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Honors physics free fall worksheet

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Therefore, you can conclude that Aristotle's predictions do not account for the effect of air resistance. In connection with this course, tensile forces such as air resistance will be neglected. In the 1600s, Galileo Galilei began a re-examination of the movement of declining bodies. Galileo, who recognizes that air resistance affects the movement of a shrinking body, conducted his famous thought experiment, in which he continually asked what would happen if the effect of air resistance was removed. Commander David Scott of Apollo 15 conducted this experiment while he was on the moon. He also dropped a hammer and a feather, and noticed that they reached the ground at the same time. Since Galileo's experiments, scientists have come to a better understanding of how earth's gravity accelerates free-falling bodies. Through experiments it has been established that the local gravitational force (g) on the earth's surface is 9.8 N/kg, which further indicates that all objects in free fall (neglecting air resistance) experience a corresponding acceleration of 9.8 m/s2 towards the centre of the earth. (NOTE: If you move away from the earth's surface the local gravitational field strength, and therefore the acceleration due to gravity, changes.) You can look at freely descending bodies as objects that fall from a certain height or plunge vertically upwards. In this study you will analyze the movement of each condition. Objects that fall from resting objects from rest have an initial speed of zero, giving you your first kinematic amount needed for problem solving. In addition to that if you call the direction of initial motion (down) positive, the object will have a positive acceleration and accelerate as it falls. An important first step in the analysis of objects in free fall is to decide which direction along the y-axis you want to call positive, and which direction will therefore be negative. you can set your positive direction as you wish and get the correct answer, after the tips below can simplify your work to achieve the right answer consistently. Identify the direction of the object's original movement and assign it as the positive direction. In the case of a lost object, the positive y-direction will point to the bottom of the paper. With the identified axis, you can now identify and write down your given kinematic information. Do not forget that a lost object has an initial speed of zero. v0=0 v=? Δy=? a=9.8 m/s2 t=? Notice the direction in which the vector arrows are drawn — if the speed and acceleration point in the same direction accelerates the object. If they point in opposite directions, the object brakes. KEY CONCEPT: The size of acceleration due to gravity (g) is constantly 9.81 m/s2 on the Earth's surface. Question: What is the speed of a 2.5 kilo mass after falling free from rest through a distance of 12 meters? Answer: Vertical problem: Declare down as the positive direction. This means that the acceleration, which is also down, is a positive amount. Objects launched upwards Study of the movement of an object launched vertically upwards happens in much the same way you examined the movement of an object falling from rest. The biggest difference is that you have to look at two segments of its movement instead of one: both up and down. Before you get into establishing a frame of reference and work through the quantitative analysis, you need to build a solid conceptual understanding of what is happening while the ball is in the air. Consider throwing the ball vertically in the air, as shown in the diagram. For the ball to move upwards, its starting speed must be greater than zero. As the ball rises, its speed decreases until it reaches its maximum height, where it stops, and then begins to fall. As the ball falls, its speed increases. In other words, the ball accelerates all the time, it is in the air, both on the way up, the moment it stops at its highest point, and on its way down. The reason for the ball's acceleration is gravity. All the time the ball is in the air, its acceleration is 9.8 m/s2 down, provided this happens on the surface of the Earth. Note that the acceleration can be either 9.8 m/s2 or -9.8 m/s2. The sign of acceleration depends on the direction you declared as positive, but in any case the direction of acceleration is due to gravity down towards the center of the Earth. You have already established the ball's acceleration for the whole time it is in the air is 9.8 m/s2 down. This acceleration causes the ball's speed to drop at a constant speed until it reaches maximum height, after which it turns around and begins to fall. To turn around, the ball's speed must pass through zero. Therefore, on the Height the speed of the ball must be zero. Question: A ball thrown vertically upwards reaches a maximum height of 30 meters above the Earth's surface. At its maximum height, the speed of the ball is: Answer: 0 m / s. The instantaneous speed of any projectile at its maximum height is zero. Because gravity provides the same acceleration to the ball on the way up (slowing it down) as on the way down (speeding it up), the time to reach maximum height is the same as the time to return to its launch position. Similarly, the initial speed of the ball will go up just the speed of the ball at the moment it reaches the point from which it was launched on the way down. Put another way, the time to go up is equal to the time to go down, and the initial speed up is equal to the final speed down (provided the object begins and ends at the same height above the ground). Now that a conceptual understanding of the ball's movement has been established, you can work towards a quantitative solution. After the rule of thumb established earlier, you can start by assigning the direction the ball starts moving as positive. Keep in mind that assigning positive and negative directions is completely arbitrary. You have the freedom to assign them as you please. However, after you assign them, don't change them. Once this positive reference direction has been established, all other speeds and offsets shall be assigned accordingly. For example, if up is the positive direction, the acceleration due to gravity will be negative because the acceleration due to gravity points down, toward the center of the Earth. At its highest point, the ball will have a positive shift, and will have a zero displacement when it returns to its starting point. If the ball is not caught but continues towards Earth past its starting point, it will have a negative shift. A trick of trading to solve free fall problems involves symmetry. The time it takes an object to reach its highest point is equal to the time it takes to return to the same vertical position. The speed at which the projectile begins its journey upwards is equal to the speed of the projectile when it returns to the same height (although its speed is obviously in the opposite direction). If you want to simplify the problem, vertically, at its highest point, the vertical speed is 0. This additional information can help you fill in your vertical motion table. If you cut the object's motion in half, you can simplify your problem solving - but don't forget that if you want the total time in the air, double the time it takes for the object to rise to its highest point. Question: A basketball player jumped right up to grab a rebound. If she was in the air for 0.80 seconds, how high did she jump? Answer: Define as the positive y-direction. at hvis basketballspiller er i luften i 0,80 sekunder, hun når sin maksimale højde på et tidspunkt på 0,40 sekunder, på hvilket tidspunkt hendes hastighed er nul. Kan ikke løse for Δx direkte med givne oplysninger, så find v0 først. Nu med v0 kendt, løse for Δx. Spørgsmål: Hvilken graf bedst repræsenterer forholdet mellem acceleration af et objekt falder frit nær overfladen af Jorden og den tid, det falder? Svar: (4) Accelerationen på grund af tyngdekraften er en konstant 9,8 m/s2 nede på jordens overflade. 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