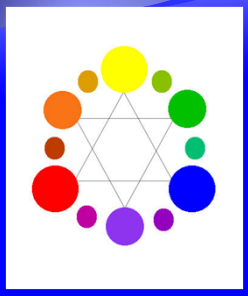
DESCRIBING UNIFORM MOTION

Question

- A car, starting at rest, experiences a constant acceleration (*or increase in velocity*) of 5 m/s^2 for 10 sec.
  - How far has the car traveled?

- We can NOT solve the previous problem using any of our current models or equations!
- BUT, we can make/derive some models that will!

An Example From Art



In Art, there are 3 Primary Colors

They can be combined to form the 3 Secondary Colors

Etc…

- The same sort of process can be done with our math models.
- Our simple models for speed, velocity and acceleration can be combined into 'Super'-models!

Limitation of our 'Super'-models

- These new models will **ONLY** work for objects that move at a constant acceleration!

WHY?

- Objects that experience a constant acceleration move in very predictable ways!

Kinematic Equations for Linear Motion

(For constant acceleration ONLY)

** To select the appropriate equation to solve a particular problem:
1) List what quantities are given - (*will be 3*)
2) List what is being asked for - (*will be 1*).
3) Find the equation in the table that contains all 4 involved quantities.

Equation	Involved Quantities	Unneeded Quantity
1) $v_f = v_i + at$	v_i, v_f, a, t	Δx
2) $v_f^2 = v_i^2 + 2a\Delta x$	$\Delta x, v_f, v_i, a$	t
3) $\Delta x = v_i t + \frac{1}{2}at^2$	$\Delta x, v_i, a, t$	v_f
4) $\Delta x = \frac{1}{2}(v_f + v_i)t$	$\Delta x, v_f, v_i, t$	a
5) $\Delta x = v_f t - \frac{1}{2}at^2$	$\Delta x, v_f, a, t$	v_i

After Working a Problem…

- Are my units ok?
- Is my magnitude reasonable?
- Is my direction reasonable?

- Using our new kinematic (motion) models, we can answer our original question:
- A car, starting at rest, experiences a constant acceleration of 5 m/s² for 10 sec.
  - How far has the car traveled?

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Question

- A driver traveling at a constant 112.6 *km/hr* (70 *mph*) drops his favorite CD on the floorboard. He takes his eyes off the road for 3 sec to retrieve it.
  - How far does he travel (in *m*) while not paying attention to the road?

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Question

- Spotting a state trooper on your way home for Thanksgiving break, you casually reduce your speed from 38 *m/s* (85 *mph*) to 31.3 *m/s* (70 *mph*) in 4 sec.
  - What is your acceleration?
  - How far did you travel while you were breaking?

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Question

- While rock climbing, you look down to monitor your progress when your favorite pair of sunglasses fall off. You observe (*in the midst of your sorrow*) that they are accelerating away from you at a constant rate of 9.8 m/s^2 as they plummet toward the ground.
  - If it takes 5 sec to reach the ground, how high are you on the cliff?
  - What is the speed of the sunglasses just before shattering on the ground below?

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Question

- Randy Johnson can throw a baseball at 100 *mph* (44.7 *m/s*). A brave catcher acting as a target must bring the ball to a complete stop in just a few inches using a well padded glove.
  - What is the acceleration of the ball as it comes to rest in the catcher's glove?

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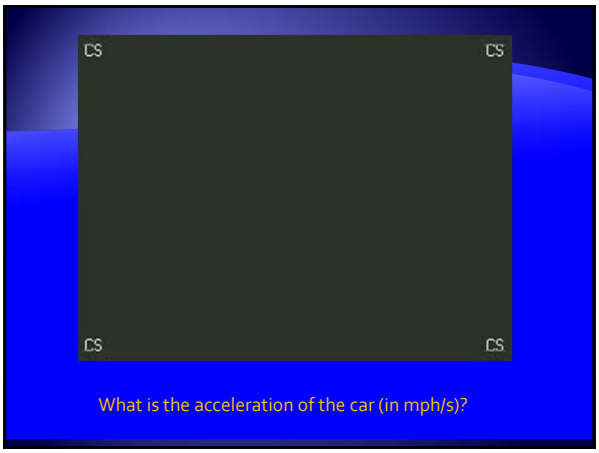

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