SUBJECT : PHYSICS

Question Bank for 10+1 and 10+2 students for subject of Physics is hereby given for practice. While preparing the questionnaire emphasis is given on the concepts, sort answer type questions, numerical problems in accordance with the syllabus prescribed by Punjab School Education Board so that it can help students from the examination point of view. We hope that you might appreciate this question bank.

Suggestions, constructive criticism of the question bank are always welcome.

With Regards,

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10+1 (PHYSICS)

Time: 3 Hours

Theory: 50 Marks
Practical: 20 Marks
C.C.E.: 30 Marks
Total: 100 Marks

STRUCTURE OF QUESTION PAPER (Theory)

1. *There will be one theory paper comprising of 26 questions. The student has to attempt total 20 questions out of 26 as per the directions given below:*
2. *Question no. 1 to 5 will be of one mark each.*
3. *Question no.6 to 14 will be of two marks each. Candidate can attempt any 6 questions out of 9 questions.*
4. *Question no. 15 to 23 will be of three marks each. Candidate can attempt any 6 questions out of 9 questions.*
5. *Question no. 24 to 26 will be of five marks each. There will be internal choice in them.*

Unit I – Physical World & Measurement : 02 Marks
Unit II – Kinematics : 07Marks
Unit III – Laws of Motion : 07 Marks
Unit IV – Work, Energy & Power : 04 Marks
Unit V – Motion of System of particles & Rigid Body : 04 Marks
Unit VI – Gravitation : 04Marks
Unit VII – Properties of Bulk Matter : 07 Marks
Unit VIII – Thermodynamics : 04 Marks

Unit IX – Behaviour of Perfect Gas & Kinetic Theory of gases : 04 Marks

Unit X - Oscillations and Waves : 07 Marks

UNIT	Title	1 Mark Question	2 Marks Question	3 Marks Question	5 Marks Question	Total Marks
1	Physical World and Measurement	-	1	-	0	2
2	Kinematics	-	1	-	1	7
3	Laws of Motion	-	1	-	1	7
4	Work , Energy and Power	1	-	1	-	4
5	Motion of System of particles & Rigid Body	1	-	1	-	4
6	Gravitation	1	-	1	-	4
7	Properties of Bulk Matter	-	1	-	1	7
8	Thermodynamics	1	-	1	-	4
9	Behaviour of Perfect Gas & Kinetic Theory of gases	1	-	1	-	4
10	Oscillations and Waves	-	2	1	-	7
	Total Questions	5	6	6	3	20
	Total Marks	5	12	18	15	50

SYLLABUS

(THEORY)

Unit I: Physical World and Measurement

Physics - scope and excitement; nature of physical laws; Physics, technology and society.
Need for measurement: Units of measurement; systems of units; SI units, fundamental and derived units. Length, mass and time measurements; accuracy and precision of measuring instruments; errors in measurement, significant figures.Dimensions of physical quantities, dimensional analysis and its applications.

Unit II: Kinematics

Frame of reference. Motion in a straight line: Position-time graph, speed and velocity. Uniform and non-uniform motion, average

speed and instantaneous velocity.Uniformly accelerated motion, velocity-time, position-time graphs, and relations for uniformly accelerated motion (graphical treatment). Elementary concepts of differentiation and integration for describing motion, Scalar and vector quantities: Position and displacement vectors, general vectors and notation, equality of vectors, multiplication of vectors by a real number; addition and subtraction of vectors. Relative velocity. Unit vector: Resolution of a vector in a plane - rectangular components. Scalar and vector product of vectors.Motion in a plane.Cases of uniform velocity and uniform acceleration-projectile motion.Uniform circular motion.

Unit III: Laws of Motion

Intuitive concept of force.Inertia. Newton's first law of motion; momentum and Newton's second law of motion; impulse: Newton's third law of motion. Law of conservation of linear momentum and its applications.Equilibrium of concurrent forces. Static and kinetic friction, laws of friction, rolling friction, lubrication.
Dynamics of uniform circular motion: Centripetal force, examples of circular motion (vehicle on level circular road. vehicle on banked road).

Unit -IV Work, Energy and Power

Work done by a constant force and a variable force; kinetic energy, work-energy theorem, power. Notion of potential energy, potential energy of a spring, conservative forces: conservation of mechanical energy (kinetic and potential energies); non- Conservative forces, motion in a vertical circle; elastic and inelastic collisions in one and two dimensions.

Unit-V Motion of System of Particles and Rigid Body

Centre of mass of a two-particle system, momentum conversation and centre of mass motion. Centre of mass of a rigid body; centre of mass of uniform rod.

Moment of a force, torque, angular momentum, conservation of angular momentum with some examples.Equilibrium of rigid bodies, rigid body rotation and equations of rotational motion, comparison of linear and rotational motions; moment of inertia, radius of gyration.Values of moments of inertia for simple geometrical objects (no derivation).Statement of parallel and perpendicular axes theorems and their applications.

Unit-VI Gravitation

Kepler's laws of planetary motion.The universal law of gravitation.Acceleration due to gravity and its variation with altitude and depth.Gravitational potential energy; gravitational potential.Escape velocity, Orbital velocity of a satellite.Geo-stationary satellites.

Unit-VII Properties of Bulk Matter

Elastic behaviour, Stress-strain relationship, Hooke's law, Young's modulus, bulk modulus, shear, modulus of rigidity, Poisson’s-ratio; elastic energy

Pressure due to a fluid column Pascal's law and its applications (hydraulic lift and hydraulic brakes).Effect of gravity on fluid pressure.

Viscosity, Stokes' law, terminal velocity, Reynolds’s number, streamline and turbulent flow.Critical velocity.Bernoulli's theorem and its applications.

Surface energy and surface tension, angle of contact, excess of pressure, application of surface tension ideas to drops, bubbles and capillary rise.

Heat, temperature, thermal expansion; thermal expansion of solids, liquids and gases, anomalous expansion, specific heat Capacity: C_p, C_v ,calorimetry; change of state-latent heat.

Heat transfer-conduction, convection radiation and thermal Conductivity, Qualitative idea of Blackbody radiation, Newton's law of cooling and Stefan’s law, Wien’s displacement law, Green House effect.

Unit-VIII Thermodynamics

Thermal equilibrium and definition of temperature (zeroth law of thermodynamics).Heat, work and internal energy.First law of thermodynamics.Isothermal and adiabatic processes. Second law of thermodynamics: reversible and irreversible processes.
Heat engines and refrigerators.

Unit-IX Behaviour of Perfect Gas and Kinetic Theory

Equation of state of a perfect gas, work done on compressing a gas.Kinetic theory of gases.Assumptions, concept of pressure. Kinetic energy and temperature; rms, speed of gas molecules; degrees of freedom, law of equipartition of energy (statement only) and application to specific heat capacities of gases: concept of mean free path, Avogadro's number.

Unit-X Oscillations and Waves

Periodic motion - period, frequency, displacement as a function of time. Periodic functions. Simple harmonic motion (S.H.M) and its equation; phase; oscillations of a spring restoring force and force constant; energy in S.H.M.-kinetic and potential energies: simple pendulum-derivation of expression for its time period: free, forced and damped oscillations (qualitative ideas only), resonance. Wave motion. Longitudinal and transverse waves, speed of wave motion. Displacement relation for a progressive wave. Principle of superposition of waves, reflection of waves, standing waves in strings and organ pipes, fundamental mode and harmonics, Beats, Doppler effect.

UNIT-I
PHYSICAL WORLD AND MEASUREMENT

2 marks questions

1. What is physics? Why it is called exact science?
2. What is electromagnetic force and nuclear force?
3. What is standard unit? What are characteristics of standard unit?
4. What necessitated the selection of some fundamental units?
5. Distinguish between fundamental units and derived units.
6. Name the basic and supplementary units of SI?
7. Write any 5 rules and conventions of writing units.
8. Define light year, parsec and astronomical unit.
9. Why we use a platinum iridium alloy in making prototype meter and kilogram?
10. What are advantages of SI system?
11. How much larger than the nanosecond is microsecond?
12. How many angstroms are there in one nanometer?
13. The mass of an electron is 9.11×10^{-31} kg. How many electrons make one gram?
14. How many quintals are there in 2 gigagram?
15. How many light years are there in one parsec?
16. Express parsec and light year in terms of AU?
17. How much larger than a nanosecond is a millisecond?
18. What is difference between mN, Nm and nm?
19. Express 0.35Å in m and nm.
20. What is parallax and parallax angle?
21. How will find the distance of distant star using parallax method?
22. What does RADAR stands for?Which types of waves are used in RADAR?
23. What does SONAR stands for?Which types of waves are used in SONAR?
24. Explain the use of RADAR and SONAR.
25. Explain the triangulation method to find the distance of inaccessible object.
26. Explain how you will determine the radius of an atom by Avogadro's hypothesis.
27. Name the unit used to measure the size of a nucleus and measure it in meters.
28. Distinguish between mass and weight.

29. State the principle of homogeneity of dimensions. What are its uses?
30. What are limitations of dimensional analysis?
31. Can a quantity have units but still be dimensionless?Give example.
32. Can a quantity have dimensions but still have no units? Give example.
33. Find the value of 20N in a system when mass is 1 kg, length is 10cm and time is 5 min.
34. Check the dimensional consistency in the following cases:

(a) $mgh = \frac{F.v}{t} - \frac{1}{2}mv^2$

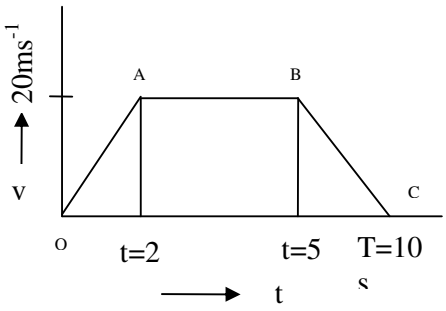
(b) $\tan\theta = \frac{v^2}{rg} - \cos\theta$

35. Check the correctness of the relation $\nu = \frac{1}{2l}\sqrt{\frac{T}{m}}$ where m is mass per unit length, T is tension; l is length of vibrating string and ν is frequency of the string.
36. A body of mass m is moving in a circle of radius r with angular velocity ω. Find the expression for the centripetal force F acting on it using methods of dimensions.
37. Check the accuracy of relation $\tau = I\alpha$
38. If $x = a + bt + ct^2$, where x is meters and t is in seconds. What are the units of a, b, c?
39. What is meant by significant digits? State the rules of finding significant figures.
40. Solve with due regard to significant figures ; (i) 36.7-10.04, (ii) $(3.0\times 10^{-6}) + (4.2\times 10^{-4})$
41. Which of the following measurements is most accurate and why?
    (i) 20.0 g (ii) 0.0002 g (iii) 2.0 g.
42. State the number of significant figures in the following:
    0.5032 , 2.43×10^{24} kg, 3.000 m
43. Subtract 7.9×10^5 from 8.3×10^{-4} with due regard to significant figures.
44. What do you understand by absolute error and relative error?
45. A potential difference V= (20 ± 1) V is applied across a resistance R= (8±2) Ω. Find the value of current with limits of error.
46. A physical quantity P is given by $P = a^3b^2c\,d^{1/3}$ the percentage error of measurement in a, b, c and d are 1%, 2%, 4% and 3% respectively. What is the percentage error in the quantity P?

UNIT- II
KINEMATICS

2 marks questions

1. Rest and motion are relative terms. Explain.
2. Distinguish between distance and displacement.
3. Distinguish between speed and velocity.
4. How will you represent uniform motion on position-time graph? What is use of such graph?
5. How will you represent uniform motion on velocity-time graph? What is use of such graph?
6. Show that area under velocity time graph for uniform accelerated motion represent distance travelled.
7. Derive the equation of displacement in the nth second of the motion.
8. Can a speed of a body change if its velocity is constant?
9. Can a velocity of a body change if its speed is constant? Give example.
10. Under what condition will the distance and displacement of moving object will have the same magnitude.
11. A car covers first half of the total distance with a speed of 72 km/h and second half with a speed of 36 km/h. find the average speed of the car.
12. A train 110 m long is moving with a velocity of 72 km h^{-1} Find the time it takes to cross the bridge 1 km long?
13. A car moving on a straight road with a speed of 72km/h is brought to rest after 100m. Calculate (i) acceleration of the car and (ii) time taken to come to rest.
14. A body moving with uniform acceleration describes 20m in 2^{nd} second and 30 m in 5^{th} second of its motion. Calculate the distance covered by it in 8^{th} second.
15. A body travels half the total distance in the last second during free fall. Find its height from the ground and the total time of free fall. (Ans: 57 m, 2.4 s).
16. The velocity time graph of an object moving along a straight line as shown. Calculate the distance covered by the object between t=0 to t=10s.



17. Distinguish between scalar and vector quantities giving examples of each type.

18. Is a quantity which has a magnitude and direction always a vector? Give examples.
19. What is an essential condition for adding two vectors?
20. Can commutative law is applicable to vector subtraction?
21. Show that the flight of a bird be an example of composition of vectors?
22. What is meant by resolution of vectors?Can a vector be zero, if one of its components is not zero?
23. What is the angle between a 2N force and 3N force, so that their resultant is 4N?
24. Two equal forces are acting at a point with an angle of 60° between them. If the resultant force is equal to $20\sqrt{3}$N. Find the magnitude of each force.
25. Two forces have magnitude in the ratio 5: 12. If the angle between them is 90^o , they give the resultant of magnitude 26 N. Find the magnitude of resultant force if the angle between them is changed to 120^o .
26. At what angle do the two vectors of magnitude A+B and A-B act so that their resultant is $\sqrt{\boldsymbol{3A^2 + B^2}}$.
27. A man can jump on moon six times as high as on earth. Why?
28. A ball is thrown straight upward. What is its velocity and acceleration at the top?
29. Show that there are two possible angles of projection for obtaining the same range.
30. While firing, one has to aim a little above the target and not exactly on the target.Why?
31. The horizontal range of a projectile is $4\sqrt{3}$ times its maximum height. Find the angle of projection.
32. Find the angle of projection for a projectile motion whose range R is 4 times the maximum height H.
33. The airplane shown is in level flight at an altitude of 1 km and a speed of 200 km/h. At what distance 'S' should it release a heavy bomb to hit the target X? Take g = 10 m/s^2.
34. Derive the relation between linear and angular velocity?
35. A flywheel is making 60 r.p.m. Calculate the linear speed of the point on its rim. The radius of the wheel is 3m.
36. A body is projected from the top of a 73.5 m high hill with a velocity of 19.6 m /s in the upward direction making an angle of 30 ° with the horizontal. Find the time of flight, range and its downward velocity when it strikes the ground.(Ans: 5 s, 84.9 m, 39.2 m /s downwards)
37. A stone is projected with a velocity of 19.6 m / s and at 30 ° to the horizontal. Calculate (i) range, (ii) total time of motion and (iii) maximum height.(Ans: (i) 33.95 m, (ii) 2 s, (iii) 4.9 m)
38. A football player kicks a football in the direction making an angle of 45 ° with the horizontal. The initial velocity of the ball in that direction is 50 m

/s. Find (a) the horizontal displacement, (b) the maximum height attained and (c) the time of flight.
(Ans: (a) 256 m, (b) 63.8 m, (c) 7. 2 s).

39. What should be the initial velocity of a football kicked at an angle of 45 ° with horizontal to pass just touching the top of a pole of 0.8 m height kept at 1 m distance from initial position? g = 9.8 m /s ^{2}.(Ans: 7 m / s)
40. A bomber flying upwards at an angle of 60 ° with the vertical releases a bomb at an altitude of 800 m. The bomb strikes the ground 20 seconds after its release. Find (a) the velocity of the bomber at the time of release of the bomb, (b) the maximum height attained by the bomb and (c) the horizontal distance traveled by the bomb before it strikes the ground. g = 10 m / s ^{2}.(Ans: (a) 120 m / s, (b) 980 m, (c) 2078 m) .
41. A stone is projected from the ground in a direction making an angle of 22.5 ° with the horizontal. It falls on the ground at a distance of 102 m. Find the initial velocity of the stone, maximum height attained and the time of flight.(Ans: 14 m / s, 1.4 m, 1.09 s).
42. Height of a tower is 39.2 m. A body is allowed to fall from the top of the tower. At the same time, another body is projected vertically upwards with velocity 19.6 m / s from its bottom. Where and when will they meet? g = 9.8 m / s ^{2}.(Ans: at 19.6 m from the bottom of the tower, after 2 s)

5 marks questions

1. Derive the equations of motion: $v = u + at$, $v^2 - u^2 = 2aS$, $S = ut + \frac{1}{2}at^2$.
2. How will you represent uniform accelerated motion on position-time and velocity-time graph? What are uses of such graphs?
3. State triangle law of vector addition. Find out the angle between the resultant vector and the vector A when two vectors A =3m is acting towards east and vector B=4m is acting towards the north east.
4. State and prove parallelogram law of vectors and discuss the special cases.
5. Show that the path followed by a body projected horizontally from the top of tower with a uniform speed is parabolic.
6. A projectile is fired at an angle ‘θ ‘with horizontal, derive expression for max. height, time period and range. At what angle range is maximum?
7. A projectile is fired at an angle ‘θ ‘with vertical, derive expression for max. height, time period and range.

UNIT- III

LAWS OF MOTION

2 marks questions

1. What is inertia? Why do we call the Newton's first law as the law of inertia?
2. Is force needed to keep a body moving with uniform velocity?
3. State Newton's law of motion.
4. Define linear momentum.If the rate of change of momentum of a body is $10 kgms^{-1}$. What is the force acting on the body?
5. Why do we fall forward, when a moving bus suddenly stops? Explain.
6. No force is required to move a body with a constant velocity. Explain.
7. We hit the carpet with a stick to remove dust particles. Explain.
8. Why a horse cannot pull a cart and run in the empty space?
9. Why an athlete runs some steps before taking the jump?
10. What is the importance of Newton's second law of motion? Explain.
11. Bodies of larger mass need greater initial effort to put them in motion. Why?
12. It is easier to pull than to push a body. Explain.
13. Show that it is easier to pull a lawn roller than to push it.
14. A cricketer player lowers his hands while taking a catch. Why?
15. Why wheels are provided with mudguards?
16. Why shockers are used in cars and scooters?
17. Why does a heavy rifle not kick as strongly as a light rifle using same cartridges?
18. A stone when thrown on a glass window smashes the window pane to pieces, but a bullet from the gun passes through making a clean hole. Why?
19. Why chinaware and glassware are wrapped in paper or straw pieces before packing?
20. Action and reaction are equal and opposite. Why cannot they cancel each other?
21. Friction is self adjusting force. Why?
22. What is relation between coefficient of friction and angle of friction?
23. What is relation between coefficient of friction and angle of repose?
24. Why is friction a non-conservative force?
25. If the coefficient of friction is 1, calculate the angle of friction?
26. Why wheels are made circular?
27. Why do we slip on a rainy day?

28. Why it is difficult to walk on sand?
29. Smoother the surface, lesser is the friction. Comment.
30. Polishing a surface beyond a certain limit may increase friction. Why?
31. Automobile tyres have generally irregular projections over their surfaces. Why?
32. Explain, how friction helps in walking.
33. Sand is thrown on tracks covered with snow in hilly areas. Why?
34. Proper inflation of tyres saves fuel. Explain.
35. Why it is difficult to move a cycle along a road with a brakes on. Explain.
36. How does lubricants helps in reducing friction?
37. Explain, any three methods of reducing friction.
38. Moon is continuously revolving around the earth without falling towards it. Why?
39. The outer rail of a curved railway track is generally raised over the inner. Why?
40. A bucket containing water is rotated in vertical circle. Explain, why the water does not fall?
41. A train moves on an unbanked circular bend of rails. Which rail will wear out faster?
42. Explain why the pilot of the aeroplane does not fall down, while looping a loop?
43. Passenger is thrown outwards when a bus takes a circular turn. Why?
44. Consider a book lying on a table. Which forces are acting on the book?

5 marks questions

1. State Newton's second law of motion. Define the SI unit of force.Show that Newton's second law of motion is real law of motion.
2. What is impulsive force?Prove that impulse is equal to the change in momentum.
3. What are concurrent forces? Obtain the condition for the equilibrium of three concurrent forces?
4. What is friction? State the laws of limiting friction.What are factors on which the force of friction depends?
5. What are advantages and disadvantages of friction?How does lubrication help in reducing friction?
6. Friction is a necessary evil, comment. Mention some methods of reducing friction.
7. Derive the expression for velocity attained by the rocket after time t.

8. Derive an expression for the apparent weight of a person in a lift when (a) the lift is moving up with acceleration (b) moving down with acceleration (c) moving up with acceleration (d) moving down with deceleration (e) moving up or down with constant velocity.
9. What is banking of roads? Why it is necessary? Obtain an expression for the angle of banking of a curved road?
10. Why does a cyclist bend inwards while negotiating a curve? Explain with diagram.
11. What provides the necessary centripetal force to a vehicle moving along a leveled circular road. With the help of a neat diagram, explain it. Also obtain the expression for the maximum velocity, with which the vehicle can be moved without skidding.

UNIT-IV
WORK, POWER AND ENERGY

1 mark questions

1. What is condition for two vectors to be perpendicular?
2. Under what conditions work done by force is zero?
3. Show that $\vec{A}.\vec{A} = A^2$.
4. What is work done by a person in holding a 15 kg suitcase, while waiting for a bus for 18 minutes?
5. What is amount of work done by a force when a body is moving in a circular path?
6. How many ergs are there in one joule?
7. Friction is non conservative force .why?
8. How many joules are there in 1 MeV?
9. How many joules are there in 1 kWh?
10. How many watts are there in 1horse power?
11. What is spring constant of a spring?
12. What is perfectly inelastic collision?
13. State the principle of conservation of energy.

3 marks questions

1. Define scalar product of two vectors. Give its two properties.
2. Define work. Define the SI unit of work.
3. When is work done by the force is negative? Give condition for work to be positive?

4. Prove work-energy theorem for a variable force.
5. A coolie is moving on a level road while carrying a bag on his head. Is there any work done by coolie and why?
6. What are conservative forces? Give its properties.
7. Distinguish between conservative and non conservative forces.
8. Define kinetic energy. Derive expression for it.
9. State and prove work energy theorem.
10. A light body and a heavy body have the same momentum which of the two bodies will have greater kinetic energy and why?
11. A light body and a heavy body have the same kinetic energywhich of the two bodies will have greater momentum and why?
12. The momentum of a body increases by 20%. What is the percentage increase in kinetic energy?
13. How does the kinetic energy of an object change, if its momentum is doubled?
14. How does the momentum of an object change, if its kinetic energy is doubled?
15. Derive an expression for potential energy of a stretched string.
16. A spring is cut into two equal halves. What is the spring constant of each portion?
17. A ball of mass 10g moves with a velocity of 100 ms^{-1}. Calculate its K.E. How much uniform force will stop it in 10s?
18. Show that the total mechanical energy of a body falling freely under gravity is conserved.
19. What are the two types of collision? Explain them.
20. Throwing mud on the wall is an example of perfectly inelastic collosion. Explain.
21. Explain, how fast moving neutrons can be quickly slowed down by passing through water on heavy water.
22. Two bodies of equal mass are moving in one dimension with velocities u_1, u_2 have elastic collision, derive the expression for final velocities after collision.
23. Prove that when two bodies of equal masses undergo elastic collision in one dimension, their velocities are just interchanged.
24. Two bodies of masses M_1 and M_2 are moving with velocities u_1 and u_2. After the collision, they stick together. What is the nature of the collision? How can the final velocity of the two be calculated?

UNIT-V

MOTION OF SYSTEM OF PARTICLES AND RIGID BODY

1 mark questions

1. Define cross product of two vectors.
2. What is condition for two vectors to be parallel?
3. What do you mean by centre of mass?
4. What do you mean by rigid body?
5. Can centre of mass of a body lie outside the body?
6. What is radius of gyration?
7. Define angular momentum. Give its SI unit.
8. Which physical quantities are represented by the following? (a) rate of change of angular momentum. (b) linear momentum times perpendicular distance from the axis of rotation.
9. State the law of conservation of angular momentum.

3 marks questions

1. Give the properties of cross product of two vectors.
2. If $\vec{A} = -2\hat{i} + 3\hat{j} - 4\hat{k}$ and $\vec{B} = 3\hat{i} - 4\hat{j} + 5\hat{k}$ find $\vec{A} \times \vec{B}$.
3. If $\left|\vec{A} \times \vec{B}\right| = \left|\vec{A}.\vec{B}\right|$, then find the angle between $\vec{A}$ *and* $\vec{B}$.
4. Show that $\vec{A} = (2\hat{i} - 3\hat{j} + 4\hat{k})$ and $\vec{A} = (-4\hat{i} + 6\hat{j} - 8\hat{k})$ are parallel to each other.
5. Calculate the area of the parallelogram when adjacent sides of the parallelogram are given by vectors $\vec{A} = 3\hat{i} + \hat{j} + 2\hat{k}$ and $\vec{B} = 2\hat{i} + 4\hat{k}$.
6. Derive an expression for the position vector of the centre of mass of a system consisting of two particles.
7. Define radius of gyration. On what factor does it depends.
8. State theorem of perpendicular axis and the theorem of parallel axes.
9. Distinguish centre of mass and centre of gravity
10. The moments of inertia of two rotating bodies A and B are I_A and I_B ($I_A > I_B$) and their angular momenta are equal. Which one has greater kinetic energy?
11. Explain why the speed of whirlwind in a tornado is alarmingly high?
12. Why is a wrench with long handles preferred to unscrew a nut?

13. Why does handles are provided on the door at the maximum distances from thee hinges?
14. Why are there two propellers in a helicopter?
15. Most of the mass of a flywheel is concentrated at the rim. Why?
16. Explain if the ice on the polar caps of the earth melts, how will it affect the duration of the day?
17. How will you distinguish between a hard boiled egg and raw egg by spinning it on a table top?
18. The angular velocity of revolution of the earth around the sun increases, when it comes closer to the sun, why?
19. A cat is able to land on its feet after a tail. Why?
20. Derive the relation $L=I\omega$ for a rigid body.
21. Define torque and angular momentum and derive relation between them.
22. State the law of conservation of angular momentum and explain it with an example.

UNIT-VI

GRAVITATION

1 mark questions

1. State the universal law of gravitation.
2. What is value of 'G' on the surface of Venus?
3. What is acceleration of gravity?
4. At what height value of g is zero?
5. Which is greater, the attraction of the earth for 1 kg of iron or attraction of 1 kg iron for the earth? Why?
6. What is the weight of a body at the center of the earth?
7. At what place on the earth, the value of g does not change due to its rotational motion?
8. At what place on the earth, the value of g changes maximum due to its rotational motion?
9. What is meant by gravitational field strength?
10. Define gravitational potential.
11. Can a gravitational potential have positive value?
12. Why do different planets have different escape velocities?
13. Name two factors, which determine whether a planet has an atmosphere or not.
14. Does the orbital velocity of a satellite depend upon its mass?

15. What is a parking orbit?
16. What is full form of geostationary satellite 'APPLE'?
17. What is weightlessness?

3 marks questions

1. Why is Newton's law of gravitation known as universal law?
2. What is difference between g and G?
3. What is the work done by the force of gravity on a satellite moving round the earth? Justify your answer?
4. Why does a freely falling body experience weightlessness?
5. Distinguish between gravity and force of gravitation.
6. Escape velocity is different for different planets. Explain why?
7. A body weighs more on poles than on equator. Why?
8. What is acceleration due to gravity? How does value of g varies with depth?
9. Explain the variation of acceleration due to gravity with altitude.
10. Explain, why a tennis ball bounces higher on hills than in plains.
11. Explain why one can jump higher on the surface of moon than on the earth.
12. Moon has no atmosphere. Why?
13. Why does hydrogen escape faster from earth's atmosphere than oxygen?
14. Derive expression for gravitational potential.
15. What is gravitational potential energy? Derive expression for it.
16. Give the principle of launching a satellite. Derive an expression for orbital velocity of satellite revolving around earth.
17. Derive an expression for time period and energy of satellite revolving around earth.
18. Air friction increases the velocity of the satellite. Explain.
19. What is difference between ordinary and geostationary satellite?
20. Why does an astronaut in space feel weightlessness?
21. What do you understand by gravitational potential energy of a body? Derive expression for it. What is its value when masses are infinite distance apart?
22. Define escape velocity and derive an expression for the escape velocity of a body on the surface of earth.
23. State the kelper's law of planetary motion.
24. Deduce Newton's law of gravitation from Kepler's laws.

25. How far away from the surface of earth does the acceleration due to gravity becomes 4% of its value on the surface of the earth? Radius of earth=64000 km.
26. What are geostationary satellites? What are conditions for satellite to be geostationary?
27. What are polar satellites? What are its uses?
28. The escape velocity for a body at earth's surface is 11.2 km /s. If mass of Jupiter is 318times that of Earth and its radius is 11.2 times that of Earth, then find the escapevelocity of the same object on Jupiter. (Ans: 59.7 km / s, Note: the phrase 'the same object' is unnecessary)
29. If the earth were entirely made of iron with a uniform density 7.86×10^{3} kg $/m^{3}$, what would be the value of acceleration due to gravity on its surface? Radius of the earth $=6.37\times 10^{6}$m(Take G = 6.67×10^{-11} Nm^{2} $/kg^{2}$).
(Ans: 13.98 m $/s^{2}$)
30. A sphere of mass 40 kg is attracted by second sphere of mass 15 kg when their centre are 2 m apart with a force equal to 10^{-3} dyne. Calculate the constant of gravitation.(Ans: 6.67×10^{-11} Nm^{2} / kg^{2})
31. The earth's mass is 90 times that of moon and their diameters are in the ratio 4: 1. What is the value of g on moon? g on earth = 9.8 m / s^{2})
(Ans: 1.74 m /s^{2})
32. What is the value of g at a height equal to the radius of the earth? At what altitudeabove the earth's surface would the numerical value of g be half of that at the surface? Radius of the earth = 6400 km.
(Ans: 2.45 m / s^{2}, 2650 km)
33. The mass of the moon is 7.36×10^{22} kg and its radius is 1.74×10^{6} m. What is theescape velocity from the surface of the moon?
(G = 6.67×10^{-11} N m^{2} / kg^{2}).
(Ans: 2.38 km / s)

UNIT - VII
PROPERTIES OF BULK MATTER

2 marks questions

1. Define Young's modulus, bulk modulus and modulus of rigidity.
2. Explain (i) ductile materials (ii) brittle materials and (iii) elastomers.
3. What is elastic after effect?What is elastic fatigue?

4. Find stress, strain and Young's modulus of elasticity in the case of a wire 1.5 m long and 1 sq. mm in cross-section, if it increases by 1.55 mm in length when a weight of 10 kg is suspended from it.
5. Steel is more elastic than rubber, why?
6. Why springs are made of steel and not of copper?
7. Why do spring balances show wrong reading after long use?
8. Can a mountain have infinite height? Give reason.
9. Why crystalline solids have sharp melting point?
10. Marching troops are asked to break the steps, while crossing the bridge, why?
11. What is value standard atmospheric pressure?Which instrument is used to measure pressure?
12. Why it is difficult to bare footed on a road covered with edged pebbles?
13. Why are sleepers used below the rails? Explain.
14. Why is mercury preferred over water as a barometric substance?
15. Define surface tension. What do you mean by surface energy?
16. Why rain drops are spherical?
17. Small insects can move on the surface of water. Why?
18. What is critical temperature in surface tension?
19. Define angle of contact. On what factors does it depend?
20. Calculate the energy spent in spraying a drop of mercury of 1cm radius into 10^6 droplets, all of same size. Surface tension of mercury is 55×10^{-2} Nm^{-1}.
21. It is easier to spray water in which some soap is dissolved. Why?
22. Why it is easier to wash clothes in hot water soap solution?
23. Why two holes are made to empty an oil tin?
24. Why hot coffee tastes better than cold coffee?
25. Why do we prefer cotton clothes in summer?
26. Why pins and nails have pointed ends?
27. Why does an air passenger prefer a ball pen over a fountain pen?
28. Why the tip of the nib of a pen is split?
29. How detergents clean dirty clothes?
30. Why is sand drier than clay?
31. How water remain cool in earthen pot?
32. Tea in thermos flask remains hot for a long time. Why?
33. Define coefficient of viscosity. How does viscosity of a liquid vary with temperature?
34. What is Reynolds's number?
35. Define critical velocity?
36. Derive Stoke's law by the method of dimensions.
37. What are similarities and dissimilarities between solid friction and viscosity?
38. Why machine parts are jammed in winter?

39. Why do the clouds float in air?
40. Why two streamlines cannot cross each other?
41. Distinguish between streamline and turbulent flow of a liquid.
42. Establish equation of continuity of an ideal liquid flow.
43. Explain why still water runs deep?
44. Why do dust particles generally settle down in a closed room?
45. Why the blood pressure in human is greater at feet than at the brain?
46. Define thermal conductivity. Is the process of conduction possible in gases?
47. At what temperature is the Fahrenheit scale reading equal to half that of the Celsius scale?
48. Can a substance contract on heating? Give an example.
49. Why water is considered unsuitable for use in thermometers?
50. Why is invar used for making pendulum of clocks?
51. During a certain wind storm, light roofs are blown off. Why?
52. Why are ventilators provided near the roof of the house?
53. Distinguish between temperature and heat.
54. Explain why are cloudy nights warmer than clear nights?
55. Woolen clothes keep our body warm in winter. Why?
56. Why is a new quilt warmer than an old one?
57. Why the pipes carrying steam should have loops?
58. Distinguish between the process of conduction and convection.
59. Write two properties of thermal radiations.
60. Why water is preferred in hot water bottles used for fomentation?
61. Why metallic utensils are provided with wooden handles?

5 marks questions

1. State Pascal's law and explain any one application. (Hydraulic brakes, hydraulic lift, hydraulic press)
2. State Hooke's law of elasticity. Draw stress vs. strain for a wire subjected to gradually increasing tension and explain the various points of the curve. (Elastic region, proportional limit, elastic limit, plastic region, yield point and breaking point).
3. Derive an expression for excess pressure inside a liquid drop and a soap bubble on account of surface tension.
4. Define capillarity. Derive an expression for the rise of liquid in a capillary tube.
5. Define terminal velocity and derive expression for it.
6. By giving assumptions, state and prove Bernoulli's theorem. What are its limitations?
7. State Bernoulli's principle. Deduce an expression for the volume of the liquid flowing per second through the wider tube of a venturimeter.

8. State Torricelli's theorem and prove it. (Derive an expression for velocity of efflux).
9. Define coefficient of linear, superficial and cubical expansion. Establish relation between them.

UNIT - VIII
THERMODYNAMICS

1 mark questions

1. What is an isochoric process?
2. What is an isobaric process?
3. State second law of thermodynamics.
4. State Zeroth law of thermodynamics
5. What is a heat engine?
6. State Carnot's theorem.
7. State the conditions for two bodies to be in thermal equilibrium.
8. Is rusting of iron is reversible process?
9. What is critical temperature?
10. Why efficiency of ideal heat engine cannot be 100%?

3 marks questions

1. Explain why a balloon is cooler after it bursts.
2. Why C_p is greater than C_v?
3. If an inflated tyre bursts the air escaping out is cooled. Why?
4. What are limitations of the first law of thermodynamics?
5. Can specific heat of a gas be (i) zero (ii) infinite, and (iii) negative? Explain.
6. What is a PV diagram? What does the area between the PV curve and the volume axis signify?
7. What is a cyclic process? Show that the work done in a cyclic process is equal to the area enclosed by the loop representing the cyclic process.
8. Why gases have two principal specific heat capacities? Define them
9. Show for an ideal gas $C_p - C_v = \frac{R}{J}$.(Derive Meyer's relation)
10. State the three laws of thermo dynamics (Zeroth law, first law and second law)
11. Apply first law of thermodynamics to (a) isothermal process

(b) adiabatic process

12. Derive an equation for the work done in an isothermal process and draw the P-V indicator diagram.
13. State first law of thermodynamics and apply it to an isothermal process.
14. Define adiabatic change. Derive expression for work done during an adiabatic change.
15. Define isothermal change. Derive expression for work done during an isothermal change.
16. Explain the construction and various operations involved in a Carnot's heat engine with neat labeled diagram.
17. Draw Carnot's cycle and write expression for efficiency of a Carnot's heat engine. On what factors does the efficiency of a Carnot engine depend?
18. State Carnot's theorem and explain its significance.
19. Define the coefficient of performance of a heat pump. (refrigerator) and obtain a relation for it in terms of temperature T_1 and T_2
20. A sample of gas ($\gamma = 1.5$) is compressed adiabatically from a volume of 1600 cm^3 to 400 cm^3. If the initial pressure is 150 kPa, what are the final pressure and how much work is done on the gas in the process?
21. State and prove Dulong-Pettit's law.

UNIT - IX

BEHAVIOUR OF PERFECT GAS AND KINETIC THEORY OF GASES

1 mark questions

1. What is temperature at which molecular motion ceases?
2. What is mean free path?
3. What is degree of freedom?
4. State the law of equipartition of energy?
5. What is an ideal gas?

3 marks questions

1. Explain how evaporation causes cooling.
2. Why there is practically no atmosphere on the surface of the moon?

3. On driving the scooter for a long time, the air pressure in the tyres slightly increases. Why?
4. When a gas is suddenly compressed, temperature of a gas rises. Why?
5. State Boyle's law and Charles's law. Why they are not applicable for all real gases at all temperatures?
6. What is the basic assumption of kinetic theory of gases?
7. On their basis, derive an expression for the pressure exerted by an ideal gas.
8. Show that r.m.s speed of the molecules of a gas is directly proportional to the square root of the absolute temperature of the gas.

UNIT -X
OSCILLATIONS AND WAVES

2 marks questions

1. Which properties of a medium are responsible for propagation of waves through it?
2. What is range of frequency of audible sound?
3. Can two persons hear each other on moon?
4. Distinguish between damped and undamped oscillation.
5. Will a pendulum clock gain or lose time, when taken to the top of the mountain?
6. Why pendulum clocks are not suitable for spaceships?
7. Explain why transverse mechanical waves cannot be propagated in liquids and gases?
8. Explain why longitudinal waves can be propagated in solids, liquids and gases?
9. Why does sound travel faster in steel than in air?
10. What are nodes and antinodes?
11. On what factors do the frequency of tuning fork depends?
12. What is Doppler Effect?What is red shift?
13. How can beats see in darkness? Explain

5 marks questions

1. Show that the oscillations of a simple pendulum are simple harmonic.
2. What are beats? How are they produced?

3. What is a simple harmonic motion? State its characteristics.
4. Distinguish between free, forced, and resonant oscillation with illustration.
5. State and explain superposition of waves.
6. What are the characteristics of progressive waves?
7. What is difference between interference, beats and standing waves?
8. What is effect of density and temperature on velocity of sound?
9. Define wave motion. Give the characteristics of wave motion.
10. Deduce an expression for the total energy of a system executing S.H.M. Draw the energy curve.
11. What do you mean by standing wave? Deduce an expression for the nodes and antinodes of a standing wave. Explain displacement, velocity, acceleration, and time period of a simple harmonic motion. Find relation between them.
12. What are stationary waves? Discuss the characteristics of stationary waves.
13. Give the graphical representation of (i) displacement (ii) velocity

    (iii) acceleration of a particle executing SHM. mention the differences between them.

14. Why and how Laplace corrected Newton's formula for velocity of sound in gas?
15. Show that the motion executed by the bob of a pendulum in S.H.M. Derive expression for time period.
16. Show that the motion of loaded spring is simple harmonic motion. Find the expression for time period.

10+2 (PHYSICS)

INSTRUCTIONS FOR PAPER SETTER

Note:

1. There will be one theory paper consisting of total 26 questions. Three questions of two mark each & three questions of three marks each are choice questions will be set in the paper.
2. Question no.6 to 14 will be of 2 marks each, out of total 9 questions carrying 2 marks each, candidate can attempt any 6 questions.
3. Question no.15 to 23 will be of 3 marks each. Out of 9 questions carrying 3 marks each, candidate can attempt any 6 questions.
4. Question no. 24 to 26 will be of five marks each. There will be internal choice in them.
5. From one unit, only choice question either of two marks of three marks can be set e.g. if in one unit according to marks distribution scheme there is no three mark question then examiner can select 3 marks choice question from that unit, same pattern will be followed for two marks choice question.

SYLLABUS : THEORY

Unit 1: Electrostatics

Electric Charges; Conservation of charge, Coulomb's law-force between two point charges, forces between multiple charges; superposition principle and continuous charge distribution. Electrical field, electric Field due to a point charger, electric-field lines; electric dipole, electric field due to a dipole; torque on a dipole in uniform electric field. Electric flux, statement of Gauss's theorem and its applications to find field due to infinitely long straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell (Field inside and outside). Electric potential, potential difference, electric potential due to a point charge, a dipole and system of charges; equipotential surfaces, electrical potential energy of a system of two point charges and of electric dipole in an electrostatic field. Conductors and insulators, free charges and bound charges inside a conductor. Dielectrics and electric polarization, capacitors and capacitance, combination of capacitors in series and in parallel, capacitance of a parallel plate capacitor with and without dielectric medium between the plates, energy stored in a capacitor, Van de Graff generator.

Unit II: Current Electricity

Electric current, flow of electric charges in a metallic conductor, drift velocity, mobility and their relation with electric current: Ohm's law, electrical resistance. V-1 characteristics (linear and non linear), electrical energy and power, electrical resistivity and conductivity. Carbon resistors, colour code for carbon resistors; series and parallel combinations of resistors; temperature dependence of resistance. Internal resistance of a cell, potential difference and emf of cell, combination of cells in series and in parallel. Kirchhoff's laws and simple applications. Wheatstone bridge, Metre Bridge. Potentiometer-principle and its applications to measure potential difference and for comparing emf of two cells, measurement of internal resistance of a cell.

Unit III: Magnetic Effects of Current and Magnetism

Concept of magnetic field. Oersted's experiment; Biot-savart law and its application to current carrying circular loop. Ampere's law and its applications to infinitely long straight wire, straight and toroidal solenoids. Force on a moving charge in uniform magnetic and electric fields. Cyclotron. Force on a current-carrying conductor in a uniform magnetic field Force between two parallel current-carrying conductors, definition of ampere. Torque experienced by a current loop in uniform magnetic field; moving coil galvanometers its current sensitivity and conversion to ammeter and voltmeter. Current loop as a magnetic dipole and its magnetic dipole moment. Magnetic dipole moment of a revolving electron. Magnetic field intensity due to a magnetic dipole (Bar magnet) along its axis and perpendicular to its axis. Torque on a magnetic dipole (bar magnet) in a uniform magnetic field; bar magnetics an equivalent solenoid, magnetic field lines; Earth's magnetic field and magnetic elements Para-, dia-and Ferro- magnetic substances with examples, Electromagnets and factors affecting their strengths. Permanent magnets.

Unit IV: Electromagnetic Induction and Alternating Currents

Electromagnetic induction, Faraday's laws, induced emf and current, Lenz's Law, Eddy currents: Self and multiple inductance. Need for displacement current. Alternating current, peak and rms value of alternating current/voltage; reactance and impedances; LC oscillations, (qualitative treatment only), LCR series circuit resonance; power in AC circuit, wattless current. AC generator and transformer.

Unit V: Electromagnetic Waves

Electromagnetic waves and their characteristics (qualitative ideas only). Transverse nature of electromagnetic waves. Electromagnetic spectrum (Radio-microwaves, infra-red, visible, ultraviolet, X-rays, gamma rays) including elementary facts about their uses.

Unit VI: Optics

Reflection of light, spherical mirrors, mirror formula. Refraction of light, total internal reflection and its applications, optical fibres, refraction at spherical surfaces, lenses, thin lens formula, lens-maker's formula. Magnification, power of a lens, combination of thin lenses in contact. Refraction and dispersion of light through a prism. Scattering of light-blue colour of the sky and reddish appearance of the sun at sunrise and sunset. Optical instruments: - Human eye, image formation and accommodation, correction of eye defects (myopia, hypermetropia, presbyopia and astigmatism) using lenses. Microscopes and astronomical telescopes (reflecting and refracting) and their magnifying powers. Wave'soptics: wave front and Huygens' Principle, reflection and refraction of plane wave at a plane surface using wave fronts. Proof of laws of reflection and refraction using Huygens 'Principle. Interference. Young's double slit experiment and expression for fringe width, coherent sources and sustained interference of light. Diffraction due to a single slit, width of central maximum. Resolving power of microscopes and astronomical telescopes. Polarisation, plane polarised light -Brewster's law, uses of plane polarised light and polarides.

Unit VII: Dual nature of Matter and Radiation

Dual nature radiation, Photoelectric effect, Hertz and Lenard's observations'; Einstein's photoelectric equation, particle nature of light. Matter waves-wave nature of particles, de Broglie relation. Davission-Germer experiment.

Unit VIII: Atoms & Nuclei

Alpha-particle scattering experiment; Rutherford's model of atom;Bohr model, energy levels, hydrogen spectrum. Composition and size of nucleus, atomic masses, isotopes, isobars; isotones. Radioactivity- alpha, beta and gamma particles/rays and their properties; radioactive decay law. Mass-energy relation, mass-defect; binding energy per nucleon and its variation with mass number; nuclear fission and fusion,

Unit IX: Electronic Devices

Semiconductors; semiconductor Diode-1-V characteristics in forward and reverse bias, diode as a rectifier, 1-V characteristics of LED, photodiode, solar cell and Zener diode, Zener diode as a voltage regulator. Junction transistor, transistor action; characteristics of a transistor: transistor as an amplifier (common emitter configuration) and oscillator, Logic gates (OR, AND, NOT, NAND and NOR). Transistor as a switch.

Unit X: Communication Systems

Elements of a communication system (block diagram only); bandwidth of signals (speech, TV and digital data); bandwidth of transmission medium-Propagation of electromagnetic waves in the atmosphere, Sky and space wave propagation. Need for modulation. Production and detection of an amplitude modulated wave.

PHYSICS 10+2

Unit 1 : Electrostatics

2 marks questions

1. Explain Quantisation and conservation of charge.
2. Give the properties of electric charge.
3. What is difference between charge and mass?
4. What is dielectric constant? How does force gets affected when charges are placed in vacuum?
5. What are similarities and dissimilarities between Coulomb's forces and Gravitational forces?
6. Why water has high dielectric constant?
7. Two point charges q_1 and q_2 are such that $q_1q_2 > 0$. What is the nature of force between two charges?
8. What is the effect on the electrostatic force between two charges if (a) a dielectric slab is introduced between them (b) A metal slab is introduced between them
9. What is principle of superposition of charges? What is its importance?
10. Vehicles carrying inflammable materials usually have metallic ropes touching the ground during motion, why?
11. How the mass of the body is affected on charging?
12. How many electrons are present in one coulomb of charge?
13. An electrostatic force between two charges is called central force. Why?
14. Dielectric constant of water is 80. What is its permittivity?
15. If the distance between two equal point charges is doubled and their individual charges are also doubled, what would happen to the force between them?
16. A comb run through one's dry hair attracts small bits of paper. Why? What happens, if the hair is wet or it is a rainy day?
17. Can a charged body attract another uncharged body? Explain.
18. Can two balls having same kind of charge on them attract each other? Explain.
19. A bird perches on a bare high-power line and nothing happens to the bird. A man standing on the ground touches the same line and gets a fatal shock. Why?
20. Find the ratio of the order of magnitude of electrostatic force to gravitational force.
21. What is the effect on the electrostatic force between two charges if (a) a dielectric slab is introduced between them (b) A metal slab is introduced between them
22. In a medium, the force of attraction between two point electric charges. distance d apart is F. What distance apart should these be kept in the same medium so that the force between them becomes

a. 3F
b. F/3

23. How many electrons would have to be removed from or added to a penny to leave it charged with 1.0 x 10^{-6} C? *[Ans: 6.25 x 10 ^{12}]*
24. Two point charges, q_1 and q_2 at a separation r in vacuum exert a force F on each other. What should be their separation in oil of relative permitivity 16 so that the force between them remains F only?
25. Distilled water is an insulator, but impure water is a conductor. Explain why?
26. Two equally charged identical metal spheres A and B repel each other with a force of 2·0 x 10^{-5} N. Another identical uncharged sphere C is touched to A and then placed at the mid point between A and B. What is the net force on C?
27. Four point charges +5 mC, +2 mC, +10mC and +2 mC are kept at the corners of a square of side 10 cm. A charge q=+1mC is placed at its centre. Find the net force on q.
28. Calculate the distance between two protons such that the electrostatic force between them is equal to the weight of either.
29. Two point charges are 0.1 m apart and their combined charge is 9 mC. If they repel each other with a force 18N, then calculate the magnitude of each charge.
30. Calculate the coulomb force between two alpha particles separated by a distance of 3.2 x 10^{-15} m

ELECTRIC FIELD

1. Define electric field. Give its units.
2. Name the physical quantity, whose SI unit is N/C.
3. Why test is vanishingly small in defining electric field intensity?
4. What is electric dipole and dipole moment? Give the unit of electric dipole moment and its direction.
5. Does an electric dipole always experience a torque, when placed in a uniform electric field?
6. Determine the magnitude of an electric field that will balance the weight of an electron.
7. A distance of 2 m separates two point charges of +5×10^{-19}C and +5×10^{-19}C. Find the point on the line joining them at which electric field intensity is zero.
8. A charged particle is free to move in an electric field. Will it always move along an electric line of force?
9. Electric field intensity within a conductor is always zero. Why?

10. The electric field at a distance r from a short dipole on the axial position is E_1 and at the same distance on the equatorial position is E_2. What is the relation between E_1 and E_2.
11. Charge q each is placed at the corners of an equilateral triangle of side a. What is the electric field intensity at the centre of the triangle?
12. An electron and proton are free to move in an electric field. Which one will have greater acceleration? Why?
13. (a) Define electric dipole moment. (b) Derive expression for electric field intensity of a dipole at a point on its axial line. (c) Two charges +10μ C and – 10 μ C are placed 5 mm apart. Determine the electric field at a point P, 15 cm away from its centre O on a line passing through O and normal axis of the dipole.
14. A proton moves through a uniform electric field of 5.01×10^{3} N/C. Calculate (a) the acceleration with which the proton is moving and (b) the time taken by the proton to cover a distance of 4.8 cm.
15. Two point charges of unknown magnitude and sign are placed certain distance apart. The electric field is zero at a point not between the two charges but at a point on the line joining them. Write two essential conditions for this to happen.

ELECTRIC POTENTIAL

1. A charge 5μC is placed at a point. What is the work required to carry 1C of charge once around it in the circle of 12 cm radius?
2. If a point charge be rotated in a circle of radius r around a charge q, what will be work done and why?
3. Establish relation between electric field and potential gradient.
4. What are equipotential surfaces? Give its uses.
5. Show that work done in moving a charge over equipotential surfaces is zero.
6. Show that electric field is always at right angle to equipotential surfaces.
7. Equipotential surfaces help us to distinguish between strong and weak fields. Explain.
8. Equipotential surfaces give the direction of electric field. Explain
9. Why two equipotential surfaces do not cross each other?
10. If electric field is zero at any point, is it necessary electric potential must be zero at that point. Explain with the help of example.
11. If electric potential is zero at any point, is it necessary electric field must be zero at that point.Explain with the help of example.
12. Calculate the electric field between two metal plates 3 mm apart connected to a 3V battery.
13. Are there points around a dipole where the electric field is not zero but potential due to it is zero?

14. What is the amount of work done in moving a 100 nC charge between two points 5cm apart on an equipotential surface?
15. Name the Physical quantity whose SI unit is
    a. newton/coulomb
    b. joule/coulomb
16. Show that the work done in rotating an electric dipole of dipole moment p in a uniform electric field E by an angle θ from the equilibrium position W = pE(1-cosθ)
17. *Sketch two equipotential surfaces for (a) a point charge. (b) between two plane sheets of charge.*

GAUSS'S THEOREM

1. Define electric flux. Give its unit.
2. What is Gaussian surface and what is its importance?
3. What is electrostatic shielding? Why it is safe to sit inside a car during lightning?
4. A box encloses an electric dipole consisting of charge 5μC and -5μC and of length 10 cm. What is the total electric flux through the box?
5. A sensitive instrument is to be shielded from the strong electrostatic field in its environment. Suggest a possible way.
6. A point charge of 8.86 C is placed at the centre of a cube of side 10 cm. Calculate the flux passing through its one face.
7. A point charge of 2 micro coulomb is at the centre of a cubic Gaussian surface 9cm edge. What is the net electric flux through all the surfaces of the cube?

CAPACITANCE

1. Explain the principle of capacitor.
2. Show that the capacitance of an insulated spherical conductor is directly proportional to the radius of the spherical conductor.
3. Why it is not possible for the sphere to have a capacity of 1F?
4. How will the capacitance of a parallel plate capacitor be affected if (i) the area of each plate is increased (ii) the distance between the plates is increased?
5. Show that there is loss of energy on sharing of charges by two capacitors.
6. What is polar and non-polar dielectric? Give example for each.
7. Why the capacitances of capacitor increase when dielectric slab is inserted between plates of the capacitor?
8. Why does the electric field inside a dielectric decrease, when it is placed in an external electric field?
9. On inserting a dielectric between the plates of a capacitor, its capacitance is found to increase 5 times. What is the relative permittivity of the dielectric?

10. An air capacitor is given a charge of 2μC raising its potential to 200V. If on inserting a dielectric medium its potential falls to 50V, what is the dielectric constant of the medium?

11. In a parallel plate, how is the capacity affected, when without changing the charge: (i) the distance between the plates is doubled (ii) area of the plates is halved.

12. Prove that the total energy stored in series combination of capacitors is equal to the sum of energies stored in the individual capacitors.

13. Prove that the total energy stored in parallel combination of capacitors is equal to the sum of energies stored in the individual capacitors.

14. Prove that energy stored per unit volume in a capacitor is given by $\frac{1}{2}\varepsilon_0 E^2$; E is the electric field of the capacitor.

15. If a parallel plate capacitor of capacitance C is kept connected to a supply voltage V to just fill the space and then a dielectric slab is inserted between the plates. What will be the change in the capacitance, potential difference, the charge, electric field and the energy stored.

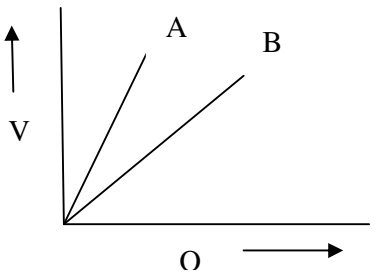
16. A parallel plate capacitor of capacitance C is charged to a potential difference V and then the battery is disconnected. Now a dielectric slab of the dimensions equal spacing between the plates is inserted between the plates. What are the changes, if any, in the capacitance, charge, potential difference, electric field and the energy stored.

17. What limits maximum potential to which the hollow sphere in Van de Graff generator can be raised?

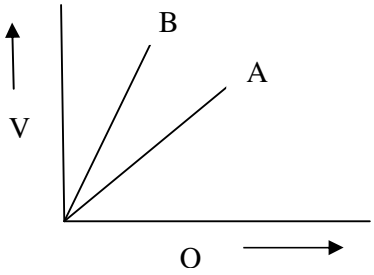
18. Why the Vande Graff generator is enclosed inside an earth connected steel tank filled with air under pressure?

19. N small drops of same size are charged to V volt each. They coalesce to form a bigger drop. Calculate the potential of the bigger drop.

20. Fig shows the variation of charge Q vs. potential difference V for two capacitors C_1 and C_2.The two capacitors have same plate separation but the plate area of C_2 is double that of C_1. Which of the two lines in the fig correspond to C_1 and C_2 and why?



21. Fig show the variation of voltage V across the plates of two capacitors A and B versus increase of charge Q stored on them. Which of the two capacitors has higher capacitance? Give reason.



22. How will the capacitance of a parallel plate capacitor be affected if (a) The Area of each plate is increased (b) The distance between each plate is increased

23. What is the area of the plates of a parallel plate

capacitor of capacitance 2F and with separation between plates 0.5 cm?

24. You are given three capacitors of value 2μF, 3μF, 6μF. How will you connect them to a resultant capacity of 4μF?

25. A parallel plate capacitor is made by stacking 'n' equally spaced plates connected alternatively. If the capacitance between any two plates is 'C', determine the resultant capacitance of the combination

26. What is the area of the plates of a parallel plate capacitor of capacitance 2F and with separation between plates 0.5 cm?

5 marks questions

1. State Coulomb's law. Define one coulomb. Give its limitations. Express coulomb's law in vector form. What is its importance?
2. Prove that electric field intensity on the axial line due to electric dipole is twice the intensity on the equatorial line. Give the direction of electric field on axial line and equatorial line.
3. What are electric lines of force? Give its properties and its importance. Why two electric lines of force do not cross each other?
4. Show that work done /line integral of electric field in moving a charge from one point to another inside the electric field is independent of path followed.
5. Define electrostatic potential energy of system of charges and derive expression for it for system of three charges.
6. Distinguish between electric potential and electric potential energy and state the relation between them.
7. Define electric potential difference and derive expression for it. Define its unit.
8. Derive an expression for the potential at a point along the axial line of a short electric dipole. Show mathematically that the potential at a point on the equatorial line of an electric dipole is zero.
9. Derive the expression for potential energy when an electric dipole is placed inside uniform electric field. Under what condition these are maximum and minimum.
10. What does the negative sign in the expression for potential energy (U= - p E cos$\boldsymbol{\theta}$) signify?
11. Derive expression for electric field due to spherical shell at any point (i) inside (ii) outside (iii) on the surface using Gauss's theorem.
12. Derive expression for electric field due to spherical body at any point (i) inside (ii) outside (iii) on the surface using Gauss's theorem.
13. State and prove Gauss's theorem.Derive expression for electric field due to line charge using Gauss's theorem.
14. Define capacitance. Derive the expression for capacitance of parallel plate capacitor.
15. Derive the expression for energy stored in a capacitor? In what form is the energy stored in a charged capacitor.

16. Three capacitors of capacitance C_1, C_2, C_3 are connected in (i) series (ii) parallel. Find the expression for resultant capacitance.
17. Derive the expression for capacitance of parallel plate capacitor when dielectric slab is inserted between plates of the capacitor.
18. Derive the expression for capacitance of parallel plate capacitor when conducting slab is inserted between plates of the capacitor.
19. Give the principle, construction and working of Vande Graff generator.

Unit II: Current Electricity

2 marks questions

CURRENT ELECTRICITY

1. How does the drift velocity of electrons in a metallic conductor vary with increase in temperature?
2. What are ohmic and non ohmic devices? Give one example of each.
3. Define resistance. On what factors it depends?
4. Draw a graph to show the variation of resistance of a metal wire as a function of its diameter, keeping length and temperature constant.
5. Define resistivity. On what factors it depends.
6. Resistivities of copper, silver and mangnin are $1.7\times10^{-8}\Omega$m, 1.0×10^{-8} Ωm and 44×10^{-8} Ωm respectively. Which of these is the best conductor?
7. A metal and a semiconductor material are cooled. What happens to their conductivities and why?
8. What is difference between e.m.f and terminal potential difference?
9. Name the material used for making standard resistors? Give two reasons.
10. What happens to the drift velocity (v_d) of electrons and to the resistance R if length of a conductor is doubled (keeping potential difference unchanged)?
11. The V-I graph is drawn for a metal wire at two temperature T_1 and T_2. If $T_1>T_2$, draw the graph.
12. A large number of free electrons are present in metals. Why is there no current in the absence of electric field across it?
13. What is more dangerous to human body, the current or voltage?
14. It is found that 10^{20} electrons each having a charge of 1.6×10^{-19} C, pass from a point X towards another point Y in 0.1 s. What are the current and its direction?
15. An electric motor operating on a 50 V dc supply draws a current of 12 A. If the efficiency of the motor is 30%, estimate the resistance of the windings of the motor.
16. Will water flow more easily through a wide pipe or a narrow pipe? Will current flow more easily through a thick wire or a thin wire?
17. Distinguish between a *kilowatt* and a *kilowatt-hour*.

18. The wattage marked on a light bulb is not an inherent property of the bulb but depends on the voltage to which it is connected, usually 110 or 120 V. How many amperes flow through a 60-W bulb connected in a 120-V circuit?
19. An electric iron connected to a 110-V source draws 9 A of current. How much heat in joules does it generate in a minute?

ELECTRICAL MEASUREMENT

1. Of which material potentiometer wire is made and why?
2. Why do we prefer potentiometer with a longer bridge wire?
3. Why do we prefer potentiometer rather than voltmeter to measure e.m.f of cell?
4. When is Wheatstone bridge most sensitive?
5. How can you increase the sensitivity of a potentiometer?
6. Kirchhoff's first law obeys the law of conservation of charge. Explain.

3 marks questions

1. What is drift velocity and relaxation time? Establish relation between them.
2. State and prove Ohm's law using the concept of drift velocity.
3. How resistivity of metals, semiconductors, and insulator does vary with temperature?
4. Derive the relation for resistivity $\rho = \frac{ml}{ne^2\tau}$ where symbols have their usual meaning.
5. Establish the relation between current and drift velocity.
6. Three resistances are connected in series. Find the expression for their equivalent resistance.
7. Three resistances are connected in parallel. Find the expression for their equivalent resistance.
8. What is internal resistance? Derive expression for it.
9. A wire of resistance 1 ohm and resistivity 'ρ' is stretched to double its length. What will be its new resistance and resistivity?
10. If a copper wire is stretched to make it 0.1% longer, what is the percentage change in its resistance?
11. A battery on emf E and internal resistance r gives a current 0.5 A with an external resistance of 12 Ω and a current 0.25 A with an external resistance of 25Ω. Calculate the internal resistance and emf of the cell.
12. State and explain Kirchhoff's law.
13. Derive the principle for the balance of Wheatstone bridge.
14. Explain the use of Slide Wire Bridge to measure unknown resistance.
15. What is potentiometer? Give its principle.
16. Explain one use of potentiometer with the help of proper diagram.
17. Draw the diagram showing the experimental arrangement for determining the resistance of a given wire of unknown resistance.

Unit III

Magnetic Effects of Current and Magnetism

1 mark questions

1. State Biot Savart's law.
2. State Fleming right hand thumb rule.
3. State Ampere's circuital law.
4. State Ampere swimming rule.
5. What is magnetic Lorentz force?
6. Under what condition magnetic Lorentz force is maximum and minimum?
7. What is the force experienced by a stationary charge in magnetic field?
8. Can neutrons be accelerated in a cyclotron?
9. What is meant cyclotron frequency?
10. State Fleming's left hand rule.
11. Give the principle of moving coil galvanometer.
12. What is nature of magnetic field in a moving coil galvanometer?
13. Define current sensitivity of a moving coil galvanometer?
14. Define voltage sensitivity of a moving coil galvanometer?
15. What is shunt?
16. What are uses of shunt?
17. How is ammeter connected in an electric circuit?
18. How is voltmeter connected in an electric circuit?
19. What is the resistance of an ideal ammeter and voltmeter?
20. Give the principle of a d.c. motor.
21. What is nature of force, when two parallel conductors carry current in (i) same direction, (ii) opposite direction?
22. What do you mean by directive property of a magnetic dipole?
23. Does an isolated magnetic pole exist like an isolate charge?
24. Define magnetic dipole moment.
25. What is SI unit of magnetic dipole moment?
26. What is geographic meridian?
27. What is magnetic meridian?
28. Write the names of parameters of earth magnetic field.
29. Define dip.
30. Define declination.
31. Define Bohr magneton.

32. What is value of Bohr magneton?
33. What is value of dip on equator of earth?
34. What is value of dip on magnetic poles of earth?
35. What do you mean by neutral points in a magnetic field?
36. Define intensity of magnetisation of magnetic materials.
37. Define magnetic flux.
38. Define magnetic susceptibility.
39. Define magnetic permeability.
40. Name a physical quantity which is measured in wb/A.
41. Define tesla.
42. Name the physical quantity, whose unit is tesla.
43. What do you mean by non magnetic materials?
44. What happens when a diamagnetic substance is placed in a varying magnetic field?
45. What happens when a paramagnetic substance is placed in a varying magnetic field?
46. State Curie law in magnetism.
47. What is Curie point?
48. What is hysteresis?
49. Define retentivity.
50. Define coercivity.
51. What type of material is used in making permanent magnets?
52. What type of material is used in making electromagnets?
53. Give the method to destroy the magnetism of a magnet.

BIOT SAVART LAW AND ITS APPLICATIONS

5 marks questions

1. Using Biot Savart's law derives the expression for magnetic field due to current carrying straight long conductor. State right hand thumb rule.
2. Using Biot Savart's law derives the expression for magnetic field at the centre of current carrying coil.
3. Using Biot Savart's law derives the expression for magnetic field on the axis of current carrying coil.
4. Derive the expression for force on a current carrying conductor placed in a magnetic field. In which condition it is maximum and minimum.

5. Find the expression for force between two infinitely long parallel current carrying conductors. Define one ampere.
6. State and prove Ampere's circuital law. How will you find magnetic field of current carrying solenoid using this law.
7. What is torrid? How will you find magnetic field due to current carrying torridial solenoid.
8. Give the principle, construction and working theory of moving coil galvanometer.
9. How will you convert galvanometer into (i) ammeter (ii) voltmeter?
10. Give the principle construction and working theory of a cyclotron. Why it is not suitable for accelerating electrons and neutrons?
11. Define magnetic field intensity at a point and derive an expression for it at a point on the axial line of a magnetic dipole.
12. A magnetic dipole is placed in a magnetic field; derive the expression for torque and potential energy? Under what conditions these are maximum and minimum.
13. Show that atom acts as a magnetic dipole. Define Bohr's magneton.
14. Give ten differences between dia-, para-, and ferro- magnetic substances.
15. Explain hystersis loop. Define coercivity and retentivity.Why do we prefer steel or alnico for making permanent magnet?

UNIT IV: ELECTROMAGNETIC INDUCTION

3 marks questions

1. State Faraday's law of electromagnetic induction.
2. State Lenz's law. Show that it obeys law of conservation of energy.
3. What are eddy currents? How are they produced and how these can be minimized?
4. Define self induction. Define its unit.
5. Derive expression for self inductance for current carrying long solenoid.
6. Define mutual induction. Define its unit.
7. Derive expression for mutual inductance for current carrying long solenoid.
8. Explain why the inductance coils are made of copper. What is non-inductive wiring of coils?
9. Coils in the resistance boxes are made from doubled up insulated wires. Why?
10. Why is spark produced in the switch of a fan, when it is switched off?
11. An induced current has no direction of its own. Comment.
12. Why the coil of dead beat galvanometer wound on a metal frame?

13. What is difference between a steady current and d.c?
14. Define average value of a.c and derive expression for it.
15. Define r.m.s value of a.c and derive expression for it.
16. Derive expression for impedance and phase angle when a.c is applied to the circuit containing resistance.
17. Derive expression for impedance and phase angle when a.c is applied to the circuit containing inductance.
18. Derive expression for impedance and phase angle when a.c is applied to the circuit containing capacitor.
19. Derive expression for impedance and phase angle when a.c is applied to the circuit containing LR.
20. Derive expression for impedance and phase angle when a.c is applied to the circuit containing CR.
21. Derive expression for impedance and phase angle when a.c is applied to the circuit containing LCR.
22. What is condition of resonance and expression for resonant frequency?
23. What is Q-factor? Give its units. On what factors it depends.
24. Derive expression for the power of an a.c circuit containing LCR circuit.
25. What is power factor? On what factor it depends? Give its importance.
26. Which is more dangerous to use: a.c or d.c? Why?
27. Distinguish between resistance, reactance and impedance.
28. Prove that capacitor blocks d.c and allows a.c to pass through.
29. Prove that an inductor offers an easy path to d.c and resistive path to a.c.
30. Prove mathematically that the average value of a.c over one complete cycle is zero.
31. The frequency of a.c source is doubled. How do R, X_L, X_C get affected?
32. Draw the graph showing the variation of resistance of (a) a capacitor and (b) an inductor with the frequency of an a.c. circuit.
33. For circuits used for transporting electric power, a low power factor implies large power loss in transmission. Why?
34. Why power factor correction is must in heavy machinery?
35. Explain the use transformer for the long distance transmission of energy.
36. What is function of choke coil in a fluorescent tube?
37. The core of a transformer is made of a material whose hysteresis loop is narrow. Why?
38. What is the use of a motor starter?
39. Why is choke preferred to rheostat in controlling a.c. supply?
40. Give the working principle of a starter used along with a choke in a fluorescent tube.
41. The rate of change of current in one of the coils (a system formed by two coils) is1.6 A /s. Due to this, induced emf in the other coil is

25.6×10^{3} μV. Find mutual inductance of the system formed by coils. (Ans: 16×10^{-3} H)

42. The number of turns in a coil is 10000 and area of each turn is 4 cm^2. It is placed perpendicularly to the magnetic induction B. If the coil is rotated through 90 ° from this position, then find the charge induced.
[R = 10 Ω, B = 6 Wb /m^2](Ans: 2.4 coulomb)

43. The total length of wings of an aeroplane is 15 m. Its horizontal velocity is 720 km /hr. Calculate the induced electromotive force between the two ends of its wings. The value of vertical component of earth's magnetic field is 4×10^{-5} Tesla. (Ans: 0.12 V)

44. There are 50 turns in the coil and the flux linked with each of its turn is 0.2 weber. If 5 ampere current passes through the coil, find self - inductance of the coil.(Ans: 2.0 H)

45. Number of turns of a coil is 50. Area of every turn is 100 cm^2. The plane of the coil is perpendicular to the uniform magnetic field of 200×10^{-4} weber /m^2. It is rotated so that the plane of the coil becomes parallel to the same magnetic field within 0.1 sec. Calculate the induced emf. (Ans: 0.10 V)

46. A coil of 500 turns and area 10 cm^2 is placed with its plane perpendicular to a magnetic field of 2×10^{-3} weber /m^2. If the field is uniformly reduced to zero in 10^{-2} s, what will be the emf? Induced in the coil? If the resistance of the coil is 50 ohm, calculate the values of the current and charge induced in the coil. Ans: 0.1 volt, 0.002 A, 2×10^{-5} C)

47. A surface vector of area 60 m2 is parallel to and in a magnetic field. The intensity of this uniform magnetic field is 300 weber /m^2 (tesla). If the surface rotates through 90° in 3 minutes, then find the induced emf.
(Ans: 100 volt)

48. In a uniform magnetic field of 600 tesla a surface-vector of area is placed parallel to it. From this position, if this surface rotates through 90° in 5 minutes producing the induced emf. of 80 volt, then find the surface-vector area.(Ans: 40 m^2)

49. The two rails of railway track, insulated from each other, and the ground are connected to a milli-voltmeter. What will be the reading of the milli-voltmeter when a train travels at a speed of 180 km /hr along

the track, if the vertical component of earth's magnetic field is 2×10^{-4} weber /m^2 and rails are separated by 1 m.(Ans: 1 mV)

50. The length of the wing of an air plane is 10 m. Its horizontal velocity is 200 m /s. If the vertical component of the earth's magnetic field is

5.0×10^{-5} weber /m^2, calculate the potential difference developed across the two ends of the wing. (Ans: 0.1 V)

51. A direct current of 2 A in a coil of 400 turns causes a flux of 10^{-4} weber to links of the coil. Compute the average counter emf. induced in the coil if the current is interrupted in 0.08 s. Find the inductance of the coil.(Ans: 0.5 V, 0.02 H)

52. The length of a solenoid having 1000 turns is 10π cm. If its cross-sectional area is 10 cm^2, find its self-inductance. If a current of 10 A flows through it, what is the strength of magnetic field intensity inside it? ($\mu_0 = 4\pi \times 10^{-7}$ tesla-m /A)
(Ans: 4×10^{-3} H, 0.04 tesla)

53. The e.m.f of ac source is given by the expression E = 300 sin 314 t volts. Write the values of a peak voltage and frequency of source.

54. An electrical element X, when connected to an alternating voltage source, has the current through it leading the voltage by $\pi/2$ rad. Identify X and write an expression for its reactance.

55. Draw the graphs showing the variation of reactance of (a) a capacitor and (b) an inductor with the frequency of an a.c. circuit.

56. Derive an expression for the instantaneous value of induced e.m.f in a coil when it is rotated in a uniform magnetic field at a uniform angular velocity. How does the e.m.f vary when the coil rotates through an angle of 2π?

57. The magnetic flux through a coil perpendicular to its plane is varying according to the relation $\Phi = (5t^3 + 4t^2 + 2t - 5)$ weber. Calculate the induced current through the coil at t = 2 s of the resistance of the coil is 5Ω.

Unit V: Electromagnetic Waves

2 marks questions

1. What are electromagnetic waves? Give its properties.
2. Give the brief history of em waves.
3. Explain Hertz's experiment for the production of electromagnetic waves.
4. Give two properties of infra-red rays.
5. Give two properties of ultra-violet rays.
6. Give two properties of micro waves.
7. Give two properties of X-rays.
8. Give two properties of Υ-rays.
9. Give two uses of infra-red rays.
10. Give two uses of ultra-violet rays.
11. Give two uses of micro waves.
12. Give two uses of X-rays.
13. Give two uses of Υ-rays
14. Explain Green house effect.
15. The small ozone layer on the top of stratosphere is crucial for human survival. Why?
16. Which part of the electromagnetic spectrum is used in operating RADAR?
17. What is displacement current? Why did Maxwell introduce the concept of displacement current?

Unit VI: Optics

2 marks questions

1. Define wave front and ray of light. How they are related to each other.
2. Why ether was called a hypothetical medium?
3. Why is the contribution of wavelets lying on the back of secondary wave front zero?
4. Draw the shape of wave front originating from (i) a point source and (ii) a line source?
5. What are two assumptions on which Huygens' Principle is based?
6. Why do the oil films on the surface of water appear to be coloured?
7. Why does an excessively thin film appear black in reflected light?
8. Bubbles of colourless soap solution appear coloured in sunlight. Why?
9. Why no interference pattern is observed, when two coherent sources are (i) infinitely close to each other (ii) far apart from each other?
10. What is diffraction of light? What is condition for diffraction to takes place?
11. What is difference between interference and diffraction?
12. Why can sound waves be diffracted more easily than light waves?

13. What do you mean by crossed polarized and elliptically polarized light?
14. What is refraction of light? State its laws.
15. What is refractive index? On what factors it depends?
16. Why do stars twinkle at night?
17. The sun is seen a little before it rises and for a short while after it sets. Explain why?
18. Why does a tank filled with water appear shallow?
19. A stick is partially immersed obliquely under water appears to be bent. Explain why?
20. How do you explain the mirage effect produced in very hot deserts?
21. Why is the diamond brilliant? Is it a source of light also?
22. Can a convergent lens in one medium behave as a divergent lens in some other medium?
23. What is spherical aberration? How it can be minimized.
24. Although the surfaces of a goggle lens are curved, it does not have any power. Explain why?
25. What is dispersion of light? Explain its cause.
26. Why sky appear blue? What will it look like on moon?
27. Why the rising sun is red in colour?
28. Eye is more sensitive to yellow colour. Why are then danger signals red?
29. What is difference between reflecting and refracting type telescope?
30. A concave lens is kept in contact with a convex lens of focal length 20 cm. the combination works as a convex lens of power 2D. Find the power of the concave lens.
31. A thin prism of 5° angle gives a deviation of 3.2°. What is the value of refractive index of the material of the prism?
32. What is the ratio of slit widths when the amplitudes of light waves from them have a ratio 3:1?
33. If the two slits in Young's experiment have width ratio 4:1, calculate the ratio of intensity at maxima and minima in the interference pattern.
34. Two coherent sources whose intensity ratio is 25:1 produce interference fringes. Calculate the ratio of intensity of maxima and minima in the fringe system.
35. A ray of light is incident on the surface of a glass plate of refractive index 1.5 at the polarising angle. Calculate the angle of refraction.
36. For a given medium the polarising angle is 60°. What will be the critical angle of the medium?

3 marks questions

1. Verify law of reflection using Huygens' wave theory.
2. Verify law of refraction using Huygens' wave theory.
3. What is interference of light? Show that it obeys law of conservation of energy.
4. What is sustained interference pattern? What conditions must be satisfied for producing sustain interference pattern?

5. What are coherent sources? Why two independent source of light do not produce interference pattern?
6. What happens to fringe width under the following operations; (i) slit width is reduced (ii) distance between screen and slit is reduced (iii) monochromatic light is replaced by white light (iv) apparatus is immersed in water?
7. Define resolving power of telescope. On what factors it depends?
8. Define resolving power of microscope. On what factors it depends?
9. What is polarization of light? How will you represent polarized and unpolarised light?
10. State and prove Brewster law of polarization of light.
11. What are Polaroid and give its uses?
12. Define (i) critical angle (ii) polarizing angle. What is relation between them?
13. What is total internal reflection? Write the conditions for total internal reflection to take place. Give one application of total internal reflection.
14. What is optical fibre? State its principle and give its applications.
15. What is power of lens? Why is the power of a lens measured as the reciprocal of focal length?
16. What is equivalent lens? Obtain an expression for the effective focal length of two convex lenses placed in contact.
17. State and prove prism formula.
18. Derive the relation for refractive index of material of prism when prism is placed in minimum deviation position.
19. Prove that for small angle of prism $\delta=A(\mu-1)$.
20. What do you understand by deviation without dispersion? Obtain expression for it.
21. An object is placed at a distance of 40cm from a concave mirror of focal length 15cm. if the object is displaced through a distance of 20cm towards the mirror, by how much distance is the image displaced?
22. A convex lens of focal length 0.2 m and made of glass ($\mu=1.5$) is immersed in water ($\mu=1.33$). Find the change in the focal length of the lens.
23. An object is placed at a distance of 75 cm from a screen, where should a convex lens of focal length 12 cm be placed so as to obtain real image of the object on the screen?
24. A ray of light incident on an equilateral glass prism shows minimum deviation of 30°. Calculate the speed of light through glass prism.
25. A person's far point is 2m and his near point is 40 cm. find the nature, focal length and power of the lenses, he must use to (a) see distant objects and (b) read a book clearly. The least distance of distinct vision is 25 cm.

26. Light of wavelength 4000 $\mathring{A}$ is incident on a double slit, if the overall separation of 10 fringes on a screen 200 cm away is 1.0 cm, find the distance between two slits.
27. The fringe width in a Young's double slit interference pattern is 2.4×10^{-4} m, when red light of wavelength 6400 $\mathring{A}$ is used. By how much will it change, if blue light of wavelength 4000 $\mathring{A}$ is used?

5 marks questions

1. State principle of superposition of light waves. Derive the conditions for constructive and destructive interference.
2. Derive the expression for fringe width for young double slit experiment.
3. Describe an experiment to show that light waves are transverse in nature.
4. Explain Fraunhoffer diffraction of single slit and derive relation for linear width of central maxima.
5. With the help of a ray diagram, explain the principle, working and expression for magnifying power of compound microscope.
6. With the help of a ray diagram, explain the principle, working and expression for magnifying power of telescope.
7. What is rainbow? Differentiate between primary and secondary rainbow with a diagram. Why two observers do not see the same rainbow?
8. Giving sign conventions and assumptions derive lens maker formula for convex lens.
9. By stating the sign-conventions and assumptions used, derive the relation between u, v and R of a convex spherical surface, when refraction takes place from optically denser to optically rarer medium.
10. By stating the sign-conventions and assumptions used, derive the relation between u, v and R of a concave spherical surface, when refraction takes place from optically denser to optically rarer medium.
11. Prove the following formula when refraction takes place at a convex spherical refracting surface and source of light lies in the rarer medium and image formed is virtual. $\frac{\mu_2}{v}-\frac{\mu_1}{u}=\frac{\mu_2-\mu_1}{R}$ Where symbols have their usual meanings.
12. Prove the following formula when refraction takes place at aconvex spherical refracting surface and source of light lies in the rarer medium and image formed is real. $\frac{\mu_2}{v}-\frac{\mu_1}{u}=\frac{\mu_2-\mu_1}{R}$ Where symbols have their usual meanings.

Unit VII: Dual nature of Matter and Radiation

1 mark questions

1. Define an electron volt.
2. How many joules make one electron volt?
3. What is photon?
4. On what factor does energy of photon of light depends?
5. What is photoelectric effect?
6. Define threshold wavelength.
7. Define threshold frequency.
8. Why alkali metals are most suited for photoelectric emission?
9. If the wavelength of the incident light is decreased, how does velocity of photoelectrons change?
10. Does the threshold frequency depend on the intensity of light?
11. Define stopping potential.
12. If the intensity of incident light is doubled, how does the stopping potential change?
13. If the frequency of the incident light is equal to the threshold frequency, what will be the value of the stopping potential?
14. What is value of rest mass of photon?
15. Which photon is more energetic: a red one or a violet one?
16. Define work function.
17. Write photoelectric equation.
18. Do non-metals show photoelectric effect?
19. Write de-Broglie wave equation.
20. Calculate de-Broglie wavelength of an electron beam accelerated through a potential difference of 100V?
21. Two metals A and B have work function 2eV, 4eV respectively, which metal have lower threshold wavelength for photoelectric effect?
22. The work function of cesium is 2eV. What does it mean?
23. It is harder to remove free electron from copper tan from sodium. Which has higher work function?
24. The maximum K.E of electrons emitted by a photocell is 3eV, what is the stopping potential?

25. What is the momentum of an electron beam of wavelength 4 $\mathring{A}$?

2 marks questions

1. How many electron volts are there in 1 joule?
2. Prove that its rest mass is zero.
3. State laws of photoelectric emission.
4. On what factors photoelectric current depends?
5. Is photoelectric emission possible at all frequencies? Give reason.
6. If the frequency of the incident radiation on the cathode of a photocell is doubled, how will the following change: (i) kinetic energy of the electrons, (ii) photoelectric current.
7. Why photoelectric cell is also called an electric eye?
8. How much charge is carried by 1kg of photoelectrons?
9. On what factors stopping potential depends?
10. Calculate the energy of a photon in electron volt, whose wavelength is 6600 $\mathring{A}$.
11. Find the number of photons emitted per second by a 25W source of monochromatic light of wavelength 6000 $\mathring{A}$?
12. Radiations of wavelength 5000 $\mathring{A}$ falls on a metal whose work function is 1.9eV. Find the energy of photo-electrons emitted?
13. On using light of wavelength 5000 $\mathring{A}$, the stopping potential for a photocell is 2.4 V. if light of wavelength 4000 $\mathring{A}$ is used, and then what is value of stopping potential.
14. What do you understand by phrase 'dual nature of radiation'?
15. A photon and electron have got the same de-Broglie wavelength. Which has greater total energy? Explain.
16. A proton and electron have got the same de-Broglie wavelength. Which has greater kinetic energy? Explain.
17. Derive an expression for de-Broglie wavelength of an electron moving under a potential difference of V volts.
18. Calculate de-Broglie wavelength in nm associated with a ball of mass 66g moving with a velocity 2.5×10^5 ms^{-1}.

Unit VIII: Atoms & Nuclei

1 mark questions

1. Define impact parameter.
2. What is scattering angle for b=0?
3. What is distance of closest approach?
4. What is Bohr's quantisation condition?
5. What is Bohr's frequency condition?
6. Name the series of hydrogen spectrum which lies in ultraviolet region?
7. Name the series of hydrogen spectrum which lies in visible region?
8. Name the series of hydrogen spectrum which lies in infra-red region?
9. What is energy possessed by an electron in $n=\infty$?
10. What is the ionisation potential of hydrogen atom?
11. What is value of Rydberg's constant?
12. How many electrons, protons and neutrons are there in a nucleus of atomic number 12 and mass number 25?
13. What are isotopes?
14. What are isobars?
15. What are isotones?
16. What are nuclear forces?
17. Give two properties of nuclear forces.
18. Define mass defect.
19. Define binding energy of a nucleus.
20. Define atomic mass unit.
21. State Einstein's mass energy relation.
22. How many joules are there in 1 MeV?
23. Define alpha decay.
24. Define beta decay.
25. Define gamma decay.
26. Select the pairs of isobars and isotones from the following nuclei: ${}_{11}Na^{22}, {}_{12}Mg^{24}, {}_{11}Na^{24}, {}_{10}Ne^{23}$

3 marks questions

1. What is Rutherford atomic model? What are its drawbacks?
2. What is distance of closest approach and impact parameter?
3. What is difference between emission and absorption spectra?
4. Define isotopes, isobars and isotones.
5. Show that nuclear density is independent of mass number.
6. Define mass defect, binding energy and binding energy per nucleon.
7. Draw the curve between mass defect and binding energy per nucleon. What conclusion is drawn from it?
8. What are nuclear forces? Give its properties.
9. What is natural and artificial radioactivity?
10. What is difference between α-rays, β-rays-rays?
11. Define radioactivity. State laws of radioactive disintegration.
12. State radioactive decay law. Show that radioactive decay is exponential decay.
13. What is half life period and mean life period? Establish relation between two.
14. What is radioactive disintegration constant? How it is related with half life period.
15. What are nuclear reactions? State the laws which are conserved during nuclear reactions.
16. What is difference between nuclear fission and nuclear fusion reactions?
17. A fusion reaction is more energetic than fission reaction. Comment.
18. Give the construction, working of nuclear reactors.
19. Why is heavy water used as a moderator?
20. Define critical mass and critical size.
21. Natural radioactive nuclei are nuclei of high mass number. Why?
22. Define two units of radioactivity. How are they related?
23. A nucleus contains no electrons, but can eject them. Why?
24. Uranium $_{92}U^{238}$ is not suitable for chain reaction. Why?
25. What are thermal neutrons? Why are the neutrons as effective as bombarding particles?
26. Why control rods are made of Cadmium in a nuclear reactor?
27. Explain the production of energy in stars.
28. In heavy nuclei, number of neutrons is more than number of protons. Why?
29. The sun is continuously losing mass. Comment on the statement.

Unit IX: Electronic Devices

1 marks questions

1. Why crystalline solids have sharp melting points?
2. What is valence band?
3. What is conduction band?
4. Define forbidden energy gap in solids.
5. What is Fermi energy level?
6. Why metallic solids are opaque?
7. What is single crystal and poly crystal?
8. Why semiconductors are doped?
9. What is hole?
10. Doping of germanium with indium leads to which type of semiconductor?
11. What is electron mobility?
12. What is an extrinsic semiconductor?
13. Draw energy band diagram for an n-type extrinsic semiconductor.
14. Draw energy band diagram for a p-type extrinsic semiconductor.
15. How does conductivity of semiconductor change with rise in temperature?
16. What do you understand by potential barrier?
17. What is depletion region in a p-n junction?
18. What is effect on width of depletion layer when p-n junction is forward biased?
19. What is effect on resistance of a p-n junction when it is reverse biased?
20. Draw a circuit diagram of a p-n junction with forward bias.
21. Draw a circuit diagram of a p-n junction with reverse bias.
22. What is zener diode?
23. What is zener break down?
24. What are photodiodes?
25. What is light emitting diodes?
26. What is solar cell?
27. What is relation between current gains α and β?
28. Define transconductance of a transistor.
29. Convert number 37 into binary number system.
30. What is logic gate?
31. What is truth table of a logic gate?
32. What is Boolean expression?

3 marks questions

1. What is difference between crystalline and amorphous solids?
2. Explain the formation of energy bands in solids.
3. On the basis of energy band theory, distinguish between metals, insulators and semiconductors.
4. What is meant by doping? Why it is done?
5. Distinguish between intrinsic and extrinsic semiconductors.
6. What is difference between p-type and n-type semiconductors?
7. What do you mean by hole in a semiconductor? Write its three characteristics.
8. What is donor energy level and acceptor energy level? Explain.
9. What is effect of increase in temperature on the conductivity of semiconductors and metals?
10. Why a semiconductor is damaged by strong currents?
11. Derive an expression for electrical conductivity of semiconductors.
12. Explain the formation of pn junction.
13. What is potential barrier, depletion layer?
14. What is forward and reverse biasing on junction diode?
15. Draw labelled characteristics (forward and reverse bias) of pn junction diode.
16. What do you mean by half waves rectifier and draw its circuit diagram?
17. Draw the circuit diagram of full wave rectifier and briefly explain its working principle?
18. What do you mean by transistor? Why it is so called? Give the symbols of n-p-n and p-n- transistor.
19. Explain the action of transistor.
20. What is zener diode? Give its symbol and use.
21. Explain the working of npn transistor as common base amplifier.
22. Explain the working of pnp transistor as common base amplifier.
23. Explain the working of npn transistor as common emitter amplifier.
24. Draw and explain the characteristic curves for pnp transistor in common emitter configuration.
25. Explain with the help of labelled diagram the working junction transistor as oscillator.
26. Write the merits and demerits of semiconductor devices over vacuum tubes.
27. Can two p-n junction diodes back to back work as transistor.
28. Define current amplification factor in common base and common emitter mode. Establish relation between two.
29. Why does the width of the depletion layer in a p-n junction vary with the increase in reverse bias?
30. In a transistor base is made thin, why?

31. In a transistor, forward bias is always small as compared to the reverse bias. Explain
32. A transistor is a heat sensitive device. Explain
33. How will you test in a simple way whether transistor is spoiled or in working order?
34. Why a transistor cannot be used as rectifier?
35. In a transistor, emitter-base junction is always forward-biased, while the collector-base junction is reversing biased. Why?
36. What is digital and analog signal?
37. What are truth table, logic gate and Boolean expression?
38. Give the symbol, truth table and Boolean expression for AND gate.
39. Give the symbol, truth table and Boolean expression for OR.
40. Give the symbol, truth table and Boolean expression for NOT gate.
41. Give the symbol, truth table and Boolean expression for NAND gate.
42. Give the symbol, truth table and Boolean expression for NOR gate.
43. NAND or NOR gate are called building blocks of digital electronics. Why?
44. How we make AND, NOT and OR gate using NAND (NOR) gates?
45. How AND gate, OR gate are actually releaised using pn junctions?
46. How NOTgate is actually releaised using transistors?

Unit X: Communication Systems

2 marks questions

1. What is communication system? What are main constituents of communication system?
2. What is transducer? Give an example.
3. What is digital and analog communication system?
4. What is frequency modulation and amplitude modulation?
5. What are advantages of frequency modulation over amplitude modulation?
6. Why do we need modulation for transmission of signals?
7. What is modulation index? Give its importance.
8. What do you mean by bandwidth and frequency deviation?
9. What do you mean by quantization and sampling of an analog signal?
10. The audio signal cannot be transmitted directly into space. Why?
11. What is carrier wave? Why high frequency carrier waves are employed for transmission?
12. What is noise? What are their causes?
13. What is difference between bit-rate and sampling rate?

14. What do you mean by pulse amplitude modulation and pulse code modulation?
15. What are merits of digital communication?
16. What is modem? Explain its principle.
17. Explain the term FAX?
18. Distinguish between a FAX and an e-mail.
19. What is ground wave? Why short wave communication over long distance is not possible via ground wave?
20. What are sky waves? Why sky waves are not used in the transmission of television signals?
21. Briefly explain space wave propogation.
22. Briefly explain sky wave propogation.
23. What is an active satellite? How is it different from a passive satellite?
24. It is necessary to use satellites for long distance TV transmission. Why?
25. Deduce an expression for the distance at which TV signals can be directly received from a TV tower of height h.
26. Greater the height of a TV transmission antenna, greater is its coverage. Explain.
27. What is micro wave communication? What are its drawbacks?
28. What is communication satellite? What are its advantage and disadvantages?
29. What is remote sensing? How it is carried out? Give its applications.
30. What are active and passive satellites?
31. What is transmission medium? What are various types of transmission media used for communication systems?
32. What are drawbacks of 2-wire line?
33. What are coaxial cables? What are their main advantages over 2-wire line?
34. What is function of copper mesh in a coaxial cable?

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