11

11 physics

11th Standard

Physics

145 x 3 = 435

1) Briefly explain the types of physical quantities.

2) What are the limitations of dimensional analysis?

3) From a point on the ground, the top of a tree is seen to have an angle of elevation 60^{o} . The distance between the tree and a point is 50m. calculate the height of the tree?

4) The Moon subtends an angle of 1^{0} 55' at the base line equal to the diameter of the earth. What is the distance of the Moon from the Earth? (Radius of the Earth is 6.4×10^{6}m)

5) The temperatures of two bodies measured by a thermometer are $t_1 = (20 + 0.5)^{o}C$, $t_2 = (50 \pm 0.5)^{o}C$. Calculate the temperature difference and the error therein.

6) Obtain an expression for the time period T of a simple pendulum. The time period T depend upon
(i) mass 'm' of the bob
(ii) length 'l' of the pendulum and
(iii) acceleration due to gravity g at the place where the pendulum is suspended. (Constant k = 2π) i.e

7) If the value of universal gravitational constant in SI is 6.6 x 10^{-11} Nm^2 kg^{-2}, then find its value in CGS System?

8) Write a short note on the scalar product between two vectors.

9) Write a short note on vector product between two vectors.

10) How do you deduce that two vectors are perpendicular?

11) Define displacement and distance.

12) Define velocity and speed

13) What is the difference between velocity and average velocity

14) Define angular displacement and angular velocity.

15) Write down the kinematic equations for angular motion.

16) Write down the expression for angle made by resultant acceleration and radius vector in the non uniform circular motion.

17) Calculate the average velocity of the particle whose position vector changes from $\vec{r}_1 = 5\hat{i} + 6\hat{j}$ to $\vec{r}_2 = 2i + 3j$ in a time 5 second.

18) If Earth completes one revolution in 24 hours, what is the angular displacement made by Earth in one hour. Express your answer in both radian and degree.

19) The Moon is orbiting the Earth approximately once in 27 days, what is the angle transversed by the Moon per day?

20) Consider an object travelling in a semi-circular path from point O to point P in 5 second, as is shown in the Figure. Calculate the average velocity and average speed.

21) Is it possible to measure the depth of a well using kinematic equations?

22) An object of mass m has angular acceleration =0.2 α $rads^{-2}$. What is the angular displacement covered by the object after 3 second? (Assume that the object started with angle zero with zero angular velocity).

23) Explain the concept of inertia. Write two examples each for inertia of motion, inertia of rest and inertia of direction.

24) Using free body diagram, show that it is easy to pull an object than to push it.

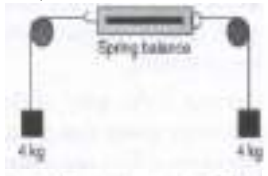
25) Explain various types of friction. Suggest a few methods to reduce friction.

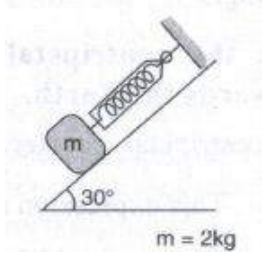
26) What are concurrent forces? State Lami's theorem.

27) Explain the similarities and differences of centripetal and centrifugal forces.

28) Explain the need for banking of tracks.

29) What is the reading shown in spring balance?





30) A bob attached to the string oscillates back and forth. Resolve the forces acting on the bob into components. What is the acceleration experience by the bob at an angle θ.

31) A stone of mass 2 kg is attached to a string of length 1meter. The string can withstand maximum tension 200 N. What is the maximum speed that stone can have during the whirling motion?

32) Apply Newton's second law to a mango hanging from a tree. (Mass of the mango is 400 gm).

33) The Moon orbits the Earth once in 27.3 days in an almost circular orbit. Calculate the centripetal acceleration experienced by the Earth? (Radius of the Earth is 6.4×10^6 m).

34) A baby is playing in a swing which is hanging with the help of two identical chains is at rest. Identify the forces acting on the baby. Apply Lami's theorem and find out the tension acting on the chain.

35) Briefly explain 'centrifugal force' with suitable examples.

36) Arrive an expression for angle of friction.

37) Write the various types of potential energy. Explain the formulae.

38) Write the differences between conservative and Non-conservative forces. Give two examples each.

39) Define the following
a) Coefficient of restitution

40) Arrive at an expression for power and velocity. Give some examples for the same.

41) Let the two springs A and B be such that $k_A > k_B$, On which spring will more work has to be done if they are stretched by the same force?

42) An object of mass m is projected from the ground with initial speed v_0. Find the speed at height h.

43) A lighter particle moving with a speed of 10 ms^{-1} collides with an object of double its mass moving in the same direction with half its speed. Assume that the collision is a one dimensional elastic collision. What will be the speed of both particles after the collision?

44) Show that the ratio of velocities of equal masses in an inelastic collision when one of the masses is stationary is $\frac{v_1}{v_2} = \frac{1-e}{1+e}$

45) Define the following
b) Power

46) Define the following
c) Law of conservation of energy

47) Define the following
d) loss of kinetic energy in inelastic collision

48) Find out the center of mass for the given geometrical structures.
(a) Equilateral triangle
(b) Cylinder
(c) Square

49) Give any two examples of torque in day-to-day life.

50) How do you distinguish between stable and unstable equilibrium?

51) Mention any two physical significance of moment of inertia?

52) Two point masses 3 kg and 5 kg are at 4 m and 8 m from the origin on X-axis. Locate the position of center of mass of the two point masses
(i) from the origin and
(ii) from 3 kg mass.

53) Locate the center of mass of a uniform rod of mass M and length I.

54) A projectile of mass 5 kg, in its course of motion explodes on its own into two fragments. One fragment of mass 3 kg falls at three fourth of the range R of the projectile. Where will the other fragment fall?

55) A cyclist while negotiating a circular path with speed 20 m s^{-1} is found to bend an angle by 30° with vertical. What is the radius of the circular path? (given, g = 10 m s^{-2})

56) A jester in a circus is standing with his arms extended on a turn table rotating with angular velocity ω. He brings his arms closer to his body so that his moment of inertia is reduced to one third of the original value. Find his new angular velocity. [Given: There is no external torque on the turn table in the given situation.]

57) A solid sphere is undergoing pure rolling. What is the ratio of its translational kinetic energy to rotational kinetic energy?

58) What is the relation between torque and angular momentum?

59) A uniform rod of mass m and length l makes a constant angle θ with an axis of rotation which passes through one end of the rod. Find the moment of inertia about this axis.

60) Two particles P and Q of mass 1 kg and 3 kg respectively start moving towards each other from rest under mutual attraction. What is the velocity of their center of mass?

61) Define the gravitational field. Give its unit.

62) What is meant by superposition of gravitational field?

63) Define gravitational potential energy.

64) What is the difference between gravitational potential and gravitational potential energy?

65) What are geostationary and polar satellites?

66) How will you prove that Earth itself is spinning?

67) Explain the variation of g with lattitude.

68) Explain the variation of g with altitude.

69) Explain the variation of g with depth from the Earth's surface.

70) Suppose we go 200 km above and below the surface of the Earth, what are the g values at these two points? In which case, is the value of g small?

71) Moon and an apple are accelerated by the same gravitational force due to Earth. Compare the acceleration of the two.

72) Moon is the natural satellite of Earth and it takes 27 days to go once around its orbit. Calculate the distance of the Moon from the surface of the Earth assuming the orbit of the Moon as circular.

73) Calculate the energy of the
(i) Moon orbiting the Earth and
(ii) Earth orbiting the Sun.

74) Suppose unknowingly you wrote the universal gravitational constant value as G = 6.67 x 10^{11} instead of the correct value G = 6.67 x 10^{-11}, what is the acceleration due to gravity g' for this incorrect G? According to this new acceleration due to gravity, what will be your weight W'?

75) A solid sphere has a radius of 1.5 cm and a mass of 0.038 kg. Calculate the specific gravity or relative density of the sphere.

76) Two pistons of a hydraulic lift have diameters of 60 cm and 5 cm. What is the force exerted by the larger piston when 50 N is placed on the smaller piston?

77) A cube of wood floating in water supports a 300 g mass at the centre of its top face. When the mass is removed, the cube rises by 3 cm. Determine the volume of the cube.

78) Explain elasticity using intermolecular forces.
79) Which one of these is more elastic, steel or rubber? Why?
80) What is the effect of temperature on elasticity?
81) Write down the expression for the elastic potential energy of a stretched wire.
82) Define coefficient of viscosity of a liquid.
83) Distinguish between streamlined flow and turbulent flow.
84) What is Reynold's number? Give its significance.
85) Write down the expression for the Stoke's force and explain the symbols involved in it.
86) What are the energies possessed by a liquid? Write down their equations.
87) Distinguish between cohesive and adhesive forces.
88) What are the factors affecting the surface tension of a liquid?
89) State the principle and usage of Venturimeter.
90) State and prove Pascal's law in fluids?
91) State and prove Archimedes principle.
92) A spring balance shows wrong readings after using for a long time. Why?
93) What do you mean by upthrust or buoyancy?
94) A drop of oil placed on the surface of water spreads out. But a drop of water place on oil contracts to a spherical shape. Why?
95) When you mix a tumbler of hot water with one bucket of normal water, what will be the direction of heat flow? Justify.
96) A gas expands from volume $1m^3$ to $2m^3$ at constant atmospheric pressure.
(a) Calculate the work done by the gas.
(b) Represent the work done in PV diagram
97) Define specific heat capacity and give its unit.
98) What is a thermal expansion?
99) Give the expressions for linear, area and volume thermal expansions.
100) Define latent heat capacity. Give its unit.
101) Define thermal conductivity. Give its unit.
102) What is a black body?
103) What is a thermodynamic system? Give examples.
104) What are intensive and extensive variables? Give examples.
105) What is an equation of state? Give an example
106) Define the internal energy of the system.
107) Are internal energy and heat energy the same? Explain.
108) Give an expression for work done in an isothermal process.
109) Express the change in internal energy in terms of molar specific heat capacity.
110) Apply first law for
(a) an isothermal
(b) adiabatic
(c) isobaric processes.
111) What is meant by a reversible and irreversible processes?
112) State Clausius form of the second law of thermodynamics.
113) Define heat engine.
114) Can the given heat energy be completely converted to work in a cyclic process? If not, when can the heat can completely converted to work?
115) Why does heat flow from a hot object to a cold object?
116) Define the coefficient of performance.
117) In a petrol engine, (internal combustion engine) air at atmospheric pressure and temperature of 20°C is compressed in the cylinder by the piston to 1/8 of its original volume. Calculate the temperature of the compressed air. (For air $\gamma = 1.4$)

118) Define molar specific heat capacity.

119) State Zeroth law of thermodynamics.

120) Give the equation of state for an isothermal process.

121) An oxygen molecule is travelling in air at 300 K and 1 atm, and the diameter of oxygen molecule is 1.2×10^{-10}m. Calculate the mean free path of oxygen molecule.

122) Write the expression for rms speed, average speed and most probable speed of a gas molecule.

123) What is the relation between the average kinetic energy and pressure?

124) Deduce Charles' law based on kinetic theory.

125) Deduce Boyle's law based on kinetic theory.

126) Deduce Avogadro's law based on kinetic theory.

127) List the factors affecting the mean free path.

128) What is the reason for Brownian motion?

129) Describe the Brownian motion.

130) During an adiabatic process, the pressure of a mixture of monatomic and diatomic gases is found to be proportional to the cube of the temperature. Find the value of $\gamma = (C_P/C_V)$

131) Estimate the total number of air molecules in a room of capacity 25 m^3 at a temperature of 27°C.

132) State the postulates of Kinetic theory of gases. (Any 6 points)

133) Show that for a simple harmonic motion, the phase difference between

a. displacement and velocity is $\frac{\pi}{2}$ radian or 90°.

b. velocity and acceleration is $\frac{\pi}{2}$ radian or 90°.

c. displacement and acceleration is π radian or 180°.

134) What is meant by periodic and nonperiodic motion? Give any two examples, for each motion.

135) Write short notes on two springs connected in series.

136) Write short notes on two springs connected in parallel.

137) Write down the time period of simple pendulum.

138) Write down the equation of time period for linear harmonic oscillator.

139) What is meant by free oscillation?

140) Consider a simple pendulum of length l = 0.9 m which is properly placed on a trolley rolling down on a inclined plane which is at θ = 45° with the horizontal. Assuming that the inclined plane is frictionless, calculate the time period of oscillation of the simple pendulum.

141) Explain damped oscillation. Give an example.

142) The ratio of the densities of oxygen and nitrogen is 16:14. Calculate the temperature when the speed of sound in nitrogen gas at 17°C is equal to the speed of sound in oxygen gas.

143) Let f be the fundamental frequency of the string. If the string is divided into three segments l_1, l_2 and l_3 such that the fundamental frequencies of each segments be f_1, f_2 and f_3, respectively. Show that $\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} + \frac{1}{f_3}$

144) If the third harmonics of a closed organ pipe is equal to the fundamental frequency of an open organ pipe, compute the length of the open organ pipe if the length of the closed organ pipe is 30 cm.

145) Describe the formation of beats.

114 x 5 = 570

146) (i) Explain the use of screw gauge and vernier caliper in measuring smaller distances.
(ii) Write a note on triangulation method and radar method to measure larger distances

147) Explain in detail the various types of errors.

148) What do you mean by propagation of errors? Explain the propagation of errors in addition and multiplication.

149) Explain the principle of homogeniety of dimensions. What are its uses? Give example

150) Explain the principle of homogeneity of dimensions and derive an expression for the force F acting on a body moving in a circular path depends on mass of the body (m), velocity (v) and radius (r) of the circular path. Obtain the expression for the force by dimensional analysis method. (Take the value of k = 1)

151) Explain in detail the triangle law of addition.

152) Discuss the properties of scalar and vector products.

153) Derive the equation of motion, range and maximum height reached by the particle thrown at an oblique angle θ with respect to the horizontal direction.

154) Derive the expression for centripetal acceleration.

155) Derive the kinematic equations of motion for constant acceleration.

156) Derive the equations of motion for a particle (a) falling vertically (b) projected vertically.

157) Derive the expression for total acceleration in the non uniform circular motion.

158) Prove the law of conservation of linear momentum. Use it to find the recoil velocity of a gun when a bullet is fired from it.

159) Explain the motion of blocks connected by a string in
i) Vertical motion
ii) Horizontal motion.

160) Briefly explain the origin of friction. Show that in an inclined plane, angle of friction is equal to angle of repose

161) State Newton's three laws and discuss their significance.

162) Describe the method of measuring angle of repose.

163) Calculate the centripetal acceleration of Moon towards the Earth.

164) Briefly explain ‘rolling friction’.

165) Write down the expression for particle moving in an inclined plane.

166) Explain with graphs the difference between work done by a constant force and by a variable force.

167) State and explain work energy principle. Mention any three examples for it.

168) Arrive at an expression for elastic collision in one Dimension and discuss various cases.

169) What is inelastic collision? In which way it is different from elastic collision. Mention few examples in day to day life for inelastic collision.

170) Explain the types of equilibrium with suitable examples?

171) Explain the method to find the center of gravity of a irregularly shaped lamina?

172) Explain why a cyclist bends while negotiating a curve road? Arrive at the expression for angle of bending for a given velocity?

173) Derive the expression for moment of inertia of a rod about its center and perpendicular to the rod?

174) Derive the expression for moment of lnertia of a uniform ring about an axis passing through the center and perpendicular to the plane?

175) Derive the expression for moment of inertia of a uniform disc about an axis passing through the center and perpendicular to the plane.

176) State and prove parallel axis theorem.

177) Discuss rolling on inclined plane and arrive at the expression for the acceleration.

178) State and prove perpendicular axis theorem.

179) Discuss conservation of angular momentum with example?

180) Discuss the important features of the law of gravitation.

181) Explain how Newton arrived at his law of gravitation from Kepler’s third law.

182) Explain how Newton verified his law of gravitation.

183) Derive the expression for gravitational potential energy.

184) Prove that at points near the surface of the Earth, the gravitational potential energy of the object is U = mgh.

185) Explain in detail the idea of weightlessness using lift as an example.
186) Derive an expression for escape speed.
187) Derive the time period of satellite orbiting the Earth.
188) Derive an expression for energy of satellite.
189) Explain in detail the geostationary and polar satellites.
190) Explain how geocentric theory is replaced by heliocentric theory using the idea of retrograde motion of planets.
191) Describe the measurement of Earth's shadow (umbra) radius during total lunar eclipse.
192) Explain in detail the Eratosthenes method of finding the radius of Earth.
193) State Hooke's law and verify it with the help of an experiment?
194) Explain the different types of modulus of elasticity?
195) Derive an expression for the elastic energy stored per unit volume of a wire.
196) Derive an equation for the total pressure at a depth 'h' below the liquid surface.
197) Derive the expression for the terminal velocity of a sphere moving in a high viscous fluid using stokes force.
198) Derive Poiseuille's formula for the volume of a liquid flowing per second through a pipe under streamlined flow.
199) Obtain an expression for the excess of pressure inside a
i) liquid drop
ii) liquid bubble
iii) air bubble.
200) State and prove Bernoulli's theorem for a flow of incompressible, non-viscous, and streamlined flow of fluid.
201) Describe the construction and working of venturimeter and obtain an equation for the volume of liquid flowing per second through a wider entry of the tube.
202) What is capillarity? Obtain an expression for the surface tension of a liquid by capillary rise method.
203) Obtain an equation of continuity for a flow of fluid on the basis of conservation of mass.
204) Explain the meaning of heat and work with suitable examples.
205) Discuss the ideal gas laws.
206) Explain in detail the thermal expansion.
207) Describe the anomalous expansion of water. How is it helpful in our lives?
208) Explain Calorimetry and derive an expression for final temperature when two thermodynamic systems are mixed.
209) Discuss various modes of heat transfer.
210) Explain in detail Newton's law of cooling.
211) Explain Wien's law and why our eyes are sensitive only to visible rays?
212) Explain Joule's Experiment of the mechanical equivalent of heat.
213) Derive the expression for the work done in a volume change in a thermodynamic system.
214) Derive Mayer's relation for an ideal gas.
215) Explain in detail the isothermal process.
216) Derive the work done in an isothermal process.
217) Explain in detail an adiabatic process.
218) Derive the work done in an adiabatic process
219) Explain the isobaric process and derive the work done in this process.
220) Explain in detail the isochoric process.
221) What are the limitations of the first law of thermodynamics?
222) Explain the heat engine and obtain its efficiency.
223) Explain in detail carnot heat engine.
224) Explain in detail the working of a refrigerator.

225) Derive the expression for Carnot engine efficiency.

226) Explain the second law of thermodynamics in terms of entropy.

227) Find the adiabatic exponent γ for mixture of μ_1 moles of monoatomic gas and μ_2 moles of a diatomic gas at normal temperature (27°C).

228) Write down the postulates of kinetic theory of gases.

229) Derive the expression of pressure exerted by the gas on the walls of the container.

230) Explain in detail the kinetic interpretation of temperature.

231) Describe the total degrees of freedom for monoatomic molecule, diatomic molecule and triatomic molecule.

232) Derive the ratio of two specific heat capacities of monoatomic, diatomic and triatomic molecules.

233) Explain in detail the Maxwell Boltzmann distribution function.

234) Derive the expression for mean free path of the gas.

235) What is meant by simple harmonic oscillation? Give examples and explain why every simple harmonic motion is a periodic motion whereas the converse need not be true.

236) Describe Simple Harmonic Motion as a projection of uniform circular motion.

237) What is meant by angular harmonic oscillation? Compute the time period of angular harmonic oscillation.

238) Write down the difference between simple harmonic motion and angular simple harmonic motion.

239) Discuss the simple pendulum in detail.

240) Explain the horizontal oscillations of a spring.

241) Write short notes on the oscillations of liquid column in U-tube.

242) Explain in detail the four different types of oscillations.

243) Describe the vertical oscillations of a spring.

244) Discuss in detail the energy in simple harmonic motion.

245) Discuss how ripples are formed in still water.

246) Briefly explain the difference between travelling waves and standing waves.

247) Show that the velocity of a travelling wave produced in a string is $v\sqrt{\frac{T}{\mu}}$

248) Describe Newton's formula for velocity of sound waves in air and also discuss the Laplace's correction.

249) Write short notes on reflection of sound waves from plane and curved surfaces.

250) Briefly explain the concept of superposition principle.

251) Explain how the interference of waves is formed.

252) What are stationary waves? Explain the formation of stationary waves and also write down the characteristics of stationary waves.

253) Discuss the law of transverse vibrations in stretched strings.

254) Explain the concepts of fundamental frequency, harmonics and overtones in detail.

255) What is a sonometer? Give its construction and working. Explain how to determine the frequency of tuning fork using sonometer.

256) Write short notes on intensity and loudness.

257) Explain how overtones are produced in a
(a) Closed organ pipe
(b) Open organ pipe

258) How will you determine the velocity of sound using resonance air column apparatus?

259) What is meant by Doppler effect?
Discuss the following cases
(1) Source in motion and Observer at rest
(a) Source moves towards observer
(b) Source moves away from the observer
(2) Observer in motion and Source at rest
(a) Observer moves towards Source
(b) Observer resides away from the Source
(3) Both are in motion
(a) Source and Observer approach each other
(b) Source and Observer resides from each other
(c) Source chases Observer
(d) Observer chases Source

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