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NCERT Solutions for Class 9 Science help students to clear any doubts instantly and efficiently. These NCERT Solutions guide students to learn the important concepts which are included in the CBSE Class 9 Science syllabus. Students are required to solve the exercise questions included in the textbook to create a proper understanding of the topics. While solving the textbook questions, doubts arise among students. The NCERT Solutions for Class 9 come in handy at such times, as they include precise explanations and detailed answers to those questions. These CBSE Science NCERT Solutions for Class 9 cover solutions to all the important chapters included in the textbook, like Matter, Atoms, Tissues, Living Organisms, Motion, Force, Laws of Motion, Gravitation, Energy and Work, Sound, Natural Resources, etc. Along with answers to the textbook questions, these solutions provide you with extra questions, exemplar problems, the important questions from previous year question papers, sample papers, worksheets, MCQs, short answering questions, descriptive type questions, their solutions, as well as tips and tricks. NCERT Solutions for Class 9 Science Chapter-Wise PDFs NCERT Solutions for Class 9 Science are provided in a format for better accessibility to the students. These solutions serve as an important studying tool for students who are preparing for their board examinations and assignments. Chapter 1 Matter in Our Surroundings Chapter 2 Is Matter Around Us Pure? Chapter 3 Atoms and Molecules Chapter 4 Structure of the Atom Chapter 5 The Fundamental Unit of Life Chapter 8 Force and Laws of Motion Chapter 10 Work and Energy Chapter 12 Improvement in Food Resources The following are the chapters that have been removed from the NCERT Class 9 Science textbook 2023-24. Diversity in Living Organisms NCERT Solutions of Class 9 Science Book Chapter Brief Chapter 1: Matter in Our Surrounding The Class 9 science textbook starts with the chapter "Matter in Our Surroundings". Everything that we see around us is made up of material which is called matter. These things occupy space and have mass. Earlier, Indian philosophers had classified matter into 5 basic elements called Panch Tatva – air, water, earth, sky and fire. Now, modern scientists have come up with 2 types of classification, i.e., based on physical property and chemical nature. In this chapter, students will learn about the physical properties of matter. The matter is made up of particles and these particulars are very small. The particles of matter have space between them, they are continuously moving and attract each other. The matter around us exists in 3 different states – solids, liquids and gases. These states of matter arise due to variation in the characteristic of the particles of matter. All the 3 states of matters have been explained in-depth with the help of activities. Further, the textbook explains that the state of matter is inter-convertible. The state of matter can be changed by changing temperature or pressure. The phenomenon of change of a liquid into vapour at any temperature below its boiling point is called evaporation. The rate of evaporation depends upon the surface area exposed to the atmosphere, the temperature, the humidity and the wind speed. Evaporation also causes cooling. Topics Covered in Class 9 Science Chapter 1 Matter in Our Surrounding : Definition of matter; solid, liquid and gas; characteristics – shape, volume, density; change of state – melting (absorption of heat), freezing, evaporation (cooling by evaporation), condensation, sublimation. Also access the following resources for Class 9 Chapter 1 Matter in Our Surrounding at BYJU'S: Chapter 2: Is Matter Around Us Pure? This chapter of NCERT Class 9 Science students will teach about mixtures, solutions, properties of solutions, separation of mixtures, and physical and chemical changes. Along with this, they will also learn about compounds and their properties, the difference between mixtures and compounds, the classification of matter, etc. Topics Covered in Class 9 Science Chapter 2 Is Matter Around Us Pure? : Nature of matter: Elements, compounds and mixtures. Heterogeneous and homogenous mixtures, colloids and suspensions. Physical and chemical changes (excluding separating the components of a mixture). Also, access the following resources for Class 9 Chapter 2 Is Matter Around Us Pure? at BYJU'S: Chapter 3: Atoms and Molecules In NCERT Class 9 Science Chapter 3, students will learn the laws of chemical combination, atoms and molecules. They will get to know how to write a chemical formula, molecular mass and mole concepts and some numerical problems related to these concepts. Topics Covered in Class 9 Science Chapter 3 Atoms and Molecules : Particle nature and their basic units: Atoms and molecules, Law of Chemical Combination, Chemical formula of common compounds, Atomic and molecular masses. Also, access the following resources for Class 9 Chapter 3 Atoms and Molecules, at BYJU'S: Chapter 4: Structure of the Atom This chapter of NCERT Class 9 Science deals with the various atomic models of atoms that were proposed by different scientists. In addition to it, this chapter also covers electrons' distribution in different orbits, calculation of valency, atomic number and mass number. Topics Covered in Class 9 Science Chapter 4 Structure of the Atom : Structure of atoms: Electrons, protons and neutrons, Valency, Atomic Number and Mass Number, Isotopes and Isobars. Also, access the following resources for Class 9 Chapter 4 Structure of the Atom at BYJU'S: Chapter 5: The Fundamental Unit of Life This chapter is related to Biology. In this chapter, students will get to know that the cell is the fundamental unit of life. The whole chapter revolves around the cell and its structural organisation, in which students will learn about the plasma membrane, cell wall, nucleus, cytoplasm and structure of an animal cell. Topics Covered in Class 9 Science Chapter 5 The Fundamental Unit of Life : Cell – Basic Unit of life: Cell as a basic unit of life; prokaryotic and eukaryotic cells, multicellular organisms; cell membrane and cell wall, cell organelles and cell inclusions; chloroplast, mitochondria, vacuoles, endoplasmic reticulum, Golgi apparatus; nucleus, chromosomes – basic structure, number. Also, access the following resources for Class 9 Chapter 5 The Fundamental Unit of Life at BYJU'S: Chapter 6: Tissues This chapter pertains to the basic definition of tissue and then elaborates on Plant and Animal tissue with proper diagrams. Students will get to know the different types of plant and animal tissues with a detailed explanation of each. Topics Covered in Class 9 Science Chapter 6 Tissues : Tissues, Organs, Organ System, Organism: Structure and functions of animal and plant tissues (only four types of tissues in animals; Meristematic and Permanent tissues in plants). Also, access the following resources for Class 9 Chapter 6 Tissues at BYJU'S: Chapter 7: Diversity in Living Organism This chapter deals with the classification of plants and animals. Students get to know that all living organisms are divided into 5 kingdoms namely Monera, Protista, Fungi, Plantae and Animalia. It also describes the classification and evolution, the hierarchy of classification. Also access the following resources for Class 9 Chapter 7 Diversity in Living Organism at BYJU'S: Chapter 8: Motion NCERT Class 9 Science Chapter 8 describes motion, the speed with direction, rate of change of velocity, and graphical representation of motion. Also, students will find the 3 equations of motion and numerical problems related to them. Overall, this chapter will be a mix of theory as well as the numerical part. Topics Covered in Class 9 Science Chapter 8 Motion : Motion: Distance and displacement, velocity; uniform and non-uniform motion along a straight line; acceleration, distance-time and velocity-time graphs for uniform motion and uniformly accelerated motion, elementary idea of uniform circular motion. Also, access the following resources for Class 9 Chapter 8 Motion at BYJU'S: Chapter 9: Force and Law of Motion This chapter explains the 3 laws of motion with the help of diagrams and examples. Below are the 3 laws of motion: First law of motion: An object continues to be in a state of rest or of uniform motion along a straight line unless acted upon by an unbalanced force. Second law of motion: The rate of change of momentum of an object is proportional to the applied unbalanced force in the direction of the force. Third law of motion: To every action, there is an equal and opposite reaction, and they act on two different bodies. Topics Covered in Class 9 Science Chapter 9 Force and Law of Motion : Force and Newton's laws: Force and Motion, Newton's Laws of Motion, Action and Reaction forces, Inertia of a body, Inertia and mass, Momentum, Force and Acceleration. Also, access the following resources for Class 9 Chapter 9 Force and Law of Motion at BYJU'S: Chapter 10: Gravitation In chapter 10 of NCERT Class 9 Science, students will learn the universal law of gravitation and its importance, free fall, mass, weight, thrust and pressure, Archimedes' principle and relative density. Students will also find numerical problems related to these topics. Topics Covered in Class 9 Science Chapter 10 Gravitation : Gravitation: Gravitation; Universal Law of Gravitation, Force of Gravitation of the earth (gravity), Acceleration due to Gravity; Mass and Weight; Free fall. Floatation: Thrust and Pressure. Archimedes' Principle; Buoyancy. Also, access the following resources for Class 9 Chapter 10 Gravitation at BYJU'S: Chapter 11: Work and Energy In this chapter, the concept of work is defined with different activities, numerical and examples. The chapter also deals with energy and its different forms. Examples are given to explain all types of energy. The chapter ends with the topic "rate of doing work". Topics Covered in Class 9 Science Chapter 11 Work and Energy : Work, Energy and Power: Work done by a Force, Energy, power; Kinetic and Potential energy; Law of conservation of energy (excluding commercial unit of Energy). Also, access the following resources for Class 9 Chapter 11 Work and Energy at BYJU'S: Chapter 12: Sound Chapter 12 of CBSE Class 9 Science, deals with concepts such as the production of sound, propagation of sound, the reflection of sound, range of hearing, applications of ultrasound, and the structure of the human ear. A few numericals are also there in the chapter which can only be solved after understanding the concepts. So, students must grasp and study the chapter carefully. Topics Covered in Class 9 Science Chapter 12 Sound : Sound: Nature of sound and its propagation in various media, speed of sound, range of hearing in humans; ultrasound; reflection of sound; echo. Also access the following resources for Class 9 Chapter 12 Sound at BYJU'S: Chapter 13: Why Do We Fall Ill? NCERT Class 9 Science chapter 13 deals with health issues and different types of diseases. It covers topics like; Health and its failure, disease and its cause, infectious diseases. This chapter is added to make students aware of different types of diseases so that they take care of their health and be fit and healthy. Also access the following resources for Class 9 Chapter 13 Why Do We Fall Ill? at BYJU'S: Chapter 14: Natural Resources We are blessed with natural resources. These are essential to meet the basic requirements of all forms of life on Earth. So, this chapter has been included by NCERT to provide knowledge on the types of resources available on the Earth. This chapter deals with the topics like air, water, soil, the biogeochemical cycle and the ozone layer, its importance and how humans are polluting them. Also access the following resources for Class 9 Chapter 14 Natural Resources at BYJU'S: Chapter 15: Improvement in Food Resources The last chapter of NCERT Class 9 Science covers topics like Improvement in crop yields, manure, fertilizer, storage of grains, and animal husbandry. This chapter provides knowledge regarding agriculture, farming and dairy. Also access the following resources for Class 9 Chapter 15 Improvement in Food Resources at BYJU'S: To download the complete book in PDF format, visit NCERT Science Book Class 9. For more practice tests and mock tests, sign up on BYJU'S the learning app. Apart from Science, get NCERT Solutions for all the subjects. Students can download worksheets, assignments, NCERT Books, notes and study materials for exam preparation and for a better understanding of the topics. CBSE Class 9 Science Evaluation Scheme (Theory) – Unit No. Unit Marks I Matter-Its Nature and Behaviour 25 II Organization in the Living World 22 III Motion, Force and Work 27 IV Food; Food Production 06 Total Theory 80 Internal Assessment 20 Grand Total 100 Features of NCERT 9th Class Science Book Solutions The book has a wide variety of features which are listed below: CBSE Class 9 Science NCERT Solutions are available to everyone for free. Covers all the exercise problems from the Class 9 textbook. Consists of extra questions, exemplar problems, the important questions from previous year question papers and sample papers, worksheets, MCQs, short answering questions, descriptive type questions, their solutions and tips and tricks. CBSE Class 9 Science Solutions files are available for download in PDF format for easy access. Diagrams are included to help students visualize the topics. Most effective solutions are given which can help to score well in the exams. About 15 chapters are there in the Class 9 Science of NCERT Solutions. Students in Class 9 can refer to the solutions framed by the faculty at BYJU'S for a better understanding of the concepts. Class 9 is a very important step as the fundamental concepts help them to score well in the higher classes. NCERT Class 9 Science Activity Solutions also help students understand the applications of concepts in their daily lives.The NCERT Solutions for Class 9 Science contains all the questions present in the prescribed textbook. Most of the questions in the annual exam can be expected from NCERT Solutions. So the students are advised to solve the questions in the textbook thoroughly for their exam preparation. The solutions at BYJU'S contain step-by-step explanations to help students ace the exam with much confidence. Understanding the method of answering questions will help them face complex questions without any difficulty.The NCERT Solutions for Class 9 Science is framed by the faculty at BYJU'S, keeping in mind the understanding abilities of students. The solutions are accurate and detailed to help students understand complex topics easily. Shortcut techniques and tricks are also highlighted to make learning fun for the students. To get an overall idea about the concepts, students are recommended to understand the syllabus thoroughly before starting their exam preparation. The solutions not only help students with their annual exam preparation but also for various competitive exams both at the state and national levels.The NCERT Solutions for Class 9 Science are available for free download at BYJU'S. All the exercise questions from the Class 9 textbook are answered by our expert faculty, having vast experience in their respective subjects. The solutions can be accessed by the students while solving the textbook questions to understand the concepts effectively. The elaborate and detailed solutions with pictorial representation improve logical and analytical thinking abilities among students. NCERT Solutions for Class 11 Physics for all chapters can be accessed here by following the links provided below. The highly experienced subject matter experts have explained each and every minute concept in the best way possible to help students face the exam without fear. Physics is a subject which contains a lot of concepts and numerical problems. For this purpose, a thorough understanding of the concepts is necessary to solve the problems effortlessly. NCERT Solutions is prepared in order to provide the students with authentic information completely based on the latest syllabus prescribed by the CBSE board. From Class 11 Physics, students will study the various concepts which are important both from the exam and competitive exam perspective. The solutions provided here can be accessed by the students in online mode or can be downloaded as a PDF. Each chapter of NCERT Solutions for Class 11 Physics can be downloaded in a PDF format by clicking on the "Download PDF" button at the top of each chapter page given below. The following chapters have been removed from the NCERT Class 11 Physics textbook 2023-24. Physical World Class 11 is an important stage in the life of a student because they are exposed to learning various new concepts. The solutions at BYJU'S not only helps them to understand it but also provides them with a basic knowledge of their applications in our daily life. So learning the chapters present in the NCERT textbook will help them to obtain a strong hold on the basic concepts. There are numerical problems and examples present in each chapter, which are explained in a step-wise manner to improve the problem-solving abilities of the students. Download NCERT Solutions for Class 11 Physics to speed up the exam preparation. NCERT Solutions Class 11 Physics NCERT Solutions Class 11 Physics is an important study material which helps students to master the subject. Physics is a crucial subject from the exam perspective, which is difficult to master as it deals with various properties of nature and matter. It forms a strong base for students who wish to pursue higher levels of education in the field of Science. The solutions are planned out to aid the Class 11 students in achieving good marks in the exam. The expert teachers answer each and every question in an elaborate manner so that students do not miss any concept which is important for the exam. By regular practice using the NCERT Solutions, students will be able to know the right way to approach the questions which would appear in the exam. NCERT Solutions Class 11 Physics Chapter Details and Exercises Chapter 1: Physical World In this chapter, we will be studying how things work and the reason behind it. Students will become more aware of the things surrounding them, the origin and the history of Science. They will also come across various aphorisms and their justification using Physics concepts in real life in this chapter. The concepts covered here are gravitational force, electromagnetic force, strong and weak nuclear force. The theories and observations done by various scientists and their conclusion is provided briefly here. You will gain more idea about the factors which are the reasons for the development of Science and Technology in our country. The existence of an electron is explained in this chapter in an elaborate manner to acquaint students with the basic conceptual knowledge. Topics Covered in Class 11 Physics Chapter 1 Physical World Physics: Scope and excitement; nature of physical laws; Physics, technology and society Also, access the following resources for Class 11 Chapter 1 Physical World, at BYJU'S: Chapter 2: Units and Measurements With the senses like ears, eyes etc., scientists gather information and make observations. A few of them are like figuring out the colour and texture, while others would be complex where measurement is necessary. It is a basic concept in Science without which scientists will not be able to conduct any experiments. Students will learn about the units of physical quantities and the method to be followed to evaluate them. It will also provide a good idea of the errors which would occur while measuring things and significant figures. Topics Covered in Class 11 Physics Chapter 2 Units and Measurements 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. Also, access the following resources for Class 11 Chapter 2 Units and Measurements, at BYJU'S: Chapter 3: Motion in a Straight Line This chapter will cover essential topics like comparing objects as point object and the method of plotting graphs and finding the values based on them. The method plotting x-t motion graph can be learnt easily by using the NCERT Solutions from BYJU'S. The time taken by a biker, the speed of a car and the time taken by a bus to travel can be found effortlessly by referring to these solutions. Students will learn the difference between magnitude of displacement and the total length of the path covered. They will also study about the average speed, average velocity, instantaneous speed and velocity as per the CBSE guidelines. Topics Covered in Class 11 Physics Chapter 3 Motion in a Straight Line 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 and position-time graphs, relations for uniformly accelerated motion (graphical treatment). Elementary concepts of differentiation and integration for describing motion. Also, access the following resources for Class 11 Chapter 3 Motion in a Straight Line, at BYJU'S: Chapter 4: Motion in a Plane Students will learn about the scalar and vector quantities and their difference. The method of performing algebraic expressions on various scalar quantities are also explained here. Besides, true or false questions based on these concepts and their justification are elaborated under each answer. We will also learn the concept of magnitude of vectors and their co-linearity, magnitude of displacement vector and the various types of displacement of a moving vehicle. It will help us to understand the time taken by a person to cross a river, experience of riding a bicycle in rain and a ball thrown by a cricketer in the ground. Topics Covered in Class 11 Physics Chapter 4 Motion in a Plane 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 vectors. Resolution of a vector in a plane – rectangular components. Motion in a plane. Cases of uniform velocity and uniform acceleration – projectile motion. Uniform circular motion. Also, access the following resources for Class 11 Chapter 4 Motion in a Plane, at BYJU'S: Chapter 5: Laws of Motion This chapter is very important in mechanics. Problems based on the conservation of momentum are frequently asked in the exam. By going through this chapter, students will become well-versed with the laws of motion and their applications in our daily activities. Various numerical problems based on mechanics are solved clearly in this chapter to boost the exam preparation of students. Having a good knowledge of these concepts, students will be able to pursue well in their higher education levels. Topics Covered in Class 11 Physics Chapter 5 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). Also, access the following resources for Class 11 Chapter 5 Laws of Motion, at BYJU'S: Chapter 6: Work, Energy and Power The Work Energy Theorem is an important concept in this chapter. Students are highly recommended to learn this chapter effectively as it is continued in future classes also. The work done by a person and the energy required to do that work is explained briefly with suitable examples to make the students well-versed with the concepts. Problems on determining the energy and power are solved in a step-wise manner based on the mark weightage allotted by the CBSE board. Practising these concepts regularly will make them master the chapter effortlessly. Topics Covered in Class 11 Physics Chapter 6 Work, Energy and Power Scalar product of vectors. 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; elastic and inelastic collisions in one and two dimensions. Also, access the following resources for Class 11 Chapter 6 Work, Energy and Power, at BYJU'S: Chapter 7: System of Particles and Rotational Motion This chapter will help students understand the motion of extended bodies, such as the system of particles. The centre of mass of a system of particles is the main concept in this chapter. The term motion and its usefulness are briefly explained as per the syllabus of the CBSE board. As many concepts are covered under this chapter, students are highly recommended to make use of a perfect study material while answering the exercise questions from the textbook. Topics Covered in Class 11 Physics Chapter 7 System of Particles and Rotational Motion Centre of mass of a two-particle system, momentum conservation and centre of mass motion. Centre of mass of a rigid body; centre of mass of circular ring, disc, rod and sphere. Vector product of vectors; moment of a force, torque, angular momentum, conservation of angular momentum with some examples. Equilibrium of rigid bodies, rigid body rotation and equation of rotational motion, comparison of linear and rotational motions; moment of inertia, radius of gyration. Values of M.I. for simple geometrical objects (no derivation). Statement of parallel and perpendicular axes theorems and their applications. Also, access the following resources for Class 11 Chapter 7 System of Particles and Rotational Motion, at BYJU'S: Chapter 8: Gravitation We know that all material objects are attracted towards the Earth. The things which we throw up fall down. Climbing a hill is difficult when compared to going downhill. Gravitation is a very popular concept as most of them which we study in the future are in accordance with this phenomenon. To understand the more complex concepts in this chapter, students should know the difference between gravity and gravitation. The other concepts discussed in this chapter are potential energy difference between two points, acceleration due to gravity and interplanetary motion. Topics Covered in Class 11 Physics Chapter 8 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 speed, orbital velocity of a satellite. Geostationary satellites. Also, access the following resources for Class 11 Chapter 8 Gravitation, at BYJU'S: Chapter 9: Mechanical Properties of Solids A rigid body has a definite shape and size, but in reality, it is bent, stretched and compressed. A force is necessary in order to know the shape of a solid. The concepts of importance in this chapter are plasticity and elasticity. Students will learn about the mechanical properties of a solid, Young's Modulus of copper and steel and the yield strength. Problems based on these concepts appear in the exams for more marks, so it is necessary to practise them on a daily basis. Students will also get to know about the stress-strain relationship graph, which is very important for the exam. Topics Covered in Class 11 Physics Chapter 9 Mechanical Properties of Solids Elastic behaviour, stress-strain relationship, Hooke's law, Young's modulus, bulk modulus, shear, modulus of rigidity. Also, access the following resources for Class 11 Chapter 9 Mechanical Properties of Solids, at BYJU'S: Chapter 10: Mechanical Properties of Fluids Here, we will learn about the physical properties of liquids and gases. They are called as fluids as they have the capacity to flow. This is an important property which separates solids from liquids and gases. The other important concepts covered here are Bernoulli's principle, Reynold's number, streamline flow, viscosity and surface tension. The fundamental property of a fluid is that it can flow. It has no resistance to change its shape. Students will get a clear picture about the mechanical properties of fluids which are of more marks in the final exam. Topics Covered in Class 11 Physics Chapter 10 Mechanical Properties of Fluids 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, Reynold's number, streamline and turbulent flow. Bernoulli's theorem and its applications. Surface energy and surface tension, angle of contact, application of surface tension ideas to drops, bubbles and capillary rise. Also, access the following resources for Class 11 Chapter 10 Mechanical Properties of Fluids, at BYJU'S: Chapter 11: Thermal Properties of Matter We all are familiar with heat and temperature. The method used to determine the temperature is covered in this chapter. Students will also get a clear idea about Newton's Law of Cooling, which is an important concept for various competitive exams. Temperature is the hotness possessed by a body that can be measured using a thermometer. The various thermal properties of matter are listed in a step-wise manner in this chapter to make students more confident about the concepts. Topics Covered in Class 11 Physics Chapter 11 Thermal Properties of Matter Heat, temperature, thermal expansion; specific heat capacity – calorimetry; change of state – latent heat. Heat transfer – conduction, convection and radiation, thermal conductivity, Newton's law of cooling. Also, access the following resources for Class 11 Chapter 11 Thermal Properties of Matter, at BYJU'S: Chapter 12: Thermodynamics Thermodynamics is a concept of heat and temperature and its conversion to other energy forms. It is one of the main topics which the question paper setters focus on, and most of the questions in the exams can appear from this chapter. In order to attain remarkable grades, it is crucial for students to learn all these concepts effectively. The laws of thermodynamics, specific heat capacity, various thermodynamic processes and the Carnot engine are some of the important concepts covered in this chapter. Topics Covered in Class 11 Physics Chapter 12 Thermodynamics Thermal equilibrium and definition of temperature (zeroth law of thermodynamics). Heat, work and internal energy. First law of thermodynamics. Second law of thermodynamics: Reversible and irreversible processes. Heat engines and refrigerators. Also, access the following resources for Class 11 Chapter 12 Thermodynamics, at BYJU'S: Chapter 13: Kinetic Theory This chapter is a more scoring section when it comes to exam preparation. Apart from the properties of solids and liquids, the properties of gases are easy to understand. Students will learn concepts like molecular nature of matter, behaviour of gases, kinetic theory of an ideal gas, law of equipartition of energy, specific heat capacity and mean free path in this chapter. The problems are also solved in a systematic manner following the CBSE guidelines so that scoring good marks would be an easy task for the Class 11 students. Topics Covered in Class 11 Physics Chapter 13 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. Also, access the following resources for Class 11 Chapter 13 Kinetic Theory, at BYJU'S: Chapter 14: Oscillations Oscillations are one of the basic concepts in Physics. It is very important for the students to learn the concepts from this chapter, as it will be continued in further classes as well. The concepts explained in this chapter are periodic and oscillatory motions, simple harmonic motion, uniform circular motion etc. To learn these concepts effectively, it is necessary for the students to follow suitable study material for this purpose. By learning the chapter on a daily basis, students will be able to face the more complex questions that would arise in the exam. Topics Covered in Class 11 Physics Chapter 14 Oscillations Periodic motion – period, frequency, displacement as a function of time. Periodic functions. Simple harmonic motion (SHM) and its equation; phase; oscillations of a spring – restoring force and force constant; energy in SHM – kinetic and potential energies; simple pendulum – derivation of expression for its time period; free, forced and damped oscillations (qualitative ideas only), resonance. Also, access the following resources for Class 11 Chapter 14 Oscillations, at BYJU'S: Chapter 15: Waves This chapter contains comprehensive questions on important concepts like wave dynamics. Questions present in this chapter will assist students through concepts like the types of waves, speed of sound in air, the tension on strings and the dependence of the speed of sound in air. The important formulas and concepts are highlighted in the solutions to make a revision of concepts easier for the students. The various wave characteristics, such as amplitude, frequency, phase, wavelength, displacement of waves and resonance, are covered in this chapter. Topics Covered in Class 11 Physics Chapter 15 Waves 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. Also, access the following resources for Class 11 Chapter 15 Waves, at BYJU'S: As there are many concepts present in each chapter, students have to revise the concepts on a regular basis to get a grip on them. It will help them to understand the right way of approaching the difficult questions in the final exam. NCERT Class 11 Books can be accessed by the students to get a clear understanding of the syllabus. Features of BYJU'S NCERT Solutions for Class 11 Physics The Class 11 Physics NCERT Solutions provided by BYJU'S have the following features: Elaborate explanations for all the textbook questions. A systematic process for answering numerical problems. Clear-cut answers for all the questions based on theory. Authentic information from highly experienced subject matter experts. Solutions are present in both online and offline modes. Note: Class 11 Physics students (who are studying under the CBSE syllabus) can bookmark this page in their browser to easily access NCERT Solutions for Class 11 Physics in the future. CBSE Marking Scheme 2023-24 CBSE board has divided the academic sessions covering the entire syllabus to help students learn the concepts effectively. A systematic approach is followed based on the interconnectivity of topics and concepts by the experts. The exams will be conducted by the CBSE board at the end of the academic year as per the bifurcated syllabus. This basically improves the condition of having board-conducted classes at the end of the year. Unit No. Name of the Unit Marks Unit–I Physical World and Measurement 23 Chapter–2: Units and Measurements Unit-II Kinematics Chapter–3: Motion in a Straight Line Chapter–4: Motion in a Plane Unit–III Laws of Motion Chapter–5: Laws of Motion Unit–IV Work, Energy and Power 17 Chapter–6: Work, Energy and Power Unit–V Motion of System of Particles and Rigid Body Chapter–7: System of Particles and Rotational Motion Unit-VI Gravitation Chapter–8: Gravitation Unit–VII Properties of Bulk Matter 20 Chapter–9: Mechanical Properties of Solids Chapter–10: Mechanical Properties of Fluids Chapter–11: Thermal Properties of Matter Unit–VIII Thermodynamics Chapter–12: Thermodynamics Unit–IX Behaviour of Perfect Gases and Kinetic Theory of Gases Chapter–13: Kinetic Theory Unit–X Oscillations and Waves 10 Chapter–14: Oscillations Chapter–15: Waves Total 70 Why Should One Opt for BYJU'S NCERT Solutions? The NCERT Solutions at BYJU'S are the best study material for students under the CBSE board. The content provided is accurate, and students can rely on these solutions to perform better in the annual exam. The solutions strictly follow the NCERT Class 11 Physics Syllabus, which is prescribed by the CBSE board. Some of the advantages of using the NCERT Solutions provided by us are given below. Top-notch experts prepare the solutions The NCERT Solutions have been prepared by a set of highly experienced faculty at BYJU'S with the main aim of making quality educational content for each student. The precise and informative solutions are considered to be the best among all the other materials available online. Students will be able to answer complex questions in the exam The NCERT Solutions at BYJU'S are famous for being student-friendly and easy to understand. Answers to difficult questions and problems are explained in steps to help students understand the method of solving them easily. The solutions provided are concept-focused and not question focused, which enables the students to face the different questions that would arise in the exam. The best study material for revision After learning all the chapters, students are advised to revise all the concepts a month prior to the exam. This will help them to remember all the problems and concepts which are important from the exam perspective. It will also help them to memorise all the formulas and problems which are of high marks as per the CBSE exam pattern. After Going through Our Class 11 Physics NCERT Solutions, Also Explore, Have any questions/issues regarding our NCERT Solutions for Class 11 Physics? Our support team is always available to resolve your queries. Register with BYJU'S and get in touch with them NOW! The solutions from BYJU'S are extremely useful for the students to find answers to the textbook questions in one place. Most of the students find the Class 11 Physics chapters difficult at the beginning as the syllabus is vast and the concepts are new. So, by choosing NCERT Solutions from BYJU'S, students can clear their doubts and prepare for the exams with much confidence. This syllabus is also very important to crack various competitive exams, like JEE and NEET, apart from board exams.If the students focus on all the concepts and work on them regularly, no chapter will be difficult. Students usually get scared by looking at the syllabus as the content is very vast. But as the syllabus is covered, students will become comfortable with the subject. If any doubts regarding this subject exist, you can get in touch with the expert faculty at BYJU'S, who possess many years of experience in this field. The solutions PDF can also be downloaded for free from BYJU'S website.The chapters present in the NCERT Solutions for Class 11 Physics are: 1 – Physical World 2 – Units and Measurements 3 – Motion in a Straight Line 4 – Motion in a Plane 5 – Laws of Motion 6 – Work, Energy, and Power 7 – Systems of Particles and Rotational Motion 8 – Gravitation 9 – Mechanical Properties of Solids 10 – Mechanical Properties of Fluids 11 – Thermal Properties of Matter 12 – Thermodynamics 13 – Kinetic Theory 14 – Oscillations 15 – WavesThe NCERT Solutions for Class 11 Physics from BYJU'S can be used by the students to score well in the annual exams. The solutions cover all the concepts from the NCERT textbook, intending to help students with their annual exam preparation. Every question is solved with the utmost care by keeping in mind the CBSE syllabus and marks weightage allotted for each concept. So, the NCERT Solutions from BYJU'S can be considered as one of the reliable reference materials for the students. Physics is the science of how matter and energy interact and affect each other over time and space. Physics functions in an exciting dimension. What we mean by this is that things keep changing in the world of physics with every discovery. As theories progress and discoveries are made, not only the answer but the whole question changes. Due to this, many individuals define physics by what it was rather than what it is and will be. Physics is an ever-evolving field of science that aspires to describe the universe's fundamental laws. From the tiny particles that make up matter to the massive forces that govern the cosmos, physics covers many topics and concepts that continue to captivate us. If you are a physics enthusiast or student looking to dive deeper into physics, plenty of resources are available here. These physics blog posts contain information on various physics concepts, theories, discoveries and cutting-edge experiments. This physics repository contains over 1800+ scholarly articles in physics. It is an excellent resource for researchers and students, with articles covering various topics, from particle physics to astrophysics. By exploring these resources, you can better understand the fundamental laws that govern the universe. Exploring the Fundamentals: A Guide to Basic Physics Physics Laws Physics Formulas Physics Constants Values of Physics Constants Relation Between Physics Concepts Difference Between Physics Concepts Classification of Physics Concepts Applications of Physics Concepts Physics SI Units Derivation of Physics Formulas Physics Scientists Physics Puzzles Physics Resources for Students and Educators Physics Made Easy: Resources to Ace Your Exam BYJU'S Physics offers an extensive collection of more than 1800 articles designed to serve as valuable study resources for students. These articles cover a wide range of physics concepts and have been carefully categorized under their parent topics for easy navigation. Each article is available for free and can be accessed through collapsible tables that provide links to the relevant content. At BYJU'S, we are committed to providing the latest and most relevant information to our students, which is why we regularly update our library with improved or new material. With our comprehensive physics resources, students can enhance their understanding of physics and excel in their academic pursuits. NCERT Resources and Supplements for CBSE students The Central Board of Secondary Education abbreviated as CBSE is one of the most prominent and prestigious educational boards of India. We, at BYJU'S, provide various resources for CBSE students to help students with their exams. The study materials given here are prepared with respect to the latest syllabus. These resources include syllabus, books, sample papers, question papers, NCERT solutions, NCERT exemplar solutions, important questions and CBSE notes. Below, we have provided an exhaustive list of all the resources that a student would require for efficient preparation of exams. CBSE Student Essentials Physics is a science that studies the structure of matter and how the universe's fundamental building blocks interact. Its scope ranges from the infinitesimally small objects studied using the principles of quantum mechanics to the entirety of the cosmos, explored using general relativity.The cornerstones of modern physics are relativity theory and quantum mechanics. Quantum mechanics describes the physical properties of atoms and subatomic particles. At the same time, relativity revolutionized our understanding of elementary particles and their interactions and enabled predictions of astronomical phenomena like black holes and gravitational waves.Physicists use the International System of Units (SI) to use a system agreed upon by scientists worldwide.Physics is called the king of science because it helps us understand how nature works.It is possible for theoretical physics to exist without Maths but it gets difficult to analyze and describe the universal phenomena without mathematical hypothesis.Physics and Biology, when combined together, help scientists learn more about biological systems on a molecular or atomic level.Physics and Chemistry may overlap when the subject under consideration is matter composed of electrons and nuclei made of protons and neutrons.Physics is important because it helps us understand the fundamental nature of the universe. It improves the quality of life by providing quantitative and analytical skills in fields like engineering, medicine and science. At BYJU'S, our learning approach combines world-class teachers, innovative technology, proven pedagogical methods and data science to deliver personalized learning, feedback, and assessment for students. Stay tuned to BYJU'S and KEEP FALLING IN LOVE WITH LEARNING! CBSE Physics Practicals for Class 12 play an important role in the assessment, adding to the final marks of the subject. As the board exam approaches, students go through the syllabus prescribed by the CBSE board. Besides this, they should also focus on the CBSE practicals for Class 12 syllabus carrying 30 marks. Preparing for the practicals will help them score better marks in Physics. For that, students must know to perform all the experiments given in the syllabus in order to understand all the concepts of CBSE 12th standard Physics in a detailed way. Students can also download the Physics Practical Class 12 Syllabus PDF for free here. Physics Practical for Class 12 is divided into two sections, with marks distributed based on the experiment. In section A, six experiments are present in the practical exam. The experiment records and activities consist of 2 marks, and the viva on the experiment consists of 5 marks. Here, students will find all the experiments and activities to be performed in sections A and section B. Also, we have provided the Physics Lab Manual of CBSE Class 12, which consists detailed explanation of each experiment. To download the CBSE Syllabus for Class 12 Physics Practicals, click on the link below. Download CBSE Class 12 Physics Practical Syllabus PDF 2023-24 Download PDF CBSE Syllabus for Class 12 Physics Practical: Evaluation Scheme Below you will find the CBSE Class 12 Physics Practical syllabus for students. Topic Marks Two experiments, one from each section 7 + 7 Practical record (experiment and activities) 5 One activity from any section 5 Investigatory Project 3 Viva on experiments, activities and project 5 Total 30 CBSE Class 12 Physics Practical Syllabus: Experiments Physics Practicals for Class 12 CBSE are given here so that students can understand the experiments in a better and more detailed way. Students are suggested to study the theory and law behind the experiment properly from Physics Lab Manual Class 12 before performing the experiment. Section A 1. To determine the resistivity of two / three wires by plotting a graph for potential difference versus current. 2. To find the resistance of a given wire / standard resistor using a metre bridge. 3. To verify the laws of combination (series) of resistances using a metre bridge. OR To verify the laws of combination (parallel) of resistances using a metre bridge. 4. To determine the resistance of a galvanometer by the half-deflection method and to find its figure of merit. 5. To convert the given galvanometer (of known resistance and figure of merit) into a voltmeter of desired range and to verify the same. OR To convert the given galvanometer (of known resistance and figure of merit) into an ammeter of desired range and to verify the same. 6. To find the frequency of AC mains with a sonometer Section B 1. To find the value of v for different values of u in the case of a concave mirror and to find the focal length. 2. To find the focal length of a convex mirror using a convex lens. 3. To find the focal length of a convex lens by plotting graphs between u and v or between 1/u and 1/v. 4. To find the focal length of a concave lens using a convex lens. 5. To determine the angle of minimum deviation for a given prism by plotting a graph between the angle of incidence and the angle of deviation. 6. To determine the refractive index of a glass slab using a travelling microscope. 7. To find the refractive index of a liquid using a convex lens and plane mirror. 8. To find the refractive index of a liquid using a concave mirror and a plane mirror. 9. To draw the I-V characteristic curve for a p-n junction diode in forward and reverse bias. CBSE Class 12 Physics Activities and Projects Syllabus Below you will find the list of CBSE Class 12 Physics activities and projects for students. CBSE Class 12 Physics Activities Section A 1. To measure the resistance and impedance of an inductor with or without an iron core. 2. To measure resistance, voltage (AC/DC), and current (AC) and check the continuity of a given circuit using a multimeter. 3. To assemble a household circuit comprising three bulbs, three (on/off) switches, a fuse and a power source. 4. To assemble the components of a given electrical circuit. 5. To study the variation in potential drop with the length of a wire for a steady current. 6. To draw the diagram of a given open circuit comprising at least a battery, resistor/rheostat, key, ammeter and voltmeter. Mark the components that are not connected in proper order and correct the circuit and also the circuit diagram. CBSE Class 12 Physics Activities Section B 1. To identify a diode, an LED, a resistor and a capacitor from a mixed collection of such items. 2. Use of a multimeter to see the unidirectional flow of current in the case of a diode and an LED and check whether a given electronic component (e.g., diode) is in working order. 3. To study the effect of intensity of light (by varying distance of the source) on an LDR. 4. To observe refraction and lateral deviation of a beam of light incident obliquely on a glass slab. 5. To observe diffraction of light due to a thin slit. 6. To study the nature and size of the image formed by a (i) convex lens or a (ii) concave mirror on a screen by using a candle and a screen (for different distances of the candle from the lens/mirror). 7. To obtain a lens combination with the specified focal length by using two lenses from the given set of lenses. CBSE Class 12 Physics Projects 1. To study various factors on which the internal resistance/EMF of a cell depends. 2. To study the variations in current flowing in a circuit containing an LDR because of a variation in (a) the power of the incandescent lamp used to 'illuminate' the LDR (keeping all the lamps at a fixed distance). (b) the distance of an incandescent lamp (of fixed power) used to 'illuminate' the LDR. 3. To find the refractive indices of (a) water (b) oil (transparent) using a plane mirror, an equiconvex lens (made from a glass of known refractive index) and an adjustable object needle. 4. To investigate the relation between the ratio of (i) output and input voltage and (ii) the number of turns in the secondary coil and primary coil of a self-designed transformer. 5. To investigate the dependence of the angle of deviation on the angle of incidence using a hollow prism filled one by one with different transparent fluids. 6. To estimate the charge induced on each one of the two identical Styrofoam (or pith) balls suspended in a vertical plane by making use of Coulomb's law. 7. To study the factor on which the self-inductance of a coil depends by observing the effect of this coil when put in series with a resistor/(bulb) in a circuit fed up by an A.C. source of adjustable frequency. 8. To study the earth's magnetic field using a compass needle-bar magnet by plotting magnetic field lines and tangent galvanometer. Physics Lab Manual Class 12 Observation table : Observation table : Stay tuned to BYJU'S to get the latest notification on CBSE exams along with the CBSE syllabus, sample papers, marking scheme and more. *According to the CBSE Syllabus 2023-24, this chapter has been renumbered as Chapter 1. NCERT Solutions for Class 11 Physics Chapter 2 Units and Measurements are the best study resources students can get to understand the main topics and to score good grades in the examination. These solutions provide appropriate answers to the textbook questions. To get a grip on this chapter, students can make use of the NCERT Solutions for Class 11 Physics available at BYJU'S. Students can also find solutions to exemplary problems, worksheets, questions from previous years' question papers, numerical problems, MCQs, short answer questions, tips and tricks. Chapter 2 of NCERT Solutions for Class 11 Physics mainly helps understand the fundamentals of units and measurements according to the latest CBSE Syllabus 2023-24. In our daily lives, most activities depend on this, and it is very important for students to learn it effectively. Everything depends on units and measurements, from buying milk in the morning to the pounds of bread needed for breakfast or from buying sugar for milk to the kilograms of rice needed for lunch. Students can access the Physics NCERT Solutions for Class 11 to comprehend the key concepts present in this chapter. NCERT Solutions for Class 11 Physics Chapter 2 Units and Measurements Download PDF carouselExampleControls112 Previous Next Access the answers of NCERT Class 11 Physics Chapter 2 Units and Measurements 2.1 Fill in the blanks. (a) The volume of a cube of side 1 cm is equal to .....m3 (b) The surface area of a solid cylinder of radius 2.0 cm and height 10.0 cm is equal to...(mm)2 (c) A vehicle moving with a speed of 18 km h–1 covers....m in 1 s (d) The relative density of lead is 11.3. Its density is ....g cm–3 or ....kg m–3. Answer: (a) Volume of cube, V = (1 cm)3 = (10-2 m)3 = 10-6 m3 (b) Surface area = curved area + area on top /base = 2πrh + 2πr2 = 2πr (h + r) r = 2 cm = 20 mm h = 10 cm = 100 mm Surface area = 2πr (h + r) = 2 x 3.14 x 20 (100 + 20) = 15072 mm2 Hence, the answer is 15072 mm2 (c) Speed of vehicle = 18 km/h 1 km = 1000 m 1 hr = 60 x 60 = 3600 s 1 km/hr = 1000 m/3600 s = 5/18 m/s 18 km/h = = (18 x 1000)/3600 = 5 m/s Distance travelled by the vehicle in 1 s = 5 m (d) The relative density of lead is 11.3 g cm-3 => 11.3 x 103 kg m-3 [1 kilogram = 103g, 1 meter = 102 cm] => 11.3 x 103 kg m-4 2.2 Fill in the blanks by suitable conversion of units. (a) 1 kg m2 s–2 = ...g cm2 s–2 (b) 1 m = ... ly (c) 3.0 m s–2 = ... km h–2 (d) G = 6.67 × 10–11 N m2 (kg)–2 = ... (cm)3s–2 g–1 Answer: (a) 1 kg m2 s–2 = ...g cm2 s–2 1 kg m2 s-2 = 1kg x 1m2 x 1s -2 We know that, 1kg = 103 1m = 100cm = 102cm When the values are put together, we get 1kg x 1m2 x 1s-2 = 103g x (102cm)2 x 1s-2 = 103g x 104 cm2 x 1s-2 = 107 gcm2s-2 =>1kg m2 s-2 = 107 gcm2s-2 (b) 1 m = ... ly Using the formula, Distance = speed x time Speed of light = 3 x 108 m/s Time = 1 yr = 365 days = 365 x 24 hr = 365 x 24 x 60 x 60 sec Put these values in the formula mentioned above, and we get One light year distance = (3 x 108 m/s) x (365 x 24 x 60 x 60) = 9.46×1015m 9.46 x 1015 m = 1ly So that, 1m = 1/9.46 x 1015ly => 1.06 x 10-16ly =>1 meter = 1.06 x 10-16ly (c) 3.0 m s–2 = ... km h–2 1 km = 1000m so that 1m = 1/1000 km 3.0 m s-2 = 3.0 (1/1000 km) (1/3600 hour) -2 = 3.0 x 10-3 km x ((1/3600)-2h-2) = 3 x 10-3km x (3600)2 hr-2 = 3.88 x 104 km h-2 => 3.0 m s-2 = 3.88 x 104 km h-2 (d) G = 6.67 × 10–11 N m2 (kg)–2 = ... (cm)3s–2 g–1 G = 6.67 x 10-11 N m2 (kg)-2 We know that, 1N = 1kg m s-2 1 kg = 103 g 1m = 100cm= 102 cm Put the values together, we get => 6.67 x 10-11 Nm2 kg-2 = 6.67 x 10-11 x (1kg m s -2) (1m2) (1kg-2) Solve the following, and cancelling out the units, we get => 6.67 x 10-11 x (1kg -1 x 1m3 x 1s-2) Put the above values together to convert kg to g and m to cm. => 6.67 x 10-11 x (103g)-1 x (102 cm)3 x (1s-2) => 6.67 x 10-8 cm3 s-2 g -1 =>G = 6.67 x 10-11 Nm2(kg)-2 = 6.67 x 10-8 (cm)3 s-2 g -1 2.3 A calorie is a unit of heat (energy in transit), which equals about 4.2 J, where 1J =1 kg m2 s–2. Suppose we employ a system of units in which the unit of mass equals α kg, the unit of length equals β m, and the unit of time is γ s. Show that a calorie has a magnitude of 4.2 α–1 β–2 γ2 in terms of the new units. Answer 1 calorie = 4.2 J = 4.2 kg m2 s–2 The standard formula for the conversion is \(\begin{array}{l}\frac{Given \, unit}{new \, unit} = \left (\frac{M_{1}}{M_{2}} \right)^{x}\left (\frac{L_{_{1}}}{L_{2}} \right)^{y} \left (\frac{T_{1}}{T_{2}} \right)^{z}\end{array} \) Dimensional formula for energy = \(\begin{array}{l}\left [M^{1}L^{2}T^{-2} \right]\end{array} \) Here, x = 1, y = 2 and z =- 2 M1 = 1 kg, L1 = 1m, T1 = 1s and M2 = α kg, L2 = β m, T2 = γ s \(\begin{array}{l}\frac{Calorie}{new \, unit} = 4.2\left (\frac{1}{\alpha } \right)^{1}\left (\frac{1}{\beta } \right)^{2} \left (\frac{1}{\gamma } \right)^{-2}\end{array} \) Calorie = 4.2 α–1 β–2 γ2 2.4 Explain this statement clearly: "To call a dimensional quantity 'large' or 'small' is meaningless without specifying a standard for comparison". In view of this, reframe the following statements wherever necessary. (a) atoms are very small objects (b) a jet plane moves with great speed (c) the mass of Jupiter is very large (d) the air inside this room contains a large number of molecules (e) a proton is much more massive than an electron (f) the speed of sound is much smaller than the speed of light. (a) Atoms are small object Answer: (a) In comparison with a soccer ball, atoms are very small (b) When compared with a bicycle, a jet plane travels at high speed. (c) When compared with the mass of a cricket ball, the mass of Jupiter is very large. (d) As compared with the air inside a lunch box, the air inside the room has a large number of

molecules. (e) A proton is massive when compared with an electron. (f) Like comparing the speed of a bicycle and a jet plane, the speed of light is more than the speed of sound. 2.5 A new unit of length is chosen such that the speed of light in a vacuum is unity. What is the distance between the Sun and the Earth in terms of the new unit if light takes 8 min and 20 s to cover this distance? Answer: Distance between them = Speed of light x Time taken by light to cover the distance Speed of light = 1 unit Time taken = 8 x 60 + 20 = 480 + 20 = 500s The distance between Sun and Earth = 1 x 500 = 500 units 2.6 Which of the following is the most precise device for measuring length? (a) a vernier callipers with 20 divisions on the sliding scale (b) a screw gauge of pitch 1 mm and 100 divisions on the circular scale (c) an optical instrument that can measure length to within a wavelength of light Answer: (a) Least count = 1- \(\begin{array}{l}\frac{9}{10}\end{array} \)= \(\begin{array}{l}\frac{1}{10}\end{array} \) = 0.01cm (b) Least count = \(\begin{array}{l}\frac{pitch}{number of divisions}\end{array} \) = \(\begin{array}{l}\frac{1}{10000}\end{array} \) = 0.001 cm (c) least count = wavelength of light = 10-5 cm = 0.00001 cm We can come to the conclusion that the optical instrument is the most precise device used to measure length. 2.7. A student measures the thickness of a human hair by looking at it through a microscope of magnification 100. He makes 20 observations and finds that the average width of the hair in the field of view of the microscope is 3.5 mm. What is the estimate on the thickness of the hair? Answer Magnification of the microscope = 100 The average width of the hair in the field of view of the microscope = 3.5 mm Actual thickness of hair =3.5 mm/100 = 0.035 mm 2. 8. Answer the following : (a) You are given a thread and a metre scale. How will you estimate the diameter of the thread? (b) A screw gauge has a pitch of 1.0 mm and 200 divisions on the circular scale. Do you think it is possible to arbitrarily increase the accuracy of the screw gauge by increasing the number of divisions on the circular scale? (c) The mean diameter of a thin brass rod is to be measured by vernier callipers. Why is a set of 100 measurements of the diameter expected to yield a more reliable estimate than a set of 5 measurements only? Answer (a) The thread should be wrapped around a pencil a number of times to form a coil having its turns touching each other closely. Measure the length of this coil with a metre scale. If L be the length of the coil and n be the number of turns of the coil, then the diameter of the thread is given by the relation Diameter = L/n. (b) Least count of the screw gauge = Pitch/number of divisions on the circular scale So, theoretically, when the number of divisions on the circular scale is increased, the least count of the screw gauge will decrease. Hence, the accuracy of the screw gauge will increase. However, this is only a theoretical idea. Practically, there will be many other difficulties when the number of turns is increased. (c) The probability of making random errors can be reduced to a larger extent in 100 observations than in the case of 5 observations. 2.9 . The photograph of a house occupies an area of 1.75 cm2 on a 35 mm slide. The slide is projected onto a screen, and the area of the house on the screen is 1.55 m2. What is the linear magnification of the projector-screen arrangement? Answer Arial Magnification = Area of the image/Area of the object = 1.55/1.75 x 104 = 8.857x 103 Linear Magnification = √Arial magnification = √8.857x 103 = 94. 1 2.10 State the number of significant figures in the following: (a) 0.007 m2 (b) 2.64 × 1024 kg (c) 0.2370 g cm–3 (d) 6.320 J (e) 6.032 N m–2 (f) 0.0006032 m2 Answer: (a) 0.007 m2 The given value is 0.007 m2. Only one significant digit. It is 7. (b) 2.64 × 1024 kg Answer: The value is 2.64 × 1024 kg For the determination of significant values, the power of 10 is irrelevant. The digits 2, 6, and 4 are significant figures. The number of significant digits is 3. (c) 0.2370 g cm–3 Answer: The value is 0.2370 g cm–3 For the given value with decimals, all the numbers 2, 3, 7, and 0 are significant. The 0 before the decimal point is not significant (d) All the numbers are significant. The number of significant figures here is 4. (e) 6, 0, 3, and 2 are significant figures. Therefore, the number of significant figures is 4. (f) 6, 0, 3, and 2 are significant figures. The number of significant figures is 4. 2. 11. The length, breadth and thickness of a rectangular sheet of metal are 4.234 m, 1.005 m, and 2.01 cm, respectively. Give the area and volume of the sheet to correct significant figures. Answer Area of the rectangular sheet = length x breadth = 4.234 x 1.005 = 4.255 m2= 4.3 m2 The volume of the rectangular sheet = length x breadth x thickness = 4.234 x 1.005 x 2.01 x 10-2 = 8.55 x 10-2 m3. 2.12 The mass of a box measured by a grocer's balance is 2.30 kg. Two gold pieces of masses 20.15 g and 20.17 g are added to the box. What is (a) the total mass of the box, (b) the difference in the masses of the pieces to correct significant figures? Answer: The mass of the box = 2.30 kg and the mass of the first gold piece = 20.15 g The mass of the second gold piece = 20.17 g The total mass = 2.300 + 0.2015 + 0.2017 = 2.7032 kg Since 1 is the least number of decimal places, the total mass = 2.7 kg. The mass difference = 20.17 – 20.15 = 0.02 g Since 2 is the least number of decimal places, the total mass = 0.02 g. 2.13 A physical quantity P is related to four observables a, b, c and d as follows: P = \(\begin{array}{l}\frac{a^{3}b^{2}}{\sqrt{c}d}\end{array} \) The percentage errors of measurement in a, b, c and d are 1%, 3%, 4% and 2%, respectively. What is the percentage error in the quantity P? If the value of P calculated using the above relation turns out to be 3.763, to what value should you round off the result? Answer: \(\begin{array}{l}\frac{a^{3}b^{2}}{\sqrt{c}d}\end{array} \) \(\begin{array}{l}\frac{\Delta P}{P}\end{array} \) = \(\begin{array}{l}\frac{3\Delta a}{a}\end{array} \) + \(\begin{array}{l}\frac{2\Delta b}{b}\end{array} \) + \(\begin{array}{l}\frac{1}{2}\end{array} \) \(\begin{array}{l}\frac{\Delta c}{c}\end{array} \) + \(\begin{array}{l}\frac{\Delta d}{d}\end{array} \) (\(\begin{array}{l}\frac{\Delta P}{P}\end{array} \) x 100) % = (3 x \(\begin{array}{l}\frac{\Delta a}{a}\end{array} \) x 100 + 2 x \(\begin{array}{l}\frac{\Delta b}{b}\end{array} \) x 100 + \(\begin{array}{l}\frac{1}{2}\end{array} \) \(\begin{array}{l}\frac{\Delta c}{c}\end{array} \) x 100 + \(\begin{array}{l}\frac{\Delta d}{d}\end{array} \) x 100) % = 3 x 1 + 2 x 3 + \(\begin{array}{l}\frac{1}{2}\end{array} \) x 4 + 2 = 3 + 6 + 2 + 2 = 13 % P = 4.235 \(\begin{array}{l}\Delta P\end{array} \) = 13 % of P = \(\begin{array}{l}\frac{13P}{100}\end{array} \) = \(\begin{array}{l}\frac{13\times 4.235}{100}\end{array} \) = 0.55 The error lies in the first decimal point, so the value of p = 4.3 2.14 A book with many printing errors contains four different formulas for the displacement y of a particle undergoing a certain periodic motion: (a) y = a sin (\(\begin{array}{l}\frac{2\pi t}{T}\end{array} \)) (b) y = a sin vt (c) y = \(\begin{array}{l}\frac{a}{T}\end{array} \) sin \(\begin{array}{l}\frac{t}{a}\end{array} \) (d) y = \(\begin{array}{l}a\sqrt{2}\end{array} \) (sin \(\begin{array}{l}\frac{2\pi t}{T}\end{array} \) + cos \(\begin{array}{l}\frac{2\pi t}{T}\end{array} \)) Answer: (a) y = a sin \(\begin{array}{l}\frac{2\pi t}{T}\end{array} \) Dimension of y = M0 L1 T0 The dimension of a = M0 L1 T0 Dimension of sin \(\begin{array}{l}\frac{2\pi t}{T}\end{array} \) = M0 L0 T0 Since the dimensions on both sides are equal, the formula is dimensionally correct. (b) It is dimensionally incorrect, as the dimensions on both sides are not equal. (c) It is dimensionally incorrect, as the dimensions on both sides are not equal. (d) y = \(\begin{array}{l}a\sqrt{2}\end{array} \) (sin \(\begin{array}{l}\frac{2\pi t}{T}\end{array} \) + cos\(\begin{array}{l}\frac{2\pi t}{T}\end{array} \)) Dimension of y = M0 L1 T0 The dimension of a = M0 L1 T0 Dimension of \(\begin{array}{l}\frac{t}{T}\end{array} \) = M0 L0 T0 The formula is dimensionally correct. 2.15 A famous relation in physics relates 'moving mass' m to the 'rest mass' mo of a particle in terms of its speed v and the speed of light, c (This relation first arose as a consequence of special relativity due to Albert Einstein). A boy recalls the relation almost correctly but forgets where to put the constant c. He writes : m = \(\begin{array}{l}\frac{m_{0}}{\sqrt{1 – u ^{2}}}\end{array} \) Guess where to put the missing c. Answer: The relation given is \(\begin{array}{l}\frac{m_{0}}{\sqrt{1 – u ^{2}}}\end{array} \) We can get, \(\begin{array}{l}\frac{m_{0}}{m}\end{array} \) = \(\begin{array}{l}\sqrt{1-u ^{2}}\end{array} \) \(\begin{array}{l}\frac{m_{0}}{m}\end{array} \) is dimensionless. Therefore, the right-hand side should also be dimensionless. To satisfy this, \(\begin{array}{l}\sqrt{1-u ^{2}}\end{array} \) should become \(\begin{array}{l}\sqrt{1-\frac{u ^{2}}{c^{2}}}\end{array} \). Thus, m = \(\begin{array}{l}m_{0}\sqrt{1-\frac{u ^{2}}{c^{2}}}\end{array} \). 2.16 The unit of length convenient on the atomic scale is known as an angstrom and is denoted by Å: 1 Å = 10–10 m. The size of a hydrogen atom is about 0.5 Å. What is the total atomic volume in m3 of a mole of hydrogen atoms? Answer: hydrogen atom radius = 0.5 A = 0.5 x 10-10 m Volume = \(\begin{array}{l}\frac{4}{3}\pi r^{3}\end{array} \) = \(\begin{array}{l}\frac{4}{3}\end{array} \) x \(\begin{array}{l}\frac{22}{7}\end{array} \) x (0.5 x 10-10)3 = 0.524 x 10-30 m3 1 hydrogen mole contains 6.023 x 1023 hydrogen atoms. Volume of 1 mole of hydrogen atom = 6.023 x 1023 x 0.524 x 10-30 = 3.16 x 10-7 m3. 2.17 One mole of an ideal gas at standard temperature and pressure occupies 22.4 L (molar volume). What is the ratio of molar volume to the atomic volume of a mole of hydrogen (Take the size of the hydrogen molecule to be about 1 Å)? Why is this ratio so large? Answer: Radius = 0.5 A = 0.5 x 10-10 m Volume = \(\begin{array}{l}\frac{4}{3}\pi r^{3}\end{array} \) = \(\begin{array}{l}\frac{4}{3}\end{array} \) x \(\begin{array}{l}\frac{22}{7}\end{array} \) x (0.5 x 10-10)3 = 0.524 x 10-30 m3 1 hydrogen mole contains 6.023 x 1023 hydrogen atoms. Volume of 1 mole of hydrogen atom = 6.023 x 1023 x 0.524 x 10-30 = 3.16 x 10-7 m3 Vm = 22.4 L = 22.4 x 10-3 m3 \(\begin{array}{l}\frac{V_{m}}{V_{a}}\end{array} \) = \(\begin{array}{l}\frac{22.4\times 10^{-3}}{3.16 \times 10^{-7}}\end{array} \) = 7.1 x 104 The molar volume is 7.1 x 104 times more than the atomic volume. Hence, the inter-atomic separation in hydrogen gas is larger than the size of the hydrogen atom. 2.18 Explain this common observation clearly: If you look out of the window of a fast-moving train, the nearby trees, houses etc., seem to move rapidly in a direction opposite to the train's motion, but the distant objects (hilltops, the Moon, the stars etc.) seem to be stationary (In fact, since you are aware that you are moving, these distant objects seem to move with you). Answer: An imaginary line which joins the object and the observer's eye is called the line of sight. When we observe the nearby objects, they move fast in the opposite direction as the line of sight changes constantly, whereas the distant objects seem to be stationary as the line of sight does not change rapidly. 2.19. The principle of 'parallax' in section 2.3.1 is used in the determination of distances of very distant stars. The baseline AB is the line joining the Earth's two locations six months apart in its orbit around the Sun. That is, the baseline is about the diameter of the Earth's orbit ≈ 3 × 1011m. However, even the nearest stars are so distant that with such a long baseline, they show parallax only of the order of 1" (second) of arc or so. A parsec is a convenient unit of length on the astronomical scale. It is the distance of an object that will show a parallax of 1" (second of arc) from opposite ends of a baseline equal to the distance from the Earth to the Sun. How much is a parsec in terms of metres? Answer Diameter of Earth's orbit = 3 × 1011 m Radius of Earth's orbit r = 1.5 × 1011 m Let the distance parallax angle be θ=1" (s) = 4.847 × 10–6 rad. Let the distance of the star be D. Parsec is defined as the distance at which the average radius of the Earth's orbit subtends an angle of 1″ Therefore, D = 1.5 × 1011 /4.847 × 10–6= 0.309 x 1017 Hence 1 parsec ≈ 3.09 × 1016 m. 2. 20. The nearest star to our solar system is 4.29 light-years away. How much is this distance in terms of parsecs? How much parallax would this star (named Alpha Centauri) show when viewed from two locations of the Earth six months apart in its orbit around the Sun? Answer 1 light year is the distance travelled by light in a year. 1 light year = 3 x 108 x 365 x 24 x 60 x 60 = 9.46 x 1015 m Therefore, distance travelled by light in 4.29 light years = 4.29 x 9.46 x 1015 = 4.058 x 1016 m Parsec is also a unit of distance 1 parsec = 3.08 x 1016 m Therefore, the distance travelled by light in parsec is given as 4.29 light years =4.508 x 1016/3.80 x 1016 = 1.318 parsec = 1.32 parsec Using the relation, θ = d / D here, d is the diameter of Earths orbit, d = 3 × 1011 m D is the distance of the star from the earth, D = 405868.32 × 1011 m ∴ θ = 3 × 1011 / 405868.32 × 1011 = 7.39 × 10-6 rad But the angle covered in 1 sec = 4.85 × 10–6 rad ∴ 7.39 × 10-6 rad = 7.39 × 10-6 / 4.85 × 10-6 = 1.52″ 2.21 Precise measurements of physical quantities are a need for science. For example, to ascertain the speed of an aircraft, one must have an accurate method to find its positions at closely separated instants of time. This was the actual motivation behind the discovery of radar in World War II. Think of different examples in modern science where precise measurements of length, time, mass etc., are needed. Also, wherever you can, give a quantitative idea of the precision needed. Answer: Precise measurement is essential for the development of science. The ultra-short laser pulse is used for measurement of time intervals. X-ray spectroscopy is used to find the interatomic separation. To measure the mass of atoms, the mass spectrometer is developed. 2.23 The Sun is a hot plasma (ionised matter) with its inner core at a temperature exceeding 107 K, and its outer surface at a temperature of about 6000 K. At these high temperatures, no substance remains in a solid or liquid phase. In what range do you expect the mass density of the Sun to be, in the range of densities of solids and liquids or gases? Check if your guess is correct from the following data: a mass of the Sun = 2.0 × 1030 kg, the radius of the Sun = 7.0 × 108 m. Answer: Mass = 2 x 1030 kg Radius = 7 x 108 m Volume V = \(\begin{array}{l}\frac{4}{3}\pi r^{3}\end{array} \) = \(\begin{array}{l}\frac{4}{3}\end{array} \) x \(\begin{array}{l}\frac{22}{7}\end{array} \) x (7 x 108)3 = \(\begin{array}{l}\frac{88}{21}\end{array} \) x 512 x 1024 m3 = 2145.52 x 1024 m3 Density = \(\begin{array}{l}\frac{Mass}{Volume}\end{array} \) = \(\begin{array}{l}\frac{3\times 10^{30}}{2145.52\times 10^{24}}\end{array} \) = 1.39 x 103 kg/m5. The density is in the range of solids and liquids. Its density is due to the high gravitational attraction on the outer layer by the inner layer of the sun. 2.24. When the planet Jupiter is at a distance of 824.7 million kilometres from the Earth, its angular diameter is measured to be 35.72″ of arc. Calculate the diameter of Jupiter. Answer: Distance of the planet Jupiter from Earth, D= 824.7 million kilometres = 824.7 x 106 km Angular diameter θ = 35.72 ″= 35.72 x 4.85 x 10-6 rad = 173.242 x 10-6 rad Diameter of Jupiter d = θ x D= 173.241 x 10-6x 824.7 x 106 km =142871 = 1.43 x 105 km 2.25. A man walking briskly in the rain with speed v must slant his umbrella forward, making an angle θ with the vertical. A student derives the following relation between θ and v: tan θ = v and checks that the relation has a correct limit: as v →0, θ →0, as expected (We are assuming there is no strong wind and that the rain falls vertically for a stationary man). Do you think this relation can be correct? If not, guess the correct relation. Answer According to the principle of homogeneity of dimensional equations, Dimensions of L.H.S. = Dimensions of R.H.S. In relation v = tan θ, tan θ is a trigonometric function, and it is dimensionless. The dimension of v is [L1 T-1]. Therefore, this relation is incorrect. To make the relation correct, the L.H.S. must be divided by the velocity of rain, u. Therefore, the relation becomes v/u= tan θ This relation is correct dimensionally 2.26. It is claimed that two caesium clocks, if allowed to run for 100 years, free from any disturbance, may differ by only about 0.02 s. What does this imply for the accuracy of the standard caesium clock in measuring a time interval of 1 s? Answer Total time = 100 years = 100 x 365 x 24 x 60 x 60 s Error in 100 years = 0.02 s Error in 1 second=0.02/100 x 365 x 24 x 60 x 60 =6.34 x 10-12 s The accuracy of the standard caesium clock in measuring a time-interval of 1 s is 10-12 s. 2.27. Estimate the average mass density of a sodium atom, assuming its size to be about 2.5 Å (Use the known values of Avogadro's number and the atomic mass of sodium). Compare it with the mass density of sodium in its crystalline phase: 970 kg m–3. Are the two densities of the same order of magnitude? If so, why? Answer The diameter of sodium= 2.5 A = 2.5 x 10-10 m Therefore, the radius is 1.25 x 10-10 m The volume of a sodium atom, V= (4/3)πr3 = (4/3) x (22/7) x (1.25 x 10-10) 3= 8.177 x 10-30 m3 Mass of one mole atom of sodium = 23 g = 23 x 10-3 kg 1 mole of sodium contains 6.023 x 1023 atoms Therefore, the mass of one sodium atom, M= 23 x 10-3/6.023 x 1023= 3.818 x 10-26 kg The atomic mass density of sodium, ρ= M/V =3.818 x 10-26/8.177 x 10-30 = 0.46692 x 104= 4669.2 kg m-3 The density of sodium in its solid state is 4669.2 kg m-3, but in the crystalline phase, the density is 970 kg m-3. Hence, both are in a different order. In the solid phase, atoms are tightly packed, but in the crystalline phase, atoms arrange a sequence which contains a void. So, the density in the solid phase is greater than in the crystalline phase. 2.28. The unit of length convenient on the nuclear scale is a fermi: 1 f = 10–15 m. Nuclear sizes obey roughly the following empirical relation : r = r0 A1/3 where r is the radius of the nucleus, A its mass number, and r0 is a constant equal to about 1.2 f. Show that the rule implies that nuclear mass density is nearly constant for different nuclei. Estimate the mass density of the sodium nucleus. Compare it with the average mass density of a sodium atom obtained in Exercise. 2.27. Answer: The radius of the nucleus r = r0 A1/3 ro = 1.2 f = 1.2 x 10-15 m Considering the nucleus is spherical. Volume of nucleus = 4/3 πr3 = 4/3 π [r0 A1/3]3 = 4/3 πr03A Mass of nucleus = mA m is the average mass of the nucleon. A is the number of nucleons. Nuclear mass density = Mass of nucleus/Volume of the nucleus = mA/(4/3πr3) = 3mA/4πr3 = 3mA/4πr03A = 3m/4πr03 Using m = 1.66 x 10-27 kg and ro = 1.2 f = 1.2 x 10-15 m in the above equation = 3 x 1.66 x 10-27 /4 x 3.14 x (1.2 x 10-15)3= 4.98 x 10-27/21. 703 x 10-45= 2.29 x 1017 kg/m3 So, the nuclear mass density is much larger than the atomic mass density for a sodium atom we got in 2.27. 2.29. A LASER is a source of very intense, monochromatic, and unidirectional beam of light. These properties of laser light can be exploited to measure long distances. The distance of the Moon from the Earth has already been determined very precisely using a laser as a source of light. A laser light beamed at the Moon takes 2.56 s to return after reflection at the Moon's surface. How much is the radius of the lunar orbit around the Earth? Answer Time taken for the laser beam to return to Earth after reflection by the Moon's surface = 2.56 s The speed of laser light is c = 3 x 108 m/s. Let d be the distance of the Moon from the Earth, The time taken by laser signal to reach the Moon, t = 2d/c Therefore, d = tc/2 = (2.56 x 3 x 108)/2 = 3.84 x 108 m 2. 30. A SONAR (sound navigation and ranging) uses ultrasonic waves to detect and locate objects underwater. In a submarine equipped with a SONAR, the time delay between the generation of a probe wave and the reception of its echo after reflection from an enemy submarine is found to be 77.0 s. What is the distance of the enemy submarine? (Speed of sound in water = 1450 m s–1). Answer: Speed of sound in water,v = 1450 m s–1 The time between generation and the reception of the echo after reflection, 2t= 77.0 s Time taken for the sound waves to reach the submarine, t = 77.0/2 = 38. 5 s Then v = d/t Distance of enemy submarine, d = tv Therefore, d=vt=(1450 x 38. 5) =55825 m=55.8 x 103 m or 55.8 km. 2.31. The farthest objects in our Universe discovered by modern astronomers are so distant that light emitted by them takes billions of years to reach the Earth. These objects (known as quasars) have many puzzling features which have not yet been satisfactorily explained. What is the distance in km of a quasar from which light takes 3.0 billion years to reach us? Answer Time taken by light from the quasar to reach the observer, t = 3.0 billion years = 3.0 x 109 years = 3.0 x 109 x 365 x 24 x 60 x 60 s = 94608000 x 109 s = 9.46 x 1016 m Speed of light = 3 x 108 m/s Distance of quasar from Earth = 3.0 x 108 x 9.46 x 1016 m = 28.38 x 1024 m 2.32. It is a well-known fact that during a total solar eclipse-the disk of the moon almost completely covers the disk of the Sun. From this fact and the information you can gather from examples 2.3 and 2.4, determine the approximate diameter of the moon. Answer From examples 2.3 and 2.4, we get the following data Distance of the Moon from Earth = 3.84 x 108 m Distance of the Sun from Earth = 1.496 x 1011 m Sun's diameter = 1.39 x 109 m Sun's angular diameter,θ = 1920″ = 1920 x 4.85 x 10-6 rad = 9.31 x 10-3 rad [1″ = 4.85 x 10-6 rad] During a total solar eclipse, the disc of the moon completely covers the disc of the sun, so the angular diameter of both the sun and the moon must be equal. Therefore, the Angular diameter of the moon, θ = 9.31 x 10-3 rad The earth-moon distance, S = 3.8452 x 108 m Therefore, the diameter of the moon, D = θ x S = 9.31 x 10-3 x 3.8452 x 108 m = 35.796 x 105 m For students of Class 11 who are looking to give their best for the upcoming annual and competitive exams, it is very important to get accustomed to the solutions to the questions in the textbook. Thus, students are advised to have good practice with different kinds of questions that can be framed from the chapter. 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NCERT Solutions for Class 11 Physics Chapter 3 Motion in a Straight Line Download PDF carouselExampleControls112 Previous Next Access answers of NCERT Solutions for Class 11 Physics Chapter 3 Motion in a Straight Line Q1. In which of the following examples of motion can the body be considered approximately a point object? (a) A railway carriage moving without jerks between two stations. (b) A cap on top of a man cycling smoothly on a circular track. (c) A spinning cricket ball that turns sharply on hitting the ground. (d) A tumbling beaker that has slipped off the edge of a table. Ans. (a), (b) The size of the railway carriage and the cap is very small as compared to the distance they've travelled, i.e. the distance between the two stations and the length of the race track, respectively. Therefore, the cap and the carriage can be considered as point objects. The size of the cricket ball is comparable to the distance through which it bounces off after hitting the floor. Thus, the cricket ball cannot be treated as a point object. Likewise, the size of the beaker is comparable to the height of the table from which it drops. Thus, the beaker cannot be treated as a point object. Q2. The position-time (x-t) graphs for two children, A and B, returning from their school O to their homes, P and Q, respectively, are shown in Fig. Choose the correct entries in the brackets below: (a) (A/B) lives closer to the school than (B/A) (b) (A/B) starts from the school earlier than (B/A) (c) (A/B) walks faster than (B/A) (d) A and B reach home at the (same/different) time (e) (A/B) overtakes (B/A) on the road (once/twice). Ans. (a) A lives closer to the school than B, because A has to cover shorter distances [OP < OQ]. (b) A starts from school earlier than B, because for x= 0, t = 0 for A but for B, t has some finite time. (c) The slope of B is greater than that of A; therefore, B walks faster than A. (d) Both A and B will reach their home at the same time. (e) At the point of intersection, B overtakes A on the roads once. Q3. A woman starts from her home at 9.00 am, walks at a speed of 5 km/h on a straight road up to her office 2.5 km away, stays at the office up to 5.00 pm, and returns home by auto at a speed of 25 km/h. Choose suitable scales and plot the x-t graph of her motion. Ans. Distance to her office = 2.5 km. Walking speed the woman = 5 km/h Time taken to reach office while walking = (2.5/5) h=(1/2) h = 30 minutes Speed of auto = 25 km/h Time taken to reach home in auto = 2.5/25 = (1/10) h = 0.1 h = 6 minutes In the graph, O is taken as the origin of the distance and the time, then at t = 9.00 am, x = 0 and at t = 9.30 am, x = 2.5 km OA is the portion on the x-t graph that represents her walk from home to the office. AB represents her time of stay in the office from 9.30 to 5. Her return journey is represented by BC. Q4. A drunkard walking in a narrow lane takes 5 steps forward and 3 steps backwards, followed again by 5 steps forward and 3 steps backwards, and so on. Each step is 1 m long and requires 1 s. Plot the x-t graph of his motion. Determine graphically and otherwise how long the drunkard takes to fall in a pit 13 m away from the start. Ans. The time taken to go one step is 1 second. In 5 s, he moves forward through a distance of 5 m, and then in the next 3s, he comes back by 3 m. Therefore, in 8 s, he covers 2 m. So, to cover a distance of 8 m, he takes 32 s. He must take another 5 steps forward to fall into the pit. So, the total time taken is 32 s + 5 s = 37 s to fall into a pit 13 m away. Q5. A jet aeroplane travelling at the speed of 500 km/h ejects its products of combustion at the speed of 1500 km/h relative to the jet plane. What is the speed of the latter with respect to an observer on the ground? Ans. Speed of the jet aeroplane, VA= 500 km/h The speed at which the combustion products are ejected relative to the jet plane, VB – VA = – 1500 km/h (The negative sign indicates that the combustion products move in a direction opposite to that of the jet) Speed of combustion products w.r.t. observer on the ground, VB – 500 = – 1500 VB = – 1500 + 500 = – 1000 km/h Q6. A car moving along a straight highway with a speed of 126 km h–1 is brought to a stop within a distance of 200 m. What is the retardation of the car (assumed uniform), and how long does it take for the car to stop? Ans. The initial velocity of the car = u The final velocity of the car = v Distance covered by the car before coming to rest = 200 m Using the equation, v = u + at t = (v – u)/a = 11.44 sec. Therefore, it takes 11.44 sec for the car to stop. Q7. Two trains, A and B, of length 400 m each, are moving on two parallel tracks with a uniform speed of 72 km h–1 in the same direction, with A ahead of B. The driver of B decides to overtake A and accelerates by 1 m s–2. If, after 50 s, the guard of B just brushes past the driver of A, what was the original distance between them? Ans. Length of trains A and B = 400 m Speed of both the trains = 72 km/h = 72 x (5/18) = 20m/s Using the relation, s = ut + (1/2)at2 Distance covered by the train B SB = uBt + (1/2)at2 Acceleration, a = 1 m/s Time = 50 s SB = (20 x 50) + (1/2) x 1 x (50)2 = 2250 m Distance covered by the train A SA = uAt + (1/2)at2 Acceleration, a = 0 SA = uAt = 20 x 50 = 1000 m Therefore, the original distance between the two trains = SB – SA = 2250 – 1000 = 1250 m Q8. On a two-lane road, car A is travelling at a speed of 36 km/h. Two cars, B and C, approach car A in opposite directions with a speed of 54 km/h each. At a certain instant, when the distance AB is equal to AC, both being 1 km, B decides to overtake A before C does. What is the minimum acceleration of car B required to avoid an accident? Ans: The speed of car A = 36 km/h = 36 x (5/8) = 10 m/s Speed of car B = 54 km/h = 54 x (5/18) = 15 m/s Speed of car C = – 54 km/h = -54 x (5/18) = -15 m/s (negative sign shows B and C are in opposite directions) Relative speed of A w.r.t. C, VAC = VA – VB = 10 – (-15) = 25 m/s Relative speed of B w.r.t. A, VBA = VB – VA = 15 – 10 = 5 m/s Distance between AB = Distance between AC = 1 km = 1000 m Time taken by the car C to cover the distance AC, t = 1000/VAC = 1000/ 25 = 40 s If a is the acceleration, then s = ut + (1/2) at2 1000 = (5 x 40) + (1/2) a (40) 2 a = (1000 – 200)/ 800 = 1 m/s2 Thus, the minimum acceleration of car B required to avoid an accident is 1 m/s2 Q9. Two towns, A and B, are connected by regular bus service, with a bus leaving in either direction every T minutes. A man cycling with a speed of 20 km h–1 in the direction A to B notices that a bus goes past him every 18 min in the direction of his motion and every 6 min in the opposite direction. What is the period T of the bus service, and with what speed (assumed constant) do the buses ply on the road? Ans. Speed of each bus = Vb Speed of the cyclist = Vc = 20 km/h The relative velocity of the buses plying in the direction of motion of the cyclist is Vb – Vc. The buses playing in the direction of motion of the cyclist go past him after every 18 minutes, i.e. (18/60) s. Distance covered = (Vb – Vc) x 18/60 Since the buses are leaving every T minutes. Therefore, the distance is equal to Vb x (T/60) (Vb – Vc) x 18/60 = Vb x (T/60) ——(1) The relative velocity of the buses plying in the direction opposite to the motion of the cyclist is Vb + Vc The buses go past the cyclist every 6 minutes, i.e. (6/60) s. Distance covered = (Vb + Vc) x 6/60 Therefore, (Vb +Vc) x 6/60 = Vb x (T/60)——(2) Dividing (2) by (1) [(Vb – Vc) x 18/60]/ [(Vb + Vc) x 6/60]= [Vb x (T/60)] /[Vb x (T/60)] (Vb – Vc) 18/(Vb +Vc) 6 = 1 (Vb – Vc)3 = (Vb +Vc) Substituting the value of Vc (Vb – 20)3= (Vb + 20) 3Vb – 60 = Vb + 20 2Vb = 80 Vb = 80/2 = 40 km/h To find the value of T, substitute the values of Vb and Vc in equation (1) (Vb – Vc) x 18/60 = Vb x (T/60) (40 – 20) x (18/60) = 40 x (T/60) T = (20 x 18) /40 = 9 minutes Q10. A player throws a ball upwards with an initial speed of 29.4 m/s. (a) What is the direction of acceleration during the upward motion of the ball? (b) What are the velocity and acceleration of the ball at the highest point of its motion? (c) Choose the x = 0 m and t = 0 s to be the location and time of the ball at its highest point, vertically downward direction to be the positive direction of the x-axis, and give the signs of position, velocity and acceleration of the ball during its upward and downward motion. (d) To what height does the ball rise, and after how long does the ball return to the player's hands? (Take g = 9.8 m s–2 and neglect air resistance). Ans. (a) The acceleration due to gravity always acts downwards towards the centre of the Earth. (b) At the highest point of its motion, the velocity of the ball will be zero, but the acceleration due to gravity will be 9.8 m s–2 acting vertically downward. (c) If we consider the highest point of ball motion as x = 0, t = 0, and vertically downward direction to be +ve direction of the x-axis, then (i) During the upward motion of the ball before reaching the highest point position, x = +ve, velocity, v = -ve and acceleration, a = +ve. (ii) During the downward motion of the ball after reaching the highest point position, velocity and acceleration, all three quantities are positive. (d) Initial speed of the ball, u= -29.4 m/s The final velocity of the ball, v = 0 Acceleration = 9.8 m/s2 Applying in the equation v2 – u2 = 2gs 0 – (-29.4)2 = 2 (9.8) s s = – 864.36/19.6 = – 44.1 Height to which the ball rises = – 44.1 m (negative sign represents upward direction) Considering the equation of motion v = u + at 0 = (-29.4) + 9.8t t = 29.4/9.8 = 3 seconds Therefore, the total time taken for the ball to return to the player's hands is 3 +3 = 6 s. Q11. Read each statement below carefully and state with reasons and examples, if it is true or false; A particle in one-dimensional motion (a) with zero speed at an instant may have non-zero acceleration at that instant (b) with zero speed may have non-zero velocity (c) with constant speed must have zero acceleration (d) with positive value of acceleration must be speeding up Ans. (a) True (b) False (c) True (if the particle rebounds instantly with the same speed, it implies infinite acceleration, which is unphysical) (d) False (true only when the chosen positive direction is along the direction of motion) Q12. A ball is dropped from a height of 90 m on a floor. At each collision with the floor, the ball loses one-tenth of its speed. Plot the speed-time graph of its motion between t = 0 to 12 s. Ans. Height from which the ball is dropped = 90 m The initial velocity of the ball, u = 0 Let v be the final velocity of the ball Using the equation v2 – u2 = 2as ——(1) v12 – 0 = 2 x 10 x 90 v1= 42.43 m/s Time taken for the first collision can be given by the equation v = u + at 42.43 = 0 + (10) t t1 = 4.24 s The ball losses one-tenth of the velocity at collision. So, the rebound velocity of the ball is v2= v – (1/10)v v2 = (9/10) v v2= (9/10) (42.43) = 38.19 m/s Time taken to reach maximum height after the first collision is v = u + at 38.19 = 0 + (10)t2 t2 = 3.819 s The total time taken by the ball to reach the maximum height is T = t1 + t2 T = 4.24 + 3.819 = 8.05 s Now the ball will travel back to the ground in the same time as it took to reach the maximum height = 3.819 s Total time taken will be, T = 4.24 + 3.819 + 3.819 = 11.86 Velocity after the second collision v3 = (9/10) (38.19) v3 = 34.37 m/s Using the above information, the speed time graph can be plotted Q13. Provide clear explanations and examples to distinguish between: (a) The total length of a path covered by a particle and the magnitude of displacement over the same interval of time. (b) The magnitude of average velocity over an interval of time, and the average speed over the same interval. [Average speed of a particle over an interval of time is defined as the total path length divided by the time interval]. In (a) and (b), compare and find which of the two quantities is greater. When can the given quantities be equal? [For simplicity, consider one-dimensional motion only]. Ans. (a) Let us consider an example of a football; it is passed to player B by player A and then instantly kicked back to player A along the same path. Now, the magnitude of displacement of the ball is 0 because it has returned to its initial position. However, the total length of the path covered by the ball = AB +BA = 2AB. Hence, it is clear that the first quantity is greater than the second. (b) Taking the above example, let us assume that football takes t seconds to cover the total distance. Then, The magnitude of the average velocity of the ball over time interval t = Magnitude of displacement/time interval = 0 / t = 0. The average speed of the ball over the same interval = total length of the path/time interval = 2AB/t Thus, the second quantity is greater than the first. The above quantities are equal if the ball moves only in one direction from one player to another (considering one-dimensional motion). Q14. A man walks on a straight road from his home to a market 2.5 km away at a speed of 5 km/h. Finding the market closed, he instantly turns and walks back home with a speed of 7.5 km h–1. What is the (a) Magnitude of average velocity, and (b) Average speed of the man over the interval of time (i) 0 to 30 min, (ii) 0 to 50 min, (iii) 0 to 40 min? [Note: You will appreciate from this exercise why it is better to define average speed as total path length divided by time and not as the magnitude of average velocity. You would not like to tell the tired man on his return home that his average speed was zero !] Ans. Distance to the market = 2.5 km = 2500 m Speed of the man walking to the market= 5 km/h = 5 x (5/18) = 1.388 m/s Speed of the man walking when he returns back home = 7.5 km/h = 7.5 x (5/18) = 2.08 m/s (a) Magnitude of the average speed is zero since the displacement is zero (b) (i) Time taken to reach the market = Distance/Speed = 2500/1.388 = 1800 seconds = 30 minutes So, the average speed over 0 to 30 minutes is 5 km/h or 1.388 m/s (ii) Time taken to reach back home = Distance/Speed = 2500/2.08 = 1200 seconds = 20 minutes So, the average speed is Average speed over a interval of 50 minutes= distance covered/time taken = (2500 + 2500)/3000 = 5000/3000 = 5/3 = 1.66 m/s = 6 km/h (ii) Average speed over an interval of 0-40 minutes = distance covered/ time taken = (2500+ 1250)/2400 = 1.5625 seconds = 5.6 km/h Q15. In Exercises 3.13 and 3.14, we have carefully distinguished between average speed and the magnitude of average velocity. No such distinction is necessary when we consider the instantaneous speed and the magnitude of velocity. The instantaneous speed is always equal to the magnitude of instantaneous velocity. Why? Ans. Instantaneous velocity and instantaneous speed are equal for a small interval of time because the magnitude of the displacement is effectively equal to the distance travelled by the particle. Q16. Look at the graphs (a) to (d) carefully and state, with reasons, which of these cannot possibly represent the one-dimensional motion of a particle? Ans. None of the four graphs shows a one-dimensional motion. (a) Shows two positions at the same time, which is not possible. (b) A particle cannot have velocity in two directions at the same time. (c) Graph shows negative speed, which is impossible. Speed is always positive. (d) Path length decreases in the graph; this is also not possible. Q17. The figure shows the x-t plot of the one-dimensional motion of a particle. Is it correct to say from the graph that shows that the particle moves in a straight line for t < 0 and on a parabolic path for t >0? If not, suggest a suitable physical context for this graph. Ans. It is not correct to say that the particle moves in a straight line for t < 0 (i.e., -ve) and on a parabolic path for t > 0 (i.e., + ve) because the x-t graph does not represent the path of the particle. A suitable physical context for the graph can be the particle is dropped from the top of a tower at t =0. Q18. A police van moving on a highway with a speed of 30 km h–1 fires a bullet at a thief's car speeding away in the same direction with a speed of 192 km h–1. If the muzzle speed of the bullet is 150 m s–1, with what speed does the bullet hit the thief's car? (Note: Obtain that speed which is relevant for damaging the thief's car). Ans. Speed of the police van = 30 km/h = 30 x (5/18) = 25/3 m/s Speed of a thief's car = 192 km/h = 192 x (5/18) = 160/3 m/s Muzzle Speed of the bullet = 150 m/s Speed of the bullet = speed of the police van + muzzle speed of the bullet = (25/3)+ 150 = 475/3 m/s The relative velocity of the bullet w.r.t. the thief's car is v = Speed of the bullet – Speed of a thief's car = (475/3) – (160/3) = 105 m/s The bullet hits the thief's car at a speed of 105 m/s Q19. Suggest a suitable physical situation for each of the following graphs. Ans. (a)The graph is similar to kicking a ball, and then it hits the wall and rebounds with a reduced speed. The ball then moves in the opposite direction and hits the opposite wall, which stops the ball. (b) The graph shows a continuous change in the velocity of the object, and at some instant, it losses some velocity. Therefore, it may represent a situation where a ball falls on the ground from a certain height and rebounds with a reduced speed. (c) A cricket ball moving with a uniform speed is hit by a bat for a very short time interval. Q20. The following figure gives the x-t plot of a particle executing one-dimensional simple harmonic motion. Give the signs of position, velocity and acceleration variables of the particle at t = 0.3 s, 1.2 s, – 1.2 s. Ans. In S.H.M., acceleration, a = – ω2 x , ω is the angular frequency —-(1) (i) At t = 0.3 s, x < 0, i.e. position is negative. Moreover, as x becomes more negative with time, it shows that velocity is negative (i.e., v < 0). However, using equation (1), acceleration will be positive. (ii) At t = 1.2 s, Positions and velocity will be positive. Acceleration will be negative. (iii) At t = -1.2 s, Position, x is negative. Velocity and acceleration will be positive. Q21. The figure gives the x-t plot of a particle in one-dimensional motion. Three different equal intervals of time are shown. In which interval is the average speed greatest, and in which is it the least? Give the sign of average velocity for each interval. Ans. Interval 3 is the greatest, and 2 is the least. The average velocity is positive for intervals 1 and 2, and it is negative for interval 3. Q22. The following figure gives a speed-time graph of a particle in motion along a constant direction. Three equal intervals of time are shown. In which interval is the average acceleration greatest in magnitude? In which interval is the average speed greatest? Choosing the positive direction as the constant direction of motion gives the signs of v and a in the three intervals. What are the accelerations at points A, B, C and D? Ans. The change in the speed with time is maximum in interval 2. Therefore, the average acceleration is greatest in magnitude in interval 2. The average speed is maximum in interval 3. The sign of velocity is positive in intervals 1, 2 and 3. The acceleration depends on the slope. The acceleration is positive in intervals 1 and interval 3, as the slope is positive. The acceleration is negative in interval 2, as the slope is negative. Acceleration at A, B, C and D is zero since the slope is parallel to the time axis at these instants. Q23. A three-wheeler starts from rest, accelerates uniformly with 1 m s–2 on a straight road for 10 s, and then moves with uniform velocity. Plot the distance covered by the vehicle during the nth second (n = 1,2,3….) versus n. What do you expect this plot to be during accelerated motion: a straight line or a parabola? Ans. For a straight line, the distance covered by a body in nth second is: SN = u + a (2n – 1)/2 . . . . (1) Where, a = Acceleration u = Initial velocity n = Time = 1, 2, 3, ... , n In the above case, a = 1 m/s2 and u = 0. ∴ SN = (2n – 1) / 2 . . . .(2) This relation shows that: SN ∝ n . . . . (3) Now substituting different values of n in equation (2) we get: n 1 2 3 4 5 6 7 8 9 SN 0.5 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 This plot is expected to be a straight line. Q24. A boy, standing on a stationary lift (open from above), throws a ball upwards with the maximum initial speed he can, equal to 49 m s-1. How much time does the ball take to return to his hands? If the lift starts moving up with a uniform speed of 5 m s-1 and the boy again throws the ball up with the maximum speed he can, how long does the ball take to return to his hands? Ans. The initial velocity of the ball, u = 49 m/s Case: I The boy throws the ball upwards when the lift is stationary. The vertically upward direction is taken as the positive direction. The displacement of the ball is zero. Considering the equation of motion s=ut + (1/2)at2 0 = (49)t + (1/2) (-9.8)t2 t = (49 x 2)/9.8 = 98/9.8 = 10 sec Case: II As the lift starts moving with a speed of 5 m/s, the initial speed of the ball will be 49 m/s + 5 m/s = 54 m/s The displacement of the ball will be s = 5t' Therefore, the time taken can be calculated using the formula s = ut + (1/2) at2 5t' = (54) t' + (1/2)(-9.8) t'2 t' = 2(54 – 5)/9.8 = 10 sec The time taken will remain the same in both cases. Q25. On a long, horizontally moving belt figure, a child runs to and fro with a speed 9 km h–1 (with respect to the belt) between his father and mother located 50 m apart on the moving belt. The belt moves at a speed of 4 km h–1. For an observer on a stationary platform outside, what is the (a) speed of the child running in the direction of motion of the belt? (b) speed of the child running opposite to the direction of motion of the belt? (c) time taken by the child in (a) and (b)? Which of the answers alter if motion is viewed by one of the parents? Ans. Speed of child = 9 km h-1 Speed of belt = 4 km h-1 (a) When the boy runs in the direction of motion of the belt, then his speed as observed by the stationary observer = (9 + 4) km h-1 = 13 km h-1. (b) When the boy runs opposite to the direction of motion of the belt, then speed of the child as observed by the stationary observer = (9 – 4) km h-1 = 5 km h-1 (c) Distance between the two parents = 50 m = 0.05 km The speed of the boy, as observed by both the parents, is 9 km h-1 Time taken by the boy to move towards one of the parents =0.05 km/9k h-1=0.0056 h =20 S Q26. Two stones are thrown up simultaneously from the edge of a cliff 200 m high with initial speeds of 15 m s–1 and 30 m s–1. Verify that the graph shown in Fig. 3.27 correctly represents the time variation of the relative position of the second stone with respect to the first. Neglect air resistance and assume that the stones do not rebound after hitting the ground. Take g = 10 m s–2. Give the equations for the linear and curved parts of the plot. Ans. For the first stone: Given, Acceleration, a = –g = – 10 m/s2 Initial velocity, uI = 15 m/s Now, we know s1 = s0 + u1t + (1/2)at2 Given, the height of the tree, s0 = 200 m s1 = 200 + 15t – 5t2 . . . . (1) When this stone hits the jungle floor, s1 = 0 ∴– 5t2 + 15t + 200 = 0 t2 – 3t – 40 = 0 t2 – 8t + 5t – 40 = 0 t (t – 8) + 5 (t – 8) = 0 t = 8 s or t = – 5 s Since the stone was thrown at time t = 0, the negative sign is not possible ∴t = 8 s For the second stone: Given, Acceleration, a = – g = – 10 m/s2 Initial velocity, uII = 30 m/s We know, s2 = s0 + uIIt + (1/2)at2 = 200 + 30t – 5t2 . . . . (2) when this stone hits the jungle floor; s2 = 0 – 5t2 + 30 t + 200 = 0 t2 – 6t – 40 = 0 t2 – 10t + 4t + 40 = 0 t (t – 10) + 4 (t – 10) = 0 (t – 10) (t + 4) = 0 t = 10 s or t = – 4 s Here again, the negative sign is not possible ∴ t = 10 s Subtracting equation (1) from equation (2), we get s2 – s1 = (200 + 30t -5t2) – (200 + 15t -5t2) s2 – s1 =15t . . . . (3) Equation (3) represents the linear trajectory of the two stones because to this linear relation between (s2 – s1) and t, the projection is a straight line till 8 s. The maximum distance between the two stones is at t = 8 s. (s2 – s1)max = 15× 8 = 120 m This value has been depicted correctly in the above graph. After 8 s, only the second stone is in motion, whose variation with time is given by the quadratic equation: s2 – s1 = 200 + 30t – 5t2 Therefore, the equation of linear and curved path is given by: s2 – s1 = 15t (Linear path) s2 – s1 = 200 + 30t – 5t2 (Curved path) Q27. The speed-time graph of a particle moving along a fixed direction is shown in the figure. Obtain the distance traversed by the particle between (a) t = 0 s to 10 s, (b) t = 2 s to 6 s. Ans. (a) Distance traversed by the particle between t = 0 s and t = 10 s = area of the triangle = (1/2) x base x height = (1/2) x 10 x x12 = 60 m The average speed of the particle is 60 m/ 10 s = 6 m/s (b) The distance travelled by the particle between t = 2 s and t = 6 s = Let S1 be the distance travelled by the particle in time 2 to 5 s and S2 be the distance travelled by the particle in time 5 to 6 s. For the motion from 0 sec to 5 sec Now, u = 0 , t = 5 , v = 12 m/s From the equation v = u + at, we get a = (v – u)/t = 12/ 5 = 2.4 m/s2 Distance covered from 2 to 5 s, S1 = distance covered in 5 sec – distance covered in 2 sec = (1/2) a (5)2 – (1/2) a (2)2 = (1/2) x 2.4 x (25 – 4) = 1.2 x 21 = 25.2 m For the motion from 5 sec to 10 sec, u = 12 m/s and a = -2.4 m/s2 and t = 5 sec to t = 6 sec means n = 1 for this motion Distance covered in the 6 the sec is S2 = u + (1/2) a (2n – 1) = 12 – (2.4/2) (2 x 1 – 1) = 10.8 m Therefore, the total distance covered from t = 2 s to 6 s = S1 + S2 = 25.2 + 10.8 = 36 m Q28. The velocity-time graph of a particle in one-dimensional motion is shown in the figure. (a) x (t2) = x (t1) + v (t1) (t2 – t1) + (1/2) a(t2 – t1)2 (b) v(t2) = v(t1) + a(t2 – t1) (c) Vaverage = [x(t2) – x (t1)] /(t2 – t1) (d) aaverage = [v(t2) – v (t1)] /(t2 – t1) (e) x (t2) = x (t1) + vav (t2 – t1) + (1/2) aav (t2 – t1)2 (f) x(t2) – x (t1) = Area under the v-t curve bounded by t- axis and the dotted lines. Ans. The graph has a non-uniform slope between the intervals t1 and t2 (since the graph is not a straight line). The equations (a), (b) and (e) does not describe the motion of the particle. Only the relations (c), (d) and (f) are correct. For students of Class 11, the topics that come under the NCERT Solutions for Class 11 Physics Chapter 3 Motion in a Straight Line are important as they lay out the foundation for the topics to follow in the future. In order to understand advanced concepts of Physics, getting a grasp on fundamental topics like the one in this chapter is very crucial. This chapter of NCERT Class 11 Physics covers simple but essential topics such as comparing objects as point objects. We will be plotting graphs and determining values according to them. When you walk at a certain speed and then climb down a bus at a certain distance, then what will be the (x-t) graph of your motion? Check out the NCERT Solutions provided below on how to plot the graph. Have you ever seen a drunk guy walking some steps forward and a few steps backwards; have you wondered what will be the (x-t) motion graph of his motion? We will be finding the speed of a supercar which will go in front of you and the time taken by a biker to stop when he is stopped by a policeman; know the answer to these questions here. Are you afraid of snakes? Want to know who will catch its prey first among two anacondas racing for their prey? Find it by accessing the NCERT Solutions for Class 11 for free. Do you love basketball? Want to know in what direction the ball is accelerating when it is thrown upwards by the referee and also find out here what will be the ball's acceleration and velocity at the highest point. Let's see what statements are true regarding the one-dimensional motion of an object. Have you seen a rubber ball bounce back when you throw it down the ground? What will be the speed-time graph of that? See the answers below. You can check out NCERT Solutions for Class 11 Physics for more chapter-wise solutions. We will be providing the explanation for the difference between the total length of the path covered by a particle and the magnitude of displacement in the same interval of time. We will also find out the difference between average velocity and average speed in the same time interval. Do you know there is no difference between instantaneous speed and velocity? Find out why here. This chapter has a vast number of questions on every important topic in this chapter. 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The correctness of the concepts provided in the NCERT Physics Books at BYJU'S is the main reason to opt for them by Class 11 students. The accurate topics covered in the books, based on the latest CBSE syllabus, are in a student-friendly language making learning easier.By referring to NCERT Books for Class 11 Physics, students can achieve high marks in the final exams. Study the NCERT Books in detail to learn and score well in Physics. Students are recommended to go through NCERT books thoroughly before the final exams to score well and boost their question-solving abilities.NCERT books are primarily designed for CBSE students and are based on the latest syllabus prescribed by the CBSE Board. Most of the questions asked in the annual exams are from these textbooks, which in turn, help to know the marking scheme and exam pattern. Branches of physics are the subjects studied within the scope of physics. The subject physics can be defined as the branch of science which deals with the study of properties of matter and energy along with the interaction between them. Physicists have divided the subject into various branches and each branch has acquired a title of a full subject in modern days. In this article, let us know in detail about the branches of physics. Table of Contents: Physics and its Branches Physics is one of the most important subjects in all science; therefore, the branches of science have evolved to understand each and every underlying aspect of the physical world. Physics asks big questions such as: How did the universe begin? What are the basic building blocks of matter? How will the universe change in the future? Many physicists work really hard and try to find answers to these types of questions. The answers they come up with often lead to unexpected technological applications. The discovery of gravitation and the knowledge of motion were among the various major breakthroughs made in the field of science. Watch the videos below to understand how these major discoveries impact our life. Various Branches of Physics Physics can be classified into various branches, but classical physics is mainly concerned with energy and matter. The traditional branches of classical physics are Optics, Acoustics, Electromagnetics, and Classical mechanics. With the rapid development of physics, the scope of the subject is growing so large that it is not possible to cover physics under the above branches. A number of main branches of physics are discussed below. Mechanics Mechanics is the branch of physics that deals with the motion of an object without or with the reference of force. Mechanics can be further divided into two branches, namely quantum mechanics and classical mechanics. Quantum mechanics deals with the behaviour of the smallest particles like neutrons, protons, and electrons, while classical mechanics is the branch that deals with laws of motion of forces and physical objects. Optics This branch of physics deals with the behaviour, propagation, and properties of light. Optics can be simply described as the study of the behaviour of infrared light, visible light, and ultraviolet. Thermodynamics Thermodynamics deals with the study of heat and its relation with work and energy. Thermodynamics also deals with the transmission of heat energy by means of convection, conduction, and radiation. Electromagnetism Electromagnetism deals with the study of electromagnetic force like electric fields, light, magnetic fields, etc. There are two aspects of electromagnetism which are "electricity" and "magnetism". Relativity This branch of physics deals with the theorem that was formulated by Albert Einstein. The theory of relativity states that space and time are relative and all the motion must be relative to a frame of reference. Acoustic Acoustics deals with the study of sound and its transmission, production, and effects. Acoustics mainly involves the mechanical waves in gases, liquids, and solids, which include vibration, sound, ultrasound, and infrasound. The branch of physics known as mechanics is concerned with the investigation of motion under the influence of forces or displacements, as well as the subsequent consequences of the bodies on their surroundings.A branch of physics called optics studies how light behaves and has certain characteristics, as well as how light interacts with materials and the instruments that measure it. A type of physical interaction that takes place between electrically charged particles is the electromagnetic force. It combines all magnetic and electrical forces and operates between charged particles. Both attraction and repulsion are possible with the electromagnetic force. Wave motion refers to the movement of energy and momentum between two locations in a medium without the physical movement of any substance. There are three different categories of wave motion: The medium of propagation, The dimensions in which a wave propagates energy, The energy transfer According to the law of conservation of energy, "the entire energy of the system is preserved in a closed system, i.e., a system that is separated from its surroundings." Stay tuned with BYJU'S to learn more interesting Physics topics with the help of engaging and interactive video lessons.