×10^{10} decay/s.
1046. The SI unit of activity is Becquerel (Bq):
1047. 1 Bq = 1 decay per second
1048. 1 Ci = 3.70×10^{10} decay/s
1049. $\lambda T ½ = 0.693$
1050. The rate of radioactive decay is directly proportional to the stability of the isotope.
1051. As the time passes, the amount of substances decreases but never reached to zero.

Interaction of Alpha Radiation with Matter

1052. The distance travelled by alpha particle in a medium is called range of the particle.
1053. The range depends upon;
    - Charge, mass and energy of particle
    - Density of medium
    - Ionization potential of medium
1054. An alpha particle is 7000 more massive than electron.
1055. The alpha particle continues producing intense ionization along its straight path till it loses all its energy and comes almost to rest.
1056. Alpha particle captures two electrons from the medium and become a neutral helium atom.

Interaction of Beta Radiation with Matter

1057. The ionization energy of beta particle is 100 times less than alpha particle.
1058. The range of beta particle is 100 times more than alpha particle.
1059. Beta particles are easily deflected by collisions than heavy alpha particle.
1060. The range of beta particle is measured by the effective depth of penetration into the medium not by the length of erratic path.
1061. Alpha and beta particles both radiates energy as X-rays.

Interaction of Beta Radiation with Matter

1062. Photons of gamma rays are being uncharged cause little ionization.
1063. Photons are removed from a beam by either scattering or absorption in the medium.
1064. Gamma rays interact with matter in three distinct ways, depending upon their energy;
    A) Low energy (less than 0.5 MeV) → the dominant process removes photons from a beam is the photoelectric effect.
    B) Intermediate energy → the dominant process is Compton scattering.
    C) Higher energy (more than 1.02 MeV) → The dominant process is pair production.
1065. In air gamma rays intensity falls off as the inverse square of the distance from the source, in the same manner as light from a lamp.
1066. In solids, the intensity of gamma rays decreases exponentially with increasing depth of penetration into the material.
1067. The intensity I_0 of a beam after passing through a distance X in the medium is reduced to intensity I given by the relation $I=I_0e^{-\mu}$. Where μ is the linear absorption coefficient of the medium.
1068. Fluorescence is the property of absorbing radiant energy of high frequency and reemitting energy of low frequency in the visible region of electromagnetic spectrum.

Interaction of Neutrons Radiation with Matter

1069. Neutrons, being neutral particles, are extremely penetrating particles.
1070. To be slowed or stopped, a neutron must undergo a direct collision with a nucleus or some other particles that has mass comparable to that of neutron Materials such as water or plastics, which contain more low mass nuclei per unit volume are used to stop neutrons.
1071. Neutrons produce a little indirect ionization when they interact with materials containing H-atoms and knock out protons.

Radiation Detector
Geiger-Muller Counter

1072. Geiger-Muller Counter is the most common device used to detect radiations.
1073. Geiger-Muller Counter consists of a cylindrical metal tube filled with gas at low pressure and long wire along the axis of the tube.
1074. In Geiger-Muller Counter the wire is maintained at a high positive potential (about 1000V) with respect to the tube.
1075. When electrons are removed from the atoms are attracted towards the wire, and in the process they ionize other atoms in their path. This result is an avalanche of electrons, which produce a current pulse at the output of the tube.

Solid State Detector

1076. A solid state detector or semi-conductor diode detector is essentially a reversed –biased P-N junction.
1077. A P-N junction diode is a device which passes current readily when forward-biased and impedes the flow of current when reversed-biased.
1078. The internal electric field sweeps the electrons towards the side of the junction connected to positive side of the battery and the holes are swept towards the negative side. This creates a pulse of current.
1079. The duration of pulse is 10^{-7}s.

Nuclear Reactions

1080. It is possible to change the structure of nuclei by bombarding them with energetic particles.
1081. A collisions that change the identity or properties of the target nuclei, are called nuclear reactions.
1082. To convert u energy to MeV, multiply u by 931.

Nuclear Fission

1083. Emission of beta negative particle increase atomic number by one, more elements can be formed.
1084. Neutron bombardment can cause a uranium nucleus to break apart, producing two or more fragments of moderate and comparable size. This process was called nuclear fission.
1085. Only U-235 goes under fission reaction not U-238.
1086. There is decrease in mass in fission reaction so energy is released.
1087. One thermal neutron strikes a uranium nuclei, three neutrons are emitted.
1088. ${}_0n^1 + {}_{92}N^{235} \rightarrow {}_{36}Kr^{92} + {}_{56}Ba^{141} + 3{}_0n^1 + Q \rightarrow$ the decrease in mass is 0.215 u = 0.125 x 931 = 200 MeV
1089. When one atom undergoes fission 200MeV of energy is released.
1090. If 1g uranium which contain 10^{19} atoms undergoes fission, the energy released will be 200 x 10^{19} MeV = 3.2 x 10^8 j.
1091. 1kg of uranium delivers as much energy as the combustion of about 3000 tons of coal.

Fission chain reaction

1092. Fission chain reaction is principle of atomic bomb.
1093. When one uranium atom undergoes fission it releases 3 neutrons.
1094. If more than one neutrons is able to cause the neutrons, it will cause more neutrons rapidly.
1095. The mass of uranium must be greater than some minimum mass called the critical mass or critical size.

Fusion Reaction

1096. Experimental research reactor called tokamaks used for fusion.
1097. When two light nuclei combine to form a heavier nucleus, the process is called nuclear fusion.
1098. The energy liberated in the fusion of light nuclei into heavier ones is often called thermonuclear energy.
1099. The basic exothermic reaction in stars, including our own sun and hence the source of nearly all of the energy in the universe – is the fusion of hydrogen nuclei into helium nucleus.

Proton Proton Cycle

${}_1H^1 + {}_1H^1 \rightarrow {}_1H^2 + e^+ + v$

${}_1H^1 + {}_1H^2 \rightarrow {}_2He^3 + \gamma$

$_2He^3 + _2He^3 \rightarrow _2He^4 + _1H^1 + _1H^1$

→ the energy liberated is 24.7 MeV.

Carbon Cycle

$_1H^1 + _6C^{12} \rightarrow _7N^{13}$

$_7N^{13} \rightarrow _6C^{13} + e^+ + v$

$_1H^1 + _6C^{13} \rightarrow _7N^{14} + \gamma$

$_1H^1 + _7N^{14} \rightarrow _8O^{15} + \gamma$

$_8O^{15} \rightarrow _7N^{15} + e^+ + v$

$_1H^1 + _7N^{15} \rightarrow _6C^{12} + _2He^4$

→ the energy released in carbon cycle is 24.7 MeV.

1100. Carbon carbon cycle is more efficient at high temperature.
1101. Proton proton cycle is more efficient at low temperature.
1102. Stars hotter than sun obtain their energy from carbon carbon cycle.
1103. Stars cooler than the sun obtain their greater energy from proton proton cycle.

Basic forces of Nature

1104. All particles in nature are subjected to four fundamental forces:
    - Strong
    - Electromagnetic
    - Weak
    - Gravitational
1105. The strong force is very short-ranged and is responsible for the building of neutrons and protons into nuclei.
1106. The strong force is very short-ranged and is negligible for separation greater than 10^{-14}m.
1107. The electromagnetic force, which is about 10^{-2} times the strength of the strong force, is responsible for the binding of atoms and molecules.
1108. The electromagnetic force is long-range that decrease in strength as the inverse square of the separation between interacting particles.
1109. Force:
    - Strong → short-range
    - Weak → short-range
    - Electromagnetic → long-range
    - Gravitational → long-range
1110. The weak force is short-range nuclear force that tends to produce instability in certain nuclei.
1111. The weak force is responsible for most radioactive decay processes such as beta decay.
1112. The strength of weak force is 10^{-9} time that of the strong force.
1113. Weak and electromagnetic forces are two manifestations of a single force called the electro weak force.
1114. The gravitational force is about 10^{-38} times that of strong force.
1115. Gravitational force is the force that holds the plants, stars and galaxies together.
1116. The effect of gravitational force on elementary particle is negligible.
1117. The gravitational force is the weakest of all the fundamental forces.
1118. Electromagnetic force is mediated by photons, which are the quanta of the electromagnetic field.

1119. The strong force mediated by field particle called gluons.
1120. The weak force is mediated by particles called the w and z bosons.
1121. The gravitational force is mediated by quanta of the gravitational field called gravitons.

Classification of particles

1. Hydrons
   a) Mesons
   b) Baryons
2. Leptos
   a) Electrons
   b) Muons
   c) Neutrinos
   → All these are less massive than lightest hydrons.
3. Quarks
   a) Up (u)
   b) Down (d)
   c) Top (t)
   d) Bottom (b)
   e) Strange (s)
   f) Charmed (c)

	U	T	**+2/3e**
S			C
-1/3e	D	B	

1122. The charge on u,t and c, in term of electron is +2/3e.
1123. The charge on s,t and b in term of electron is -1/3e.
1124. Particles that interact through strong forces are called hadrons.
1125. Meson has the mass between electron and proton.
1126. All mesons are known to be decay finally into:
   - Electrons
   - Positrons
   - Neutrinos
   - Photons.

   →The pion is the lightest of mesons.
1127. Baryons have mass equal or greater than proton mass.
1128. Protons and neutrons are included in the baryon family.
1129. With exception of the proton, all baryons decay in such a way that the end products include a proton.
1130. Leptons are group of particles that participate in the weak interaction.
1131. Lepton has no internal structure, they appear to be truly elementary particles.
1132. Scientists believe that there are only six leptons.
1133. The quark theory was initiated by M.Gell-Mann and GZweig.
1134. The quarks are proposed as the basic building blocks of the mesons and baryons.
1135. For every type of quark, there is a corresponding antiquark.
1136. Quarks combine in threes to form particles like protons and neutrons.

1137. Antiquarks combine in threes to form antiparticles like the antiproton and antineutron.
1138. A meson consists of a quark and antiquark.
1139. An antiquark carries an equal and opposite charge to its corresponding quark.
1140. The symbol for quark is the same as for a quark but with a bar over the top.
1141. A proton is composed of two up quarks and a down quark. 2U→D.
1142. A neutron consists of an up quark and two down quarks. U ←2D.