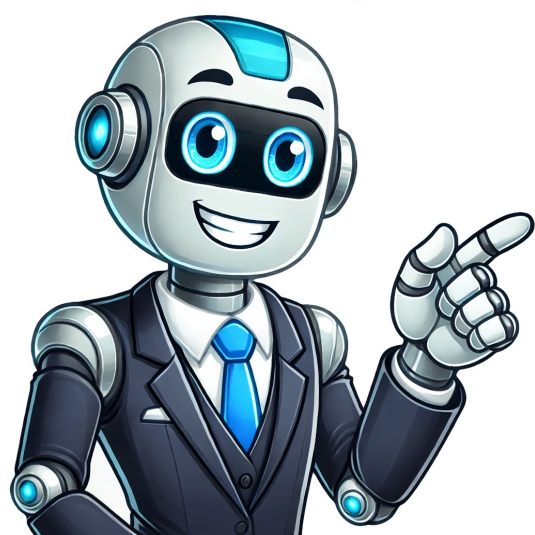


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Use the button below to print out the text. Changes in the Eighth Edition A large number of changes and improvements were made to this text. For example, suppose the automobile is moving along a straight line at a constant speed. Quick questions have been cast in an objective format, including multiple choice, true– false, and ranking. A friend spins the front wheel, of radius 0.381 m, and observes that drops of water fly off tangentially in an upward direction when the top of the wheel is at the same level as the center of the wheel, denotes challenging problem. Is it moving at 1.5 ? When we mean average acceleration, we shall always use the adjective average. By definition, the instantaneous velocity at is directed along the line tangent to the curve at . To illustrate this procedure, suppose you are interested in an equation for the position x of a car at a time t if the car starts from rest at $x = 0$ and moves with constant acceleration a . The number of significant figures is related to the number of numerical digits used to express the measurement, as we discuss below. This definition is based on the rotation defined as 1/60 of one planet, the Earth. S Figure P1.42 44. (In fact, even when you know you are going to be carrying out a calculation, you should sketch the vectors to check your results.) With an ordinary ruler and protractor, a large diagram typically gives answers to two-digit S but not to three-digit precision. Length may be described with symbols such as x , y , and z (for position); r (for radius); a , b , and c (for the legs of a right triangle); l (for the length of an object); d (for a distance); h (for a height); and so forth. Keep in mind that few people are able to absorb the full meaning of scientific material after only one reading; several readings of the text and your notes may be necessary. The units of slope in Active Figures 2.1b and 2.3 are meters per second, the units of velocity. The mass of the other is five times greater. Is it reasonable that the magnitude of R is larger S S than that of both A and B ? Assessment and Course Preparation Resources A number of resources listed below will assist with your assessment and preparation processes. You should develop a process of building models as you study physics. (rather than 1 in./2.54 cm) so that the unit “inch” in the denominator cancels with the unit in the original quantity. s2 (d) kg ? Two of them—Leucippus and his student Democritus—could not accept the idea that such cuttings could go on forever. 30 40 50 60 ≥ 20 ≥ 40 ≥ 60 t (s) 0 10 b a ACTIVE FIGURE 2.1 A car moves back and forth along a straight line. A slightly different ratio accomplishes that for us. Integration with Enhanced WebAssign. From this information, determine the magnitude of the average angular acceleration of the wheel. (If the expression were given as $v = 5$ at 2, it would be dimensionally incorrect. It is much better to take this first step: Identify the analysis model that is appropriate for the problem. Many chapters include review problems requiring the student to combine concepts covered in the chapter with those discussed in previous chapters. When the lamb’s length changes by 15.8%, its mass increases by 17.3 kg. Serway, John W. What distance differs from 100 m and from 1 000 m by equal factors so that we could equally well choose to represent its order of magnitude as , 102 m or as , 103 m? Suppose this crystal cleaves along a face diagonal as shown in Figure P1.7b. Your understanding of the material will be enhanced through a combination of efficient study habits, discussions with other students and with instructors, and your ability to solve the problems presented in the textbook. Rudolph, California State Polytechnic University, Pomona Marlin L. In an effort to boost interest in a television game show, each weekly winner is offered an additional \$1 million bonus prize if he or she can personally count out that exact amount from a supply of one-dollar bills. (c) Consider the view seen by cow B. For example, in part (B) of Example 2.4, we find the position when the velocity and the time are known. A drop that breaks loose from the tire on one turn rises h = 54.0 cm above the tangent point. (a) smaller than 100 (b) larger than 100 (c) equal to 100 Ex a m pl e 1.3 Is He Speeding? If so, identify the point(s). (1 U.S. gal 5 231 in.3) 21. These experiments can be used to test ideas and models discussed in class or in the textbook. Her total displacement is zero, so her average velocity is zero! Nonetheless, we need to be able to quantify how fast she was running. We added a number of problems related to biomedical situations in this edition, to highlight the relevance of physics principles to those students taking this course who are majoring in one of the life sciences. Dear Patron: Please don’t scroll past this. Interested in adopting audience response system technology? Consider any zero value in this book to have as many significant figures as you need. graph at each instant. A useful procedure for doing that, called dimensional analysis, can be used because dimensions can be treated as algebraic quantities. Note: The next 12 problems call on mathematical skills from your prior education that will be useful throughout this course. In addition, standards used for measurements must not change with time. These problems (there is one in every chapter of the text) help train students to break down complex problems into a series of simpler problems, an essential problem-solving skill. (f) Describe the physical meaning of the slope. Most other variables are derived quantities, those that can be expressed as a mathematical combination of fundamental quantities. When physical models are not available, be imaginative and try to develop models of your own. Part (d) asks a conceptual question about the situation. Notice that the data in Table 2.1 result only in the six data points in the graph in Active Figure 2.1b. Because velocity at constant acceleration varies linearly in time according to Equation 2.13, we can express the average velocity in any time interval as the arithmetic mean of the initial velocity v_{xi} and the final velocity v_{xf} : ACTIVE FIGURE 2.11 A particle under constant acceleration a_x moving along the x axis: (a) the position–time graph, (b) the velocity–time graph, and (c) the acceleration–time graph. 63. In fact, at , 30 s after we start measuring, the car is at the origin of coordinates (see Active Fig. In this situation, the object moves in some direction and experiences a force acting in the opposite direction. Raue, Florida International University; James E. To make problems clearer to both students and instructors, this extensive process involved editing problems for clarity, editing for length, adding figures where appropriate, and introducing better problem architecture by breaking up problems into clearly defined parts. At t , the slope b of the x - t graph is zero, so the velocity is zero at that x instant. Similarly, we expect the displacement between x and x' to be positive. y Direction of v at S Figure 4.2 As a particle moves between two points, its average velocity is in the direction of the S displacement vector D_r . It is the foundation upon which the other sciences—astronomy, biology, chemistry, and geology—are based. 36. The beauty of physics lies in the simplicity of its fundamental principles and in the manner in which just a small number of concepts and models can alter and expand our view of the world around us. The S displacement R is the resultant when the two S individual displacements A and B are added. Two spheres are cut from a certain uniform rock. x (m) 10 8 6 4 2 0 (A) Determine the displacement of the particle in the time intervals $t = 0$ to $t = 1$ s and $t = 1$ s to $t = 5$ s. It would be meaningless if a visitor from another planet were to talk to us about a length of 8 “glitches” if we do not know the meaning of the unit glitch. Try using these tools on R in Figure 3.11a! S The second way to solve the problem is to analyze it algebraically. We shall treat vector quantities in greater detail in Chapter 3. A typical bacterial length scale is 1026 m. For addition and subtraction, you must consider the number of decimal places when you are determining how many significant figures to report: When numbers are added or subtracted, the number of decimal places in the result should equal the smallest number of decimal places of any term in the sum or difference. Dr. Jewett enjoys playing keyboard with his alphysicist band, traveling, underwater photography, running, and collecting antique quack medical devices that can be used as demonstration apparatus in physics lectures. Some require calculations designed to facilitate students’ familiarity with the equations, the variables used, the concepts the variables represent, and the relationships between the concepts. Current requirements of science and technology, however, necessitate more accuracy than that with which the separation between the lines on the bar can be determined. Notice the clear distinction between the definitions of average velocity and average speed: average velocity (Eq. 2.2) is the displacement divided by the time interval, whereas average speed (Eq. 2.3) is the distance divided by the time interval. You can purchase any Cengage Learning product at your local college store or at our preferred online store www.ichapters.com. (B) Calculate the average velocity during these two time intervals. Make sure that you read the syllabus for the course and adhere to the schedule set by your instructor. 2.3 | Analysis Model: Particle Under Constant Velocity 27 2.3 cont. The car exceeds the speed limit at some time within the time interval 0 2 50 s. The space inside the shell is filled with a liquid having a density of 1.23 g/cm3. full solution available in the Student Solutions Manual/Study Guide 1. We can perform a dimensional check by substituting the dimensions for acceleration, $1/T^2$ (Table 1.5), and time, T , into the equation. Stracher, East Georgia College; Jeff Sundquist, Palm Beach Community College; Gerald Taylor, James Madison University; Valentina Tobos, Lawrence Tech University; John Vassiliou, Villanova University; Jogindra Wadehra, Wayne State University; Bill Warren, Lord Fairfax Community College; Michael Weber, Brigham Young University-Hawaii; Zodiac Webster, Columbus State University; Margaret Wessling, Pierce College; Joseph O. Audience Response System Solutions. Second, a triangle only results if you are adding two vectors. Your lectures and laboratory work supplement the textbook and should clarify some of the more difficult material. A bicycle is turned upside down while its owner repairs a flat tire. In the second time interval, $\Delta t = 2$ s: v_x avg 1 S 2 5 Dx S 8m 5 5 14 m/s $\Delta t = 2$ s These values are the same as the slopes of the blue lines joining these points in Figure 2.4a. When multiplying several quantities, the number of significant figures in the final answer is the same as the number of significant figures in the quantity having the smallest number of significant figures. Installing a Carpet A carpet is to be installed in a rectangular room whose length is measured to be 12.71 m and whose width is measured to be 3.46 m. He even covers the door and window. P10.67). 35. One micron (1026 m) is a typical length scale associated with these microbes. The algebraic symbol for the quantity itself will be an italicized letter such as L for the length of an object or t for time. Our ready-to-go content includes: • all the questions from the Quick Quizzes • all end-of-chapter Objective Questions to provide helpful conceptual checkpoints to drop into your lecture • animated Active Figures enhanced with multiple-choice questions to help test students’ observational skills • Assessing to Learn in the Classroom questions developed at the University of Massachusetts Amherst. Notice that the curve is a parabola. Your ability to interpret a question properly is an integral part of problem solving. A careful reading of the problem reveals that in addition to being given the initial speed of 63 m/s, we also know that the final speed is zero. Whittaker, Stevens Institute of Technology Prior to our work on this revision, we conducted a survey of professors to gauge how they used end-of-chapter questions and problems in their classes. For example, marginal notes are useful for locating and describing important equations and concepts, and boldface indicates important definitions. By contrast, a scalar quantity has a numerical value and no direction. Many instructors choose to use such questions in a “peer instruction” teaching style or with the use of personal response system “clickers,” but they can be used in standard quiz format as well. The entire contents of the book in its extended version could be covered in a three-semester course, but it is possible to use the material in shorter sequences with the omission of selected chapters and sections. SOLUTION (A) The average velocity for the thrown ball is zero because the ball returns to the starting point; therefore, its displacement is zero. (a) What is the appropriate analysis model for the beam before it begins to tip? 10 t (s) 0 ≥ 10 Figure 2.9 (Example 2.6) The velocity–time graph for a particle moving along the x axis according to the expression $v_x = 5.40 - 2.5t$. What it is doing is undergoing a constant acceleration due to gravity. CHAPTER 2 | Motion in One Dimension 32 Ex a m pl e 2.6 Average and Instantaneous Acceleration The velocity of a particle moving along the x axis varies according to the expression $v_x = 5.40 - 2.5t$, where v_x is in meters per second and t is in seconds. The remaining unit is the centimeter, our desired result. Significant Figures. You will gain a great deal of experience in the use of these equations by solving a number of exercises and problems. 2.11c) is a straight line having a slope of zero. 39. “Speed” means instantaneous speed. A proton, which is the nucleus of a hydrogen atom, can be modeled as a sphere with a diameter of 2.4 fm and a mass of 1.67 3 10⁻²⁷ kg. The slope of this tangent line represents the velocity of the car at point . The radius of a uniform solid sphere is measured to be (6.50 $\pm$ 0.20) cm, and its mass is measured to be (1.85 $\pm$ 0.02) kg. (A) What is the runner’s velocity? This format helps those students who are more visual learners. For a more complete list, see P. (c) What is the speed of the block when it is at a position $x/2 = 3.00$ cm? 52. Pluto is now defined as a “dwarf planet” (like the asteroid Ceres). Consider a car moving back and forth along the x axis as in Active Figure 2.1a. Our exclusive audience response system content is perfect for amateur, intermediate, or advanced users of this new learning technology. The difference between the number of cars and the number of SUVs is 18. Following the discovery of the nucleus in 1911, an atomic model was developed in which each atom is made up of electrons surrounding a central nucleus. Once your project is finalized, Cengage Learning Custom Solutions will print the product and ship it to your bookstore. 2. All worked examples in the text may be assigned for homework in Enhanced WebAssign. This looks like an incorrect subtraction, but that is only because we have rounded the numbers 17.7 km and 34.6 km for display. For example, consider these operations that satisfy the rule: 1.000 1 1 0.000 3 5 1.000 4 1.002 5 0.998 5 0.004 In the first example, the result has five significant figures even though one of the terms, 0.000 3, has only one significant figure. (a) The aluminum can is larger. In forming a mental representation of a moving object, a pictorial representation called a motion diagram is sometimes useful to describe the velocity and acceleration while an object is in motion. 7. How many dollar bills attached end to end would it take to reach the Moon? P10.68). Assume there are 100 million passenger cars in the United States and the average fuel consumption is 20 mi/gal of gasoline. The examples closely follow the General Problem- Solving Strategy introduced in Chapter 2 to reinforce effective problem-solving habits. A car traveling on a highway is an example of translational motion, the Earth’s spin on its axis is an example of rotational motion, and the backand-forth movement of a pendulum is an example of vibrational motion. Ex a m pl e 3.2 A Vacation Trip A car travels 20.0 km due north and then 35.0 km in a direction 60.0° west of north as shown in Figure 3.11a. 25. The length of the This car moves at constant velocity (zero acceleration). In addition, these problems also have feedback to address student misconceptions, helping students avoid common pitfalls. Now consider a particle moving with a constant speed along a curved path.

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