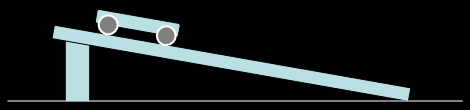
Questions of the Day
CAP – Constant Acceleration Particle

Question of the Day



- A cart is released from rest and allowed to roll down a ramp. Describe its motion.
- Answer: $v_i = 0$, *but its* $v_f \neq 0$! *Therefore, the cart undergoes a* ***change in velocity***.

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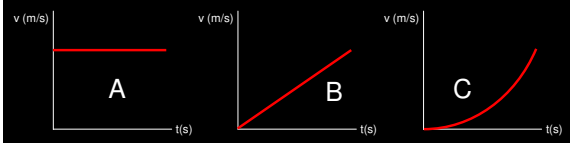

- Which of the above represents the motion of an object with a velocity that is changing at a constant rate?
- *Answer: B, A is constant velocity, C is nonconstantly changing velocity*

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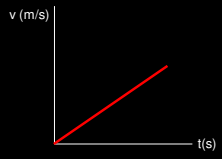

- On the above graph…
  - What does the slope represent?
  - What are the units for slope on the above graph?
- *Answer: the rate at which the velocity changes, the acceleration;* $(m/s)/s = m/s^2$ *(meters per second, every second)*

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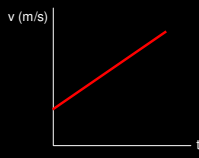

- What is the general equation for this graph?
- *Answer:* $v = a \cdot t + v_i$

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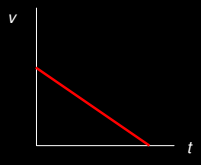

- Is the acceleration positive, negative, or zero?
- Is the object speeding up, slowing down, or maintaining a constant speed?
- Is the initial velocity (v_i) positive, negative, or zero?
- Is the final velocity (v_f) positive, negative, or zero?
- *Answer:* $a = -$ *, slowing down,* $v_i = +$, $v_f = 0$

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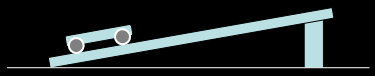

- A cart is launched up a ramp at 3 m/s and reaches its highest point in 1.5 s. Determine the following:
  - Δx =
  - v_i =
  - v_f =
  - a =
  - Δt =
- *Answers: Δx = 4.5 m, v_i = 3 m/s, v_f = 0 m/s, a = -2 m/s^2, Δt = 1.5 s*

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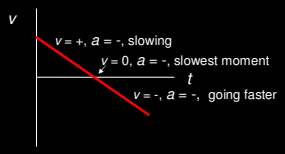

- Label where the velocity is +, -, and/or 0.
- Label where the acceleration is +, -, and/or 0.
- Label where the object is slowing, going faster, or going a constant speed.

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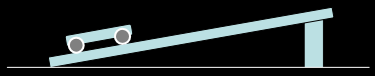


- A cart is launched up a ramp at 9 m/s. The acceleration of the cart on the ramp is -3 m/s^2.
  - How long until the cart turns around?
  - How long will it take the cart to return to its initial position?
  - What will be the cart's velocity when it returns to its initial position?
  - What will be the cart's velocity after 3.14159 s?
- *Answers: t = 3s; 3 more seconds; v = -9 m/s; v = $a \cdot t + v_i$ = (-3 m/s^2)·(3.14159 s)+9 m/s = -.425 s*

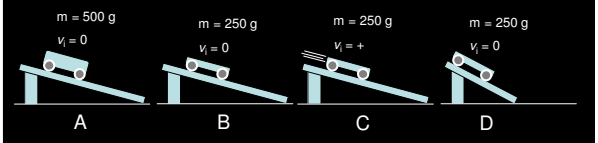
Question of the Day

- Brainstorm three real-life scenarios that would demonstrate constant acceleration.
- *Possible Answers: Tubing down a straight hill, coasting on a bike down a straight hill, rolling a laptop cart down the ramp on the way to the lunch room, skydiving (initially), dropping an object (any freefall), etc.*

Question of the Day

- You release a marble down a stairway railing. The marble's velocity changes by 6 m/s every second.
  - How fast will the marble be going after 3 seconds?
  - How fast will the marble be going after 6.28318 seconds?
- *Answer: t = 3 s, v = 18 m/s ; t = 6.28318 s, v = 37.699 m/s*

Question of the Day



- Which cart will have the greatest acceleration?
- Which cart will have the least acceleration?
- *Answer: Since mass and v_i don't affect the acceleration, "D" will have the greatest acceleration because it has the steepest ramp.*

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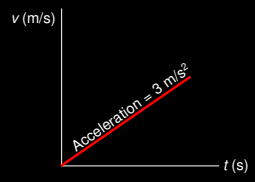

- What is the displacement after 5 seconds?
- *Answer: Δx = area between function and t axis = ½ · (5 s) · [(5 s) · (3 m/s²)] = 37.5 m*

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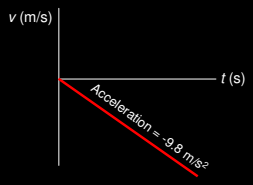

- A ball is dropped and falls for 5.0 seconds.
  - Sketch the *velocity*-vs.-*time* graph.
  - What will be the object's velocity after falling for 5.0 seconds?
  - How far will the object have traveled during this interval?
- *Answer: v_f = 49 m/s; Δx = -122.5 m*

Question of the Day

- A skydiver drops a golf ball from his balloon capsule that has reached its maximum height of 36,600 m. *If* there is no air resistance at any point during the descent…
  - How long will it take the ball to hit the ground?
  - With what speed will the ball hit the ground?
  - The speed of sound is about 340 m/s. How does the final velocity compare to this?
- *Answer: Δt = 86.4 s ; v_f = 847 m/s = mach 2.5*

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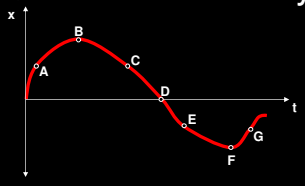

- At which point(s) is the object…
  - moving the slowest? …moving the fastest?
  - changing direction?
  - decreasing speed? …increasing speed?
- *Answer: slowest: B & F; fastest: A, D, or G; changing direction: B & F; slowing: A→ B, D→F; speeding: B→D, F→G*

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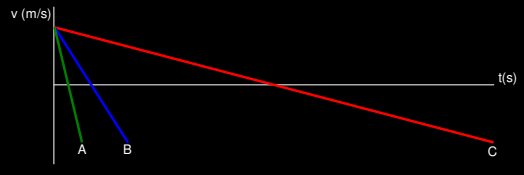

- The free fall acceleration on Jupiter is about 25 m/s² and on our Moon it is 1.6 m/s². An object is thrown straight up on Earth, Jupiter, and the Moon. Match the graph with the location.
- *Answer: Earth = B, Jupiter = A, Moon = C*