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Uniformly accelerated motion physics ppt

1 Evenly Accelerated MotionChapter 2 Evenly Accelerated Motion 2 Speed 3 Speed 4 Acceleration What are the units for acceleration? 5 Evenly accelerated movement in a straight lineIn this case... Acceleration is constant, and the acceleration vector lies in the offset vector line. 6 5 equations! (1) (2) (3) (4) (5) 7 Guidelines for Problem Solving Draw a Sketch to indicate the origin and positive direction of a list of data quantities using the symbols of equations. Is the time known or do we need to find it? Why should we decide? Write general kinematic equations 8 More More Guidelines Rewrite common equations using known quantities. Look at the known and unknown and outline a strategy solution. Check your units to make sure you answer the question. 9 Problem Solution Time Fifteen Minutes 10 Definitions Instant Acceleration Instant Acceleration Tilt Bias compared to Time Chart Instant Acceleration Of Tilt Speed Compared to Time Chart 11 Slopes Moving A B Time 12 Team Exercises Next Challenge Solving 13 Free Fall Force Gravitational The points down air resistance ignored by the Gravity Healion near the Earth's surface called g 9.8 m/s2 and 32.1 ft/s2 Air Resistance ignored We then conditions one-dimensional kinematics - direct line movement with constant acceleration. 14 Sample Problem Ball is thrown vertically up at 10 m/s. How high it will get, how long it will be in the air, and how fast it will move when it hits the ground. 15 Shell problems - Two-dimensional air resistance KinematicsIgnore. ax 0 ay g 9.81 m/s2 вниз 16 Движения в двух направлениях являются независимыми Horizontal Вертикальный 17 Реальное движение представляет собой сочетание двух 18 2-D Проблема Руководящие принципы Настройка двух 1-D решений Происхождение x Происхождение yПозитивный x Положительный y xi й й й й й й йи g 19 2-D Руководящие принципы Cont'd Написать общие кинематические уравнения для каждого направления Переписать их для проблемы под рукой Найти условие, что пары движений (обычно время) 20 равномерно ускоренного движения вдоль прямой линии Academia.edu больше не поддерживает Интернет Explorer.То просматривать Academia.edu и более широкий Интернет быстрее и более безопасно, пожалуйста, занять несколько секунд, чтобы обновить браузер. 1. Week 3, Lesson 2 Evenly Accelerated Movement 1 Evenly Accelerated Week of Motion 3, Lesson 2 - Units of Length and Time - Speed - Distance vs. Moving - Average Speed vs. Average Speed - Instant Acceleration - Evenly Accelerated Traffic Along The Straight Line Links / Reading Preparation: Schaum in Outline Ch. 4 Principles of Physics Week 3, Lesson 2 Evenly Accelerated Movement 2 Evenly Accelerated Movement In This Situation, We Limit Situation Acceleration acceleration or in which the object is evenly accelerated. For example: - objects that fall freely under the influence of gravity near the earth's surface, have a constant acceleration. 3. Week 3, Lesson 2 Evenly Accelerated Motion 3 Unit Length and Time In order to determine the quantities that describe movement, we must first identify the basic units of measurement of length and time. The main si unit of length is a meter. The main time unit of SI is the second. 4. Week 3, Lesson 2 Evenly Accelerated Traffic 4 Speed When we say that the car is moving at a speed of 80 km/h, everyone knows what we mean: the car will go a distance of 80 km per hour - provided that it maintains this speed. In general, the distance traveled by the car, if its speed is constant: Distance and speed x time, overshadowed taken 5. Week 3, Lesson 2 Evenly Accelerated Move 5 6. Week 3, Lesson 2 Evenly Accelerated Movement 6 7. Week 3, Lesson 2 Evenly Accelerated Motion 7 Average Instant Speed Speed 8. Week 3, Lesson 2 Evenly Accelerated Motion 8 Speed Solution for Speed: Speed and Distance Traveled Time We use the same equation to determine the average speed of a car when its speed is not constant. If the car passes 200 km in 4.0 hours, its average speed: Average speed - traveled time traveled distance - d t 9. Week 3, Lesson 2 Evenly Accelerated Traffic 9 Move Suppose A and B represents two cities. B B is 800 km east of A. There are many roads from A to B - each at a different distance. One road is shown. Its length is 1200 km. The shortest distance is represented by the s. s vector, called displacement from A to B. 10. Week 3, Lesson 2 Evenly Accelerated Traffic 10 A B s Distance vs. Travel You can see the difference between distance travel and travel. The distance traveled depends on the distance traveled. Moving does not depend on the path. 11. Week 3, Lesson 2 Evenly Accelerated Movement 11 A B s Average Speed vs. Average Speed We have seen that average speed - time traveled by definition: Average speed - time plugd by the vector of movement In symbols: v s t Bar above v is used to indicate average speed. 12. Week 3, Lesson 2 Evenly Accelerated Movement 12 Note: SPEED is a scalable amount. VELOCITY is a vector number. Distance B passed If I travel on the shown trajectory (black line) at 20 hours, then: My average speed - traveled distance time - 1200 km/h, 60 km/h, but my average speed - the time of the shift vector, covered 800 km 20 h, the eastern average speed against the average speed of 13. Week 3, Lesson 2 Evenly Accelerated Movement 13 Instant If we move along the x-axis from: xi on ti xf on tf We can do a graph like this: x t P (ti, xi) (tf, xf) distance x xf - xf - time xi t t t - ti average line line tilt speed P and q. v x t - xf - xi tf - ti Looking at our plot, let's approach the P, so the z gets smaller, and instant speed - v lim t 0 x / t 14. Week 3, Lesson 2 Evenly Accelerated Motion 14 Instant Speed Out of This we can see that the instantaneous speed at a certain time t is a tilt curve at a time. t P (ti , xi) (tf , xf) R x 15. Week 3, Lesson 2 Evenly Accelerated Motion 15 Illustration ball thrown straight up. (He goes up, then stops, changes direction, then falls to the ground). The picture on the next slide shows the ball, y-coordinates (vertical shift) as a function of time. Let's find instant ball speed at points P and J. Let's also find the average speed between points A and 16. Week 3, Lesson 2 Evenly Accelerated Motion 16 Illustration 5 10 15 20 y (m) 1 2 3 4 t (s) P q 0 Instant Speed at points P and q is a tangent tilt at each point. vp - 10m 1.25 with 10 m/1.25 s, 8 m/s all-slope on slope 0 on the slope P - the average speed between A and I is the slope of the line joining the two: Vaz 20 m / 2.0 s and 10 m/s 17. Week 3, Lesson 2 Evenly Accelerated Acceleration 17: ACCELERATION measures the change in speed of time. It is defined as: average acceleration - change of vector speed time, taken - vf - vo t where: vf - final speed vo - original speed t - time interval during which there was a change Typical units (m/s)/s or m/s2 18. Week 3, Lesson 2 Evenly Accelerated Movement 18 Evenly Accelerated Movement in a Straight Line In this case the acceleration vector is constant and along the line of the vector of movement. Because the movement is in a straight line, we simplify our discussion by using plus and minus signs to show direction. (positive if in a positive direction and negative if in a negative direction.) and we imagine: 1) vector shift to x. 2) X-directed speed by Article 3) X-directional acceleration to a. 19. Week 3, Lesson 2 Evenly Accelerated Movement 19 Evenly Accelerated Movement - Cont'd Movement Can Now Be Described with the following Equations: 1) x vt 2) v Week 3, Lesson 2 Evenly Accelerated Movement 20 Let's Do a Few Sample Issues. 4.1 (Shaum) 4.3 (Shaum) 21. Week 4, Lesson 1 Evenly Accelerated Movement 21 Evenly Accelerated Movement - Cont'd Week 4, Lesson 1 - Acceleration Due to Gravity - Evenly Accelerated Movement Along the Straight Line Links /Reading Preparation: Shaum Outline Ch. 4 Principles of Physics Beuche - Ch.2 22. Week 4, Lesson 1 Evenly Accelerated Movement 22 We have seen that evenly accelerated movement in a straight line can now be described by the following equations: 1) x th vt 2) v Vf - vo t 4) vf2 - vo2 - 2ax 5) x - vo t - at2 2 Last lesson review 23. Week 4, Lesson 1 Evenly Accelerated Motion 23 These equations can be applied to two main situations: 1. Straight Line Movement (say, x-axis). 2. Free falling bodies - in which the body accelerates downwards with an acceleration of 9.8 m/s2. And, in this course (General Physics 1) you will need to apply these formulas to these two situations. 24. Week 4, Lesson 1 Evenly Accelerated Motion Acceleration 24 due to acceleration of gravity due to gravity (g): Body acceleration moving under gravity, g, gravitational (or free fall) acceleration, which is directed vertically downwards. On the ground, d 9.8 m/s2 (32.2 feet/s2); that may vary slightly from place to place. 25. Week 4, Lesson 1 Evenly Accelerated Motion 25 Graphic Interpretations As we have seen, graphic interpretations of movement in a straight line (x-axis) are as follows: - Instant speed of an object at a certain time is a tilt of the x-vs-t chart at a time. Instant acceleration of an object at a certain time is a tilt of the v-vs-t chart at a time. For constant speed, the x-vs-t chart is a straight line. For constant acceleration, the v-vs-t chart is a straight line. 26. Week 4, Lesson 1 Evenly Accelerated Movement 26 Case of the question - linear movement. 4.10 Bus, moving at a speed of 20 m/s, begins to slow down at a speed of 3 m/s per second. Find out how far you'll go before you stop. Take the direction of travel to be x-direction. Vo 20 m/s vf 0 m/s a -3 m/s2 Please note that the bus is slowing down and therefore the acceleration is negative (slowing down). Using vf2 - vo2 - 2ax x -(20 m/s) 2 2 (-3 m/s2) - 66.7 m 27. Week 4, Lesson 1 Evenly Accelerated Movement 27 Example - Falling Object 4.8 Ball falls from rest at an altitude of 50 m above the ground. (a) What is his speed before he falls to the ground? b) How long does it take to get to earth? Note that for these types of issues, we ignore the friction of the air. For this question, we take up as positively as possible: We have: y -50 m; a -9.8 m/s2; Vo No 0 a) Use of formula: vf2 - vo2 - 2ay - 0 - 2 (-9.8 m/s2) (-50 m) - 980 m2/s2 vv and 980 m2/s 2 - 32.1 m/s b) from a (vf-vo)/t t vf-vo a (-31.3 - 0) m/s -9.8 m/s2 and 3.19 with 28. Week 4, Lesson 1 Evenly Accelerated Motion 28 Sample question - a falling object ball is thrown up at a speed of 15 m/s. a) How high is it going? b) What is his speed before he is caught? c) How long has it been in the air? First, draw a sketch. A B C We can look at the problem in two parts. First, a trip from A to B. (above - hoe) and -9.8 m/s2; vo 15 m/s; vf No 0 ; Y?? y Using the equation: vf2 - vo2 - 2ay (change of note by y) y -(15)2 / 2 (-9.8) - 11.5 m (from A to B) 29. 4, Lesson 1 Evenly Accelerated Traffic 29 For the second part, we are concerned about the trip from B to C. b) This is a new trip, so we have a new famous: -9.8 m /s2 ; th -11.5 m; vo No 0 ; Vf?? Using 2ay y vf2 - vo2 vf No 2 (-9.8) (-11.5) -15 m/s (because the final speed is down) in) To find the duration of time in the air, we use the formula: y vo t - at2/2 (First term No 0 with vo No0), from which we get, what: t2 y 2y/a 2 (-11.5)/ /-9.8) 2.35 s2 t 1.53 s (remember that it is time from B to C) Thus, thus, TIME TOTAL is in the air 2 x 1.53s and 3.06 s 30. Week 4, Lesson 1 Evenly Accelerated Motion 30 Problems of projectile problem problem (problems in which something is thrown or moving through the air) are a combination of an object moving linearly (in a horizontal direction) and falling under the influence of gravity. Thus, we believe that the object consists of 2 independent parts: 1) horizontal component with th 0 and wf wu v v vh and 2) vertical component with g 9.8 m/s2 down. We also ignore the friction of the air. 31. Week 4, Lesson 1 Evenly Accelerated Motion 31 Example of the projectile problem Suppose the ball leaves the thrower's hand horizontally at a speed of 15 m/s from a position 2.0 m above the ground. Where will he hit the ground? There are two parts to this problem. Because the horizontal speed of 15 m/s remains unchanged throughout the ball's journey, the distance it travels depends on the total time it is in the air. The time it is in the air depends on the g and the time it takes to fall to the ground. 32. Week 4, Lesson 1 Evenly Accelerated Movement 32 So we resolve this in two parts: 1) The time it takes to fall to the ground v0 No 0 ; a -9.8 m/s2; y -2.0 m Use: y' vo t - 1/2at2 t - 2 (-2.0)/ / (-9.8) - 0.639 s (this time, Needs to fall to the ground) 2) Horizontal distance, which it passes in .639 s. vh 15 m/s Use x wh (t) x 15 m / s x 0.639 s and 9.58 m It will hit the ground 9.58 m from where it was liberated. 33. Week 4, Lesson 1 Evenly Accelerated Motion 33 The projectile, fired at an angle of 4.20 The ball is thrown at an initial speed of 100 m/s at an angle 30 above the horizontal, as shown in the photo. How far will the ball travel, assuming he hits the ground at the same altitude he was thrown at? 30 wu - 100 m/s x x ?? To solve this problem, we must divide the problem into horizontal and vertical parts. Thus, vox and vo cos30 - 86.6 m/s 86.6 m/s, and vo sin30 - 50 m/s 50 m/s 34. Week 4, Lesson 1 Evenly Accelerated Motion 34 In the vertical problem, at No. 0, as the ball returns to its original height. Then: y s voy t - 1/2 ay t2 or 0 (50 m/s) - 1/2 (-9.8 m/s2) t and t 10.2 s In horizontal problem, vox - vfx - 86.6 m/s. So: x - vfx t (86.6 m/s) (10.2 s) - m 35. ANS 1) Plane accelerates down the track at 3.20 m/s2 for s until finally raises from the ground. Determine the distance traveled before takeoff. ANS: d 1720 m 2) The car starts from rest and evenly accelerates in a time of 5.21 seconds at a distance of 110 m. Determine the acceleration of the car. ANS: 8.10 m/s2 3) Chuck rides giant drops in Great America. If Chuck falls 2.6 seconds free, what will be his final speed and how far will he fall? ANS: d 33 m; vf -25.5 m/s 4) The race car accelerates evenly from 18.5 m/s to 46.1 m/s in 2.47 seconds. Determine the acceleration of the car and the distance traveled. ANS: 11.2 m/s2; d 79.8 m 36. Week 3, Lesson 2 Evenly Accelerated Traffic 36 5) The car is traveling at a speed of 80 feet/s when the brakes suddenly apply, causing a constant slowdown of 10 feet/s2. Determine the time it takes to stop the car and the distance traveled to the stop. Stop.

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