PHYSICS

MORE ACCELERATION

Learning Goals

B2.3 - Use a v-t graph to derive the equation for average velocity and the equations for displacement.

B2.7 - Solve problems involving non-uniform linear motion.

B3.2 - Distinguish between scalar and vector quantities as they relate to uniform and non-uniform motion.

Success Criteria

- ☐ What is another word for negative acceleration?
- ☐ What is Δv?
- ☐ Can you rearrange the acceleration formula to find v_1 or v_2?

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BRINGING IT ALL TOGETHER (More Acceleration Formulas)

So Far ...

And Now ...

Remember - when dealing with velocities (or accelerations with direction) its important to establish which direction is ***Positive***.

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Ex: *A ball is dropped from rest and accelerates at 10 m/s^2 towards the ground for 3 seconds. How far does it fall?*

Ex: *A ball is thrown up in the air with an initial velocity of 20 m/s [up] and accelerates at 10 m/s^2 [down] towards the ground for 5 seconds. How far does the ball travel?*

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Ex: *A car travelling at 80 km/h (22.22 m/s) decelerates to 50 km/h (13.88 m/s) in 2 seconds. How far does it travel over this time period?*

Ex: *The CN Tower is 553 m tall. If you dropped a watermelon off the top how fast would it be going when it hits the ground? The acceleration due to gravity is 10 m/s^2.*

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Ex: *Aaron while driving his car at 100 km/h (27 m/s) decides to text message his friend. While he takes his eyes off the road he tragically hits a tree, stopping him in 0.3 seconds. What is his acceleration? What distance does he cover during the impact?*

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HOMEWORK

1. Shelly starts from rest on her bicycle at the top of a hill. After 6.0s she has reached a final velocity of 14m/s. What is Shelly's acceleration?

2. A ball is rolling at 4.80m/s over level ground when it encounters a ramp, which gives it an acceleration of -0.875m/s^2. If the ramp is 0.750m long, what is the final velocity of the ball when it reaches the top of the ramp?

3. Bill's motorcycle can accelerate at 7.05m/s^2 at a certain RPM and gear. How far, starting from rest, will Bill travel in the first 2.50s?

4. Lisa drops a ball. If the ball accelerates at 9.80m/s^2, how long will it take the ball to reach a velocity of 15.0m/s?

5. Big Bob is on his Harley and moving at 14.0m/s. He then accelerates to a velocity of 25.0m/s over a distance of 0.250km. What is Big Bob's acceleration?

6. Chuck's car is moving at 65.0m/s when he suddenly accelerates his car at 15.0m/s^2 for 3.00s. How far did Chuck, and car, travel while he was accelerating?

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HOMEWORK

7. Atom Ant is traveling with an initial velocity of 20.0 cm/s. He begins to accelerate at a rate of 8.00 cm/s^2 for 5.00 s. What is his total displacement in the 5.00 second interval? What is his displacement in the last second?

8. A skier starts from rest and slides 9.00 m down a slope in 3.00 s. In what time after starting will the skier acquire a velocity of 24.0 m/s? Assume constant acceleration. Answer: 12.0 s.

9. A bus moving at a speed of 20.0 m/s begins to slow at a rate of 3.00 m/s each second. Find how far it goes before stopping. Answer: 66.7 m

10. The engine of a model rocket accelerates the rocket vertically upward for 2.00 s such that its speed is given by the following data. At $t = 0$, its speed is zero; at $t = 1.00$ s, its speed is 5.00 m/s; at $t = 2.00$ s, its speed is 10.0 m/s, at $t = 3.00$ s, its speed is 15.0 m/s, and at $t = 4.00$ s its speed is 20.0 m/s. Plot a velocity vs. time graph for this motion and from it determine the average acceleration. What do you expect its acceleration to be at $t = 5.00$ s? Why? What will its velocity be at $t = 10.0$ s if it continues at this acceleration? How far will it have traveled after 10 s?

11. Until recently, the world's land speed record was held by Colonel John P. Stapp, USAF. On March 19, 1954, he rode a rocket-propelled sled that moved down the track at 632 mi/hr. He and the sled were safely brought to rest in 1.40 s. Determine the acceleration he experienced and the distance he traveled during this acceleration.

12. A go-cart travels the first half of a 100 m track with a constant speed of 5.00 m/s. In the second half of the track, it experiences a mechanical problem and slows down at a rate of 0.200 m/s^2. How long does it take the go-cart to travel the 100 m distance?

13. A car moving at 30.0 m/s slows uniformly to a speed of 10.0 m/s in a time of 5.00 s. Determine the acceleration of the car and the distance it moves in the third second. Answers: - 4.00 m/s^2, 20.0 m.

14. The velocity of a train is reduced uniformly from 15.0 m/s to 7.00 m/s while traveling a distance of 90.0 m. a. Compute the acceleration. b. How much farther will the train travel before coming to rest, provided the acceleration remains constant? Answers: -0.980 m/s^2, 25.0 m.

15. A bullet is fired at right angles through a board 10.0 cm thick. If the initial speed of the bullet is 400 m/s, and it the speed as it emerges is 300 m/s, find the deceleration of the bullet and the time it is in contact with the board.

16. A late passenger, sprinting at 8.00 m/s, is 30.0 m away from the rear end of a train when the train starts from rest with a constant acceleration of 1.00 m/s^2. Will the passenger catch the train, and if so, how far must he run to do so? How long will he have to run?