Chapter 1

Short Questions

1. Define physics and give the names of its two main branches.
2. What are the main frontiers of fundamental science?
3. What are base units? Name all of them.
4. How many years are there in 1 second?
5. How many seconds are there in one year?
6. How many nano-seconds are there in one year?
7. How many meters are there in one light year? (Speed of light = $3 \times 10^8 ms^{-1}$)
8. Name several repetitive phenomenon occurring in nature which could serve as a reasonable time standard.
9. Why do we find it useful to have two units for the amount of substance, the kilogram and the mole?
10. What do you mean by scientific notation? Give an example.
11. What are supplementary units? Define only one unit.
12. Define radian and steradian.
13. An old saying is, "A chain is only as strong as its weakest link." What analogous statement can you make regarding experimental data used in computation?
14. What are derived units? Explain.
15. Differentiate between base unit and derived units.
16. The time period of a simple pendulum is measured by stop watch what types of errors are possible?
17. Define random error and systematic error.
18. Define systematic error. Explain how can we remove the effect of systematic error?
19. Define significant figures.
20. Define precision and accuracy?
21. What is the difference between a precise and an accurate measurement?
22. Add the following masses given in kg up to appropriate precision. 2.189, 0.089, 11.8 and 5.32.
23. Give drawbacks if time period of a pendulum is used as a time standard.
24. Does a dimensional analysis give any information on the constant of proportionality that may appear in an algebraic expression? Explain
25. Write down the two uses of dimension analysis.
26. The wavelength 'λ' of a wave depends on the speed 'v' of the wave and its frequency 'f' knowing that $[\lambda] = [L]$, $[v] = [LT^{-1}]$ and $[f] = [T^{-1}]$. Decide which one of these is correct? $f=v\lambda$ or $f = v/\lambda$
27. Write the dimensions of pressure and density.
28. Write down the units and dimensions of G from the equation $F = G\, m_1 m_2 / r^2$
29. What are the dimensions and S. I. units if the coefficient of viscosity η in the relation $F = 6\pi\eta rv$
30. Show that the expression $v_f = v_i + at$ is dimensionally correct.
31. Show that the famous Einstein equation, $E = mc^2$ is dimensionally consistent.

Long Questions

1. What is uncertainty? Explain how we can assess the total uncertainty in final answer in different circumstances.
2. Write a note on significant figures.
3. What are significant figures? How can we find which figures are significant?
4. What are the rules to round off the digits to the desired decimal place?

Chapter 2

Short Questions

1. Show the sum and difference of two perpendicular vectors of equal lengths are also perpendicular and of the same length.
2. The vector sum of three vectors gives a zero resultant. What can be the orientation of the vectors?
3. How would the two vectors of same magnitude are oriented such that resultant vector has magnitude equal to each vector.
4. Two vectors have unequal magnitude. Can their sum be zero? Explain
5. Can you add zero to a null vector?
6. Define null vectors and equal vectors?
7. Define the multiplication of a vector by a scalar.
8. What is the unit vector in the direction of the vector $\mathbf{A} = 4\mathbf{i} + 3\mathbf{j}$
9. Define (a) Unit Vector (b) Position Vector.
10. Can the magnitude of a vector have a negative value?
11. Under what circumstances would a vector have components that are equal in magnitude?
12. Can a vector have components greater than the vectors magnitude?
13. Is it possible to add a vector quantity to a scalar quantity? Explain.
14. If $\mathbf{A} + \mathbf{B} = \mathbf{0}$, what can you say about the components of the two vectors?
15. If one of the rectangular components of a vector is not zero, can its magnitude be zero? Explain.
16. Why do you keep your legs far apart when you have to stand in the aisle of a bumpy riding bus?
17. Prove that commutative law holds for addition of vectors.
18. You are falling off the edge. What should you do to avoid the fall?
19. Name three different conditions that could make $\mathbf{A}_1 \times \mathbf{A}_2 = \mathbf{0}$
20. Name three conditions that could make $\mathbf{A.B=0}$
21. Write two examples of vector product.
22. Define torque and moment arm.
23. Write two conditions for which torque is zero.
24. What do you understand by positive and negative torque?
25. Define torque. Write its units and dimensions.
26. Define the two conditions of equilibrium.

27. Can a body rotate about its center of gravity under the action of its weight? Explain briefly with diagrams.

Long Questions

1. Define torque. Calculate torque due to force acting on a rigid body?
2. Define the rectangular components of a vector. Discuss the vector addition of number of coplanar vectors by rectangular component method.
3. Derive the expression for the magnitude and direction of resultant of two vectors, added by rectangular component method.
4. Define scalar product with examples. Write down its characteristics.
5. Define vector product of two vectors. Also write the characteristics of vector product of two vectors.
6. Explain cross product of two vectors, state right hand rule and write at least four characteristics.

Chapter 3

Short Questions

1. Differentiate between distance and displacement.
2. Explain what do you mean by the term velocity?
3. Define instantaneous velocity of a moving body.
4. Can the velocity of an object reverse its direction when the acceleration is constant? If so, give an example.
5. What is the difference between uniform and variable velocity? Give S. I. Units of velocity and acceleration.
6. An object is thrown vertically upward. Discuss sign of acceleration due to gravity relative to velocity.
7. Explain the circumstances in which the velocity '**v**' and the acceleration '**a**' of a car are parallel, perpendicular to one another and anti-parallel.
8. Motion with constant velocity is a special case of motion with constant acceleration. Is this statement true? Discuss.
9. What is meant by instantaneous acceleration? Write its formula.
10. A man standing on the top of a tower throws a ball straight up with initial velocity v_i and at the same time throws a second ball straight down with the same speed? Which ball will have larger speed when it strikes the ground?
11. How is distance calculated from velocity-time graph?
12. Prove that the area between the velocity-time graph and the time axis is numerically equal to the distance covered by the object.
13. State Newton's second and third law of motion?
14. State Newton's second law of motion and write its mathematical form.
15. Why the first law of motion is also called the law of inertia.
16. Show that the rate of change in momentum for an object is equal to the applied force.
17. State the second law of motion in terms of momentum.

18. Define impulse. Show how it is related to linear momentum?
19. Define impulse. Give its unit and dimension.
20. Does a moving object have impulse?
21. State the law of conservation of momentum.
22. Why is it useful to use a safety helmet?
23. Why motor cycle's safety helmet is padded?
24. A 1500 kg car has its velocity reduced from 20 ms^{-1} to 15ms^{-1} in 3.0 seconds. How large was the average retarding force.
25. Define momentum and give its unit.
26. Define elastic and inelastic collision. Explain how a bouncing ball would behave in each case.
27. Differentiate between elastic and inelastic collisions. Also give an example of car.
28. Find the relation of force due to the water flow.
29. How would you find the momentum of an explosive force? Explain with one example.
30. When rocket re-enters the atmosphere, its nose become very hot, why?
31. Explain what is meant by projectile motion. Give an example.
32. At what point or points in the path does a projectile have its minimum speed and maximum speed?
33. Define time of flight of a projectile.
34. Define range of a projectile.
35. Show that range of projectile s maximum when projectile is thrown at an angle of 45^o with the horizontal.
36. What is ballistic flight? Explain
37. Write down two characteristics of ballistic missile.
38. What is ballistic missile? Define its trajectory?
39. Derive the relation for maximum height reached by the projectile.

Long Questions

1. State and explain the law of conservation of momentum
2. State and prove law of conservation of linear momentum.
3. Define elastic and inelastic collision. Explain elastic collision in one dimension to show the relative velocities before and after collision are same.
4. What is elastic collision? Discuss the collision of two balls in one dimension and calculate their final velocities if target was initially at rest.
5. Define projectile motion. Derive formulas for time of flight and the horizontal range of the projectile.
6. Define projectile motion. Derive the mathematical formula for its height and time of flight.

Chapter 4

Short Questions

1. An object has one joule potential energy. What does it mean?
2. Calculate the work done in kilojoules in lifting the mass if 10kg (at a steady velocity) through a vertical height of 10m.
3. What do you understand by work and energy? Give their units.
4. In which case is more work done? When a 50kg bag of books is lifted though 50cm or when a 50kg crate is pushed through 2m across the floor with a force of 50N.
5. A person holds a bag of groceries while standing still, a car is stationary with its engine running at stand point, how the two situations are simpler.
6. A force 'F' acts though a distance 'L'. The force is then increased to '3F' and then acts through a further distance of '2L'. Draw the work diagram to scale and calculate total work done.
7. What do you mean by variable force? Give its two examples.
8. Define conservation field. Give its two examples.
9. Define the term power and its S.I. units.
10. Derive the relation between power and velocity.
11. Define kilowatt hour. Show that $1kWh = 3.6x10^6$ J.
12. Write power in terms of force and velocity?
13. Define work energy principle. Also write down its equations.
14. What sort of energy is in the following (a) Compressed spring (b) water in a high dam (c) A moving car?
15. What is escape velocity of an object? Write its mathematical expression.
16. State the law of conservation of energy.
17. A girl drops a cup from a certain height, which energy changes are involved?
18. A boy uses a catapult to throw a stone which accidently smashes a greenhouse window. List the possible energy changes.
19. How electrical energy can be obtained by using tides?
20. Write down two sources of energy which are renewable.
21. Name some non-conventional energy sources.
22. How electrical energy be obtained by sunlight by indirect conversion method?
23. What is geo-thermal energy?
24. Explain briefly about residual heat of the earth.
25. How energy is obtained from direct combustion and fermentation.
26. How many most common methods used for the conservation of biomass, into fuel write their names?

Long Questions

1. Explain the work done in gravitational field. Also define conservative field.
2. Prove that the work done by gravitational field is independent of the path followed. And what you conclude from this?

3. Define escape velocity. Derive and expression for escape velocity and calculate its value on the earth's surface.
4. Define absolute potential energy. Derive a relation for absolute gravitational potential energy.
5. Define energy and prove that K.E. = ½ mv^2. Also derive work energy relation.
6. Explain the interconversion of potential energy and kinetic energy.

Chapter 5

Short Questions

1. Differentiate between degree and radian?
2. Find the velocity of a disc rolls down along an inclined plane of height 10m?
3. Show that $v = r \omega$
4. Show that $a = r \alpha$
5. Can a body move along a circle without centripetal force?
6. Is any work done by centripetal force?
7. What does "INTELSAT" stands for?
8. Define real weight and apparent weight.
9. An object revolving around the earth is said to be a freely falling body. Why?
10. State right hand rule to find the direction of angular displacement?
11. Show that 1 radian = 57.3^o
12. Describe what should be the minimum velocity for a satellite to orbit close to the Earth around it.
13. A lift is ascending with the acceleration "a". Derive the expression for apparent weight of the body of mass "m" in it.
14. Define weightlessness and gravity free system.
15. What is geostationary satellite?
16. Write down applications of communication satellite.
17. What is meant by centripetal force? How is it converted in terms of angular velocity?
18. Why banked tracks are needed for turns?
19. Show that $L = mr^2\omega$
20. Define artificial gravity. Write down expression for its frequency.

Long Questions

1. Define angular momentum? How can we relate it with moment of Inertia?
2. State and explain the law of conservation of angular momentum?
3. Define moment of inertia. Derive an expression for moment of inertia of a rigid body.
4. What is meant by centripetal force? Derive relation for centripetal force and acceleration?
5. Explain rotational kinetic energy? Find rotational kinetic energy of a disc and hoop?
6. What do you understand by real and apparent weight? Find the apparent weight in different cases for an object suspended by a string and spring balance in an elevator? (Cases discussed in text book)

7. What are artificial satellites? Find the expression for minimum velocity and period to put a satellite into the orbit?
8. What is orbital velocity and derive an expression for orbital velocity?
9. What is artificial gravity? Derive an expression for frequency of spaceship required to provide the artificial gravity?
10. What are geo-stationary orbits and geo-stationary satellites? Find the orbital radius of geo-stationary satellites?

Chapter 6

Short Questions

1. Define and explain briefly drag force.
2. Briefly explain viscous drag and Stoke's law.
3. Briefly explain terminal velocity.
4. How an aeroplane is lifted up in the air?
5. State the Stoke's law and write its formula.
6. Explain the term viscosity? What is its unit?
7. What is the Venturi's effect? Write only its mathematical form.
8. Show that for a fluid where the speed of the fluid is high the pressure will be low.
9. How a chimney works the best?
10. State Bernoulli's equation and Torricelli's theorem.
11. Define systolic and diastolic pressure.
12. Write few lines on blood flow.

Long Questions

1. What is terminal velocity? Show that terminal velocity of fog droplet is directly proportional to the square of its radius?
2. State and derive equation of continuity.
3. State and derive Bernoulli's Equation.
4. State Bernoulli's Equation and apply this equation to derive Torricelli's theorem and Venturi's relation.
5. State Bernoulli's Equation and apply this equation to discuss relation between speed and pressure of the fluid.
6. What do you know about blood pressure? How it can be measured dynamically?

Chapter 7

Short Questions

1. Define Hooke's law. Write it in mathematical form?
2. If a heavy and light masses of same size are set into vibration which of them will stop first?
3. What is difference between displacement and amplitude?
4. What is effect of amplitude on frequency and period of simple pendulum?
5. What is meant by phase and initial phase?

6. State the total energy of the vibrating mass and spring is constant. Differentiate between free and forced oscillations?
7. What is driven harmonic oscillator?
8. Write one advantage and one disadvantage of resonance.
9. Describe the condition under which a vibrating body resonates with other body.
10. Define sharpness of resonance?
11. Write three uses of simple pendulum.
12. How resonance is produced in tuning of radio set?
13. Define frequency and time period and relation in them.
14. What is second's pendulum? Find its length and frequency.
15. Define damping and resonance.
16. Why soldiers are advised to break their steps while marching on a bridge?
17. Write and explain electrical application of resonance.
18. Differentiate between frequency and angular frequency.
19. Define the term Oscillations.
20. Briefly explain restoring force.
21. Describe the function of microwave oven.
22. How does the mass change the time period of mass spring system.
23. Evaluate the frequency of a simple pendulum whose length is 9.8 m.

Long Questions

1. Define simple harmonic motion? Discuss motion of projection of particle along the circle and show that this motion is simple harmonic?
2. Show that the motion of the projection of a particle moving around a circle is SHM and derive the relation for its instantaneous displacement, instantaneous velocity and acceleration. (one derivation can be asked for).
3. Discuss the motion of horizontal mass spring system and also derive formula for its time period, displacement and velocity?
4. What is simple pendulum? Show that the motion of simple pendulum is SHM. Also derive an expression for time period and frequency of simple pendulum.
5. Show that the total energy of the vibrating mass spring system remains constant?
6. Explain phenomenon of resonance? Also give examples where resonance plays an important role.

Chapter 8

Short Questions

1. Why sound travel faster in hydrogen than in oxygen?
2. What is the effect of density on speed of sound?
3. Why can microwave not detect underwater object?
4. Explain the term red shift and blue shift in Doppler's effect?
5. Define waves and progressive waves.

6. Write characteristic of stationary waves.
7. Write formula of speed of sound at O ^{O}C.
8. State the principle of super position.
9. How the velocity of a wave will change if "tension" is made 16 times?
10. Define mechanical and electromagnetic waves.
11. Write any two applications of Doppler's effect.
12. Differentiate between "an open organ pipe" and "a closed organ pipe".
13. Define Beats. Write its two uses.
14. Define interference of waves. Write the conditions for interference.
15. Write down effects of variation of pressure and density on the speed of sound.
16. Briefly describe principle of superposition.
17. What are stationary waves and how are they produced?
18. Which is richer in harmonics, an open organ pipe or a closed organ pipe?
19. Define Doppler's shift. Also write its formula.
20. What is radar?
21. What is velocity of sound in air, if temperature of air is 20 ^{o}C?
22. How the velocity of stationary waves in string is affected by changing its tension?
23. Can Doppler's effect be applied to electromagnetic waves? Give an example.
24. What is apparent change in frequency when source is moving away from stationary observer?
25. What is apparent change in frequency when source is moving towards stationary observer?
26. What is apparent change in frequency when observer is moving away from stationary source?
27. What is apparent change in frequency when observer is moving towards stationary source?

Long Questions

1. What was drawback in Newton's formula for speed of sound waves in air? How it was corrected by Laplace? Explain.
2. What is effect of temperature on speed of sound? Also derive a formula to find the rise of speed with temperature?
3. Describe the principle of superposition of waves. State the three phenomenon produced by the superposition of waves.
4. Define and explain interference of sound waves. What are its kinds and their conditions?
5. What are beats? Explain it with the help of examples as well as graphically? Write its two uses?
6. How are stationary waves set up in a medium? Describe the formation of stationary waves explaining clearly the meanings of node and antinodes.
7. What are stationary waves? Describe the stationary waves produced in a stretched string and prove that their frequencies are quantized?
8. An organ pipe has a length of 50 cm. Find the frequency of its fundamental note when it is
9. (i) Open at both ends (ii) Closed at both ends

10. What is Doppler's effect? Discuss the cases when the source moves towards and away from a stationary observer?
11. What are the factors on which speed of sound depends upon? Derive Newton's formula for the speed of sound waves in air.

Chapter 9

Short Questions

1. Define Light and Physical Optics.
2. Define wave front also differentiate spherical and plane wave front?
3. State Huygen's principle and its two steps.
4. Define interference of light and its conditions.
5. What are the conditions for dark and bright fringes in Young double slit experiment of Interference?
6. Explain thin films and also explain the darkness of central fringe of Newton ring.
7. Draw the diagram of Michelson Interferometer.
8. Define diffraction of light.
9. Write down the essential condition for diffraction grating.
10. Define X-ray diffraction? Also write its two uses.
11. Define polarization and plane polarized light?
12. Define optical rotation?
13. What is the meaning of fringe spacing and on which factors it depends upon?
14. What is sugar solution process in polarization?
15. When white light projected through the diffraction grating and produces interference? What colors are between the bands of interference?

Long questions

1. Define interference of light also explain Young double slit experiment for interference.
2. Explains Newton rings in detail and how they work for constructive and destructive interference.
3. Write down construction, working and uses of Michelson Interferometer?
4. What is diffraction of light? How does it take place through a narrow slit?
5. Explain diffraction grating and derive the condition for constructive and destructive interference.
6. Explain the interference phenomena in thin films.
7. Write down diffraction of X-rays by crystals, also derive Bragg formula for X-ray diffraction.

Chapter 10

Short Questions

1. Define least distance of vision and what is the minimum value of human distance of vision?
2. Define magnification and resolving power?
3. Differentiate linear and angular magnification?
4. How can we measure the magnification of simple microscope?
5. Define compound microscope and draw its diagram?
6. Write down the formula for compound microscope magnification?
7. What is astronomical telescope; explain its working with a diagram?
8. What are the meaning of eye piece and objective lenses?
9. How can we measure the magnification of an astronomical telescope?
10. Define spectrometer and write down its essential parts?
11. What is the use of spectrometer?
12. If an astronomer wants to study the stars which are million years away, which type of telescope they will use?
13. Write down the formula of time and speed for measuring the speed of light?
14. What is an optical fiber? Define its types.
15. What is the principle of fiber optics?
16. Write down the uses of optical fibers?
17. Explain total internal reflection?
18. How signal can transmit through optical fiber
19. Differentiate cladding and jacket?
20. Why we use infrared light in fiber optic communication system?
21. Define refractive index?
22. What is effect of age on least distance of vision?
23. How power is lost in optical fiber through dispersion?
24. Define refractive index and critical angle?

Long Questions

1. Explain the difference of magnification and resolving power. How can we measure the resolving power?
2. Calculate the magnifying power of simple microscope?
3. Draw the diagram of compound microscope also calculate the magnifying power of it?
4. Explain astronomical telescope with diagram and also measure its magnification?
5. Define spectrometer and discuss its parts in detail and working of the parts.
6. How we can measure the speed of light, explain the experiment in detail?
7. What is optical fiber, write down its types and uses?
8. What is the principle of optical fiber? Discuss total internal reflection and continuous refraction.

9. Explain the phenomena of signal transmission and conversion of sound?

Chapter 11

Short Answers

1. Define thermodynamics and kinetic theory of gases
2. Describe the relation of temperature and kinetic energy?
3. Define equation of state?
4. Define Boyle's law with graph?
5. Define Charle's law, explain absolute temperature with the help of Charle's law?
6. What is the meaning of internal energy?
7. Differentiate work and energy, derive formula for work done in form of equation of state?
8. Explain first law of thermodynamics with equation.
9. Differentiate isothermal and adiabatic processes with graphs.
10. Define molar specific heat. What is the difference in molar specific heat at constant volume and constant pressure?
11. Differentiate reversible and irreversible process.
12. Define second law of thermodynamics and heat engine.
13. What is Carnot theorem and how Carnot engine works on the theorem.
14. What is the meaning of efficiency of Carnot engine.
15. Define second law of thermodynamics in terms of Entropy.
16. Define absolute temperature.
17. Define Diesel engine how works.
18. Define petrol engine and its working
19. Define Entropy and its environmental crises.

Long Questions

1. Explain kinetic theory of gases and derive the expression for pressure?
2. Explain first law of thermodynamics and also define isothermal and adiabatic process?
3. Define molar specific heat and derive $C_p - C_v = R$
4. Define heat engine on basis of second law of thermodynamics.
5. Discuss Carnot engine and calculate its efficiency.
6. Explain Petrol engine and its working.
7. Discuss Entropy and write down its effects on environment.