Announcements 30 Jan 09

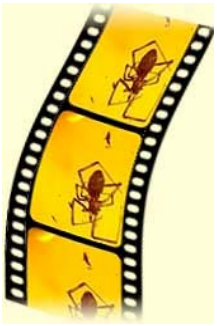
- **Textbook**
  - Two copies on Reserve at DuBois library (3rd floor)
  - Any question or issue?
- **Homework with MasteringPhysics web system**
  - Please report problems to tech support team

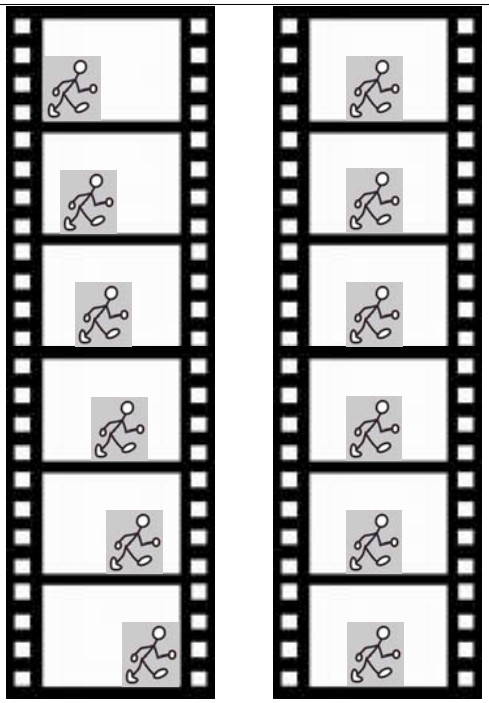
TO DO

- ***By Tuesday morning*** **(8 am on Feb 3)**
  - Complete the "Introduction to MasteringCollegePhysics" homework assignment
  - This assignment does not count toward your grade but is necessary to get acquainted with MasteringPhysics web-based homework system
- ***By Wednesday morning*** **(9 am on Feb 4)**
  - Buy PRS transmitter & Use it during lecture

MOTION

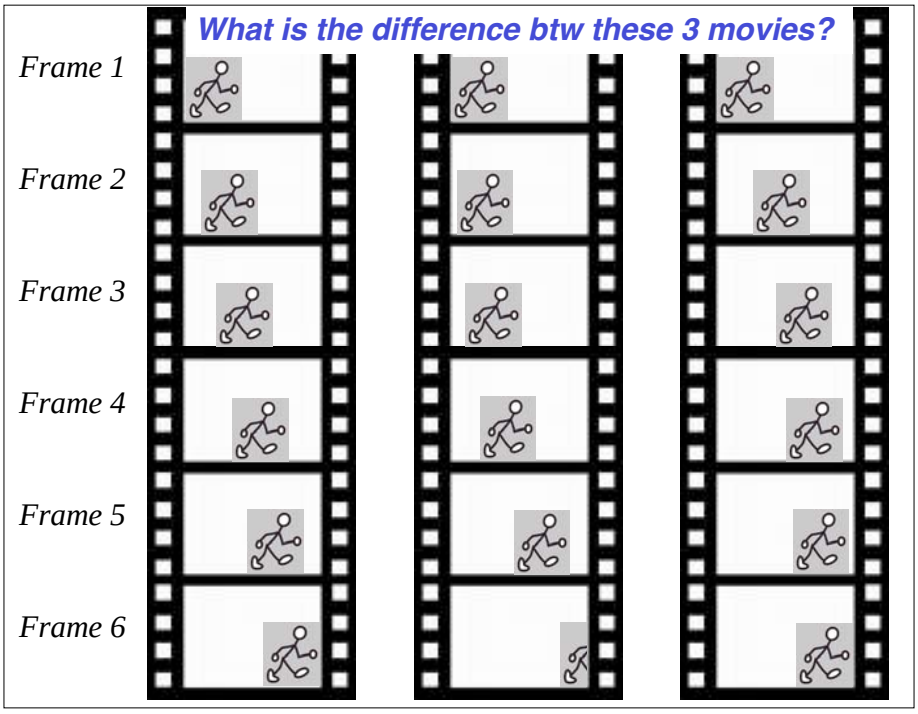
- What is motion? What causes motion?
- How can we describe it?
- What *changes*?





Amount of time between successive frames is constant

Is your movie like the one on the left or that on the right?



Four types of motion
(we'll focus on straight-line and projectile motion)


Straight-line motion


Circular motion


Projectile motion


Rotational motion

Chapter 1
Concepts of Motion and Mathematical Background

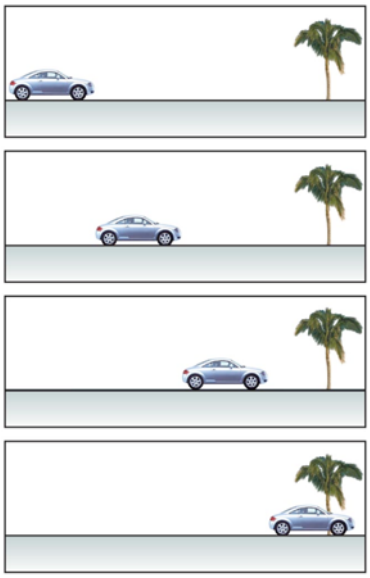
Topics:

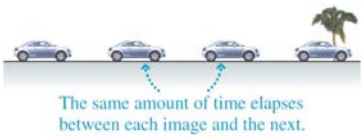
- Motion diagrams
- Position and time
- Velocity
- Scientific notation and units
- Vectors and motion

Sample question:

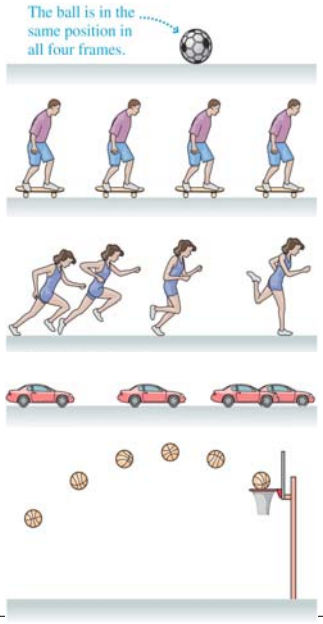
As this snowboarder moves in a graceful arc through the air, the direction of his motion, and the distance between each of his positions and the next, is constantly changing.
What language should we use to describe this motion?

Making a motion diagram



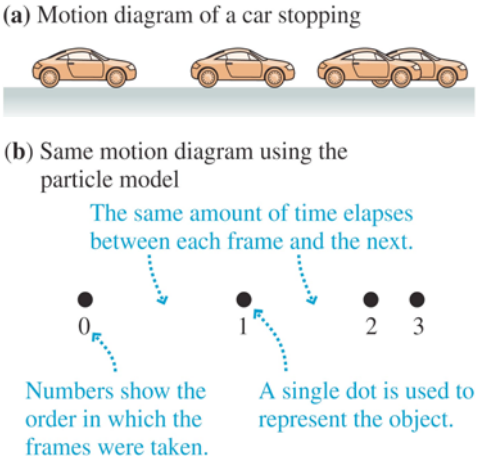


Examples of motion diagrams



The particle model

A simplifying *model* in which we treat the object as if all its mass were concentrated at a single point. This model helps us concentrate on the *overall* motion of the object.

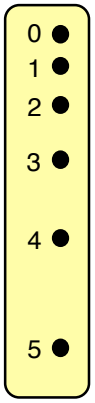


Particle Model

Types of Motion

What kind of motion is this?

A. A dust particle settling to the floor at constant speed
B. A ball dropped from the roof of a building
C. A descending rocket slowing to make a soft landing on Mars?

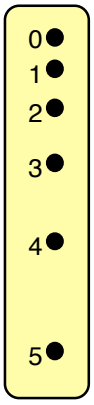


Quantifying Motion

Can we say more than just whether speed is constant, increasing or decreasing?

Does the ball drop on the surface of the Earth or the Moon?

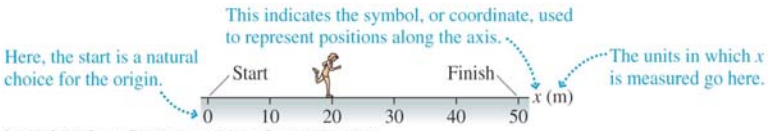
Can we quantify this?



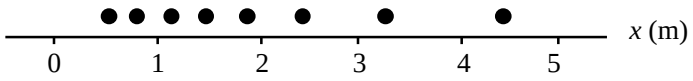
Yes! But we need a coordinate system to quantify the changes in the position of the "particle" and compute displacements between successive points

Position

The position of an object is located along a *coordinate system.*



A possible motion diagram for a car traveling down the road:



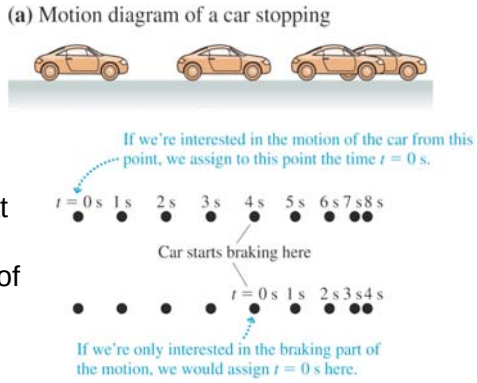
Is the car moving to the left or to the right?

Position and Time

Choose origin and axes for position measurement + origin of time

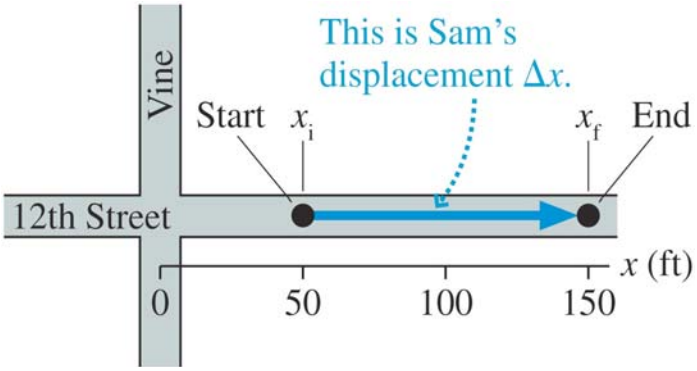
Describing motion requires that we determine both
position and time

At each time *t*, the object is at some particular position. We are free to choose the origin of time (i.e., when *t* = 0).



Displacement

The *change* in the position of an object as it moves from initial position x_i to final position x_f is its *displacement* $\Delta x = x_f - x_i$.



Question about displacement

Maria is at position x = 23 m. She then undergoes a displacement Δx = –50 m. What is her final position?

A. –27 m

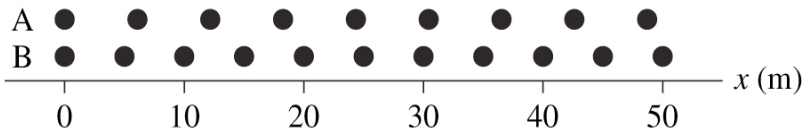
B. –50 m

C. 23 m

D. 73 m

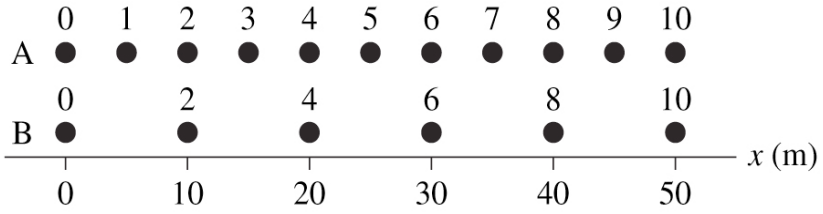
Question about motion diagram

Two runners jog along a track. The positions are shown at 1 s time intervals. Which runner is moving faster?



Question about motion diagram

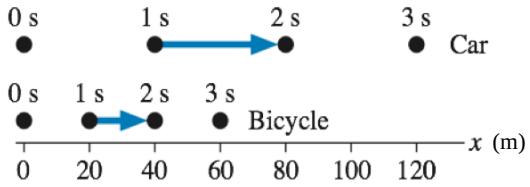
Two runners jog along a track. The times at each position are shown. Which runner is moving faster?



A. Runner A
B. Runner B
C. They are both moving at the same speed

Speed

$$\text{speed} = \frac{\text{distance traveled in a given time interval}}{\text{time interval}}$$



The car moves 40 m in 1 s. Its speed is $\frac{40\text{ m}}{1\text{ s}} = 40\frac{\text{m}}{\text{s}}$.

Velocity

Velocity describes both the speed and direction of an object

$$\text{velocity} = \frac{\text{displacement}}{\text{time interval}} = \frac{\Delta x}{\Delta t}$$

Velocity of a moving object