

**Speed, acceleration, friction,  
inertia, force, gravity**

11/16/15

# Which ball wins?

- A. High Road
- B. Low Road
- C. Tie



**Which ball wins?**

A. High Road

B. Low Road

C. Tie



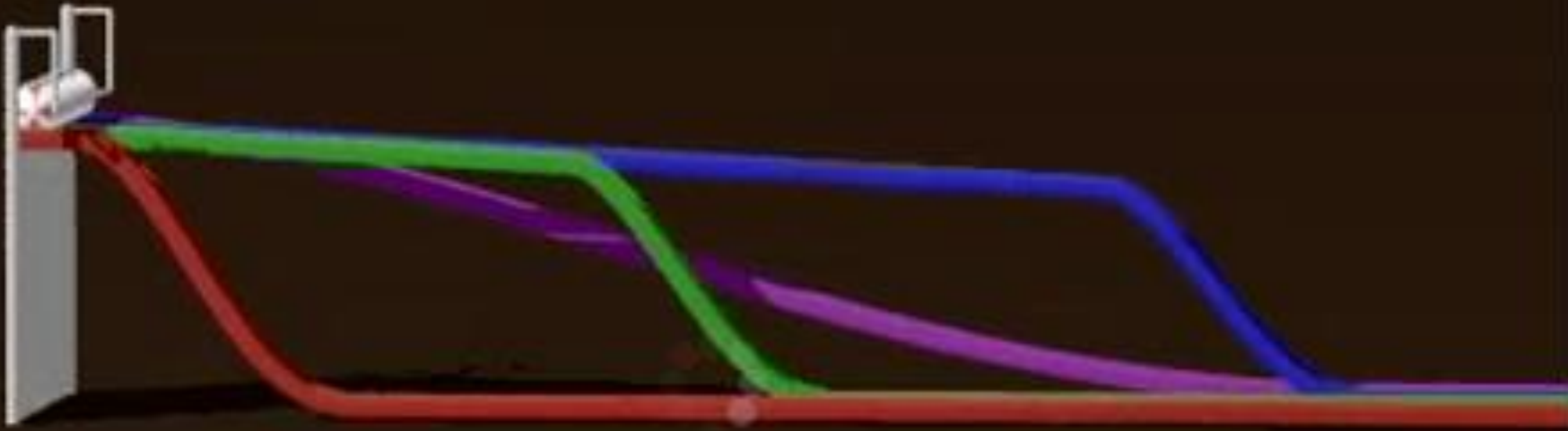
# Which ball wins?

A. Red

C. Purple

B. Green

D. Blue



# Gravity

- Gravity is a force that **pulls** downward
- *Weight* measures the force of gravity

## Gravity pulls

- A. Harder on heavier objects
- B. Harder on lighter objects
- C. The same on all objects

- **Mass:** A property of an object. A measure of the amount of “stuff” or matter contained in an object. Measured in slugs (English) or grams (metric)
- **Weight:** The force due to gravity on an object. The force with which an object is pulled to Earths’ (or other planet/moon) surface. Measured in pounds (English) or Newtons (metric).



# Weight

What weighs more?

- A. heavier objects
- B. lighter objects
- C. they weigh the same



# Gravity

*Weight* measures the force of gravity

## Gravity pulls

- A. Harder on heavier objects
- B. Harder on lighter objects
- C. The same on all objects



# Gravity

- Gravity is a force that **pulls** downward
- *Weight* measures the force of gravity

## Gravity pulls

- A. Harder on heavier objects**
- B. Harder on lighter objects
- C. The same on all objects

# Galileo's famous experiment

If a person drops two rocks, one very heavy and one very light, which hits the ground first?

- A. The heavy rock
- B. The light rock
- C. They hit the ground at the same time



# Galileo's famous experiment

If a person drops two rocks, one very heavy and one very light, which hits the ground first?

- A. The heavy rock
- B. The light rock
- C. They hit the ground at the same time**



# WAIT!

Gravity pulls harder on heavier objects

How do they hit the ground at the same time?

Terms from today:

**Speed**

**Acceleration**

**Friction**

**Inertia**

**Natural Motion**

**Violent Motion**

# WAIT!

Gravity pulls harder on heavier objects

How do they hit the ground at the same time?

Terms from today:

**Speed**

**Acceleration**

**Friction**

**Inertia**

**Natural Motion**

**Violent Motion**

# Inertia

- Harder to get heavier objects going.
  - Takes more force



*At rest stays at rest*

# Gravity

- Works out perfectly.
- If more inertia then gravity supplies more force.

Always the same rate of speeding up

$$9.8 \text{ m/s}^2$$

This question is on the quiz

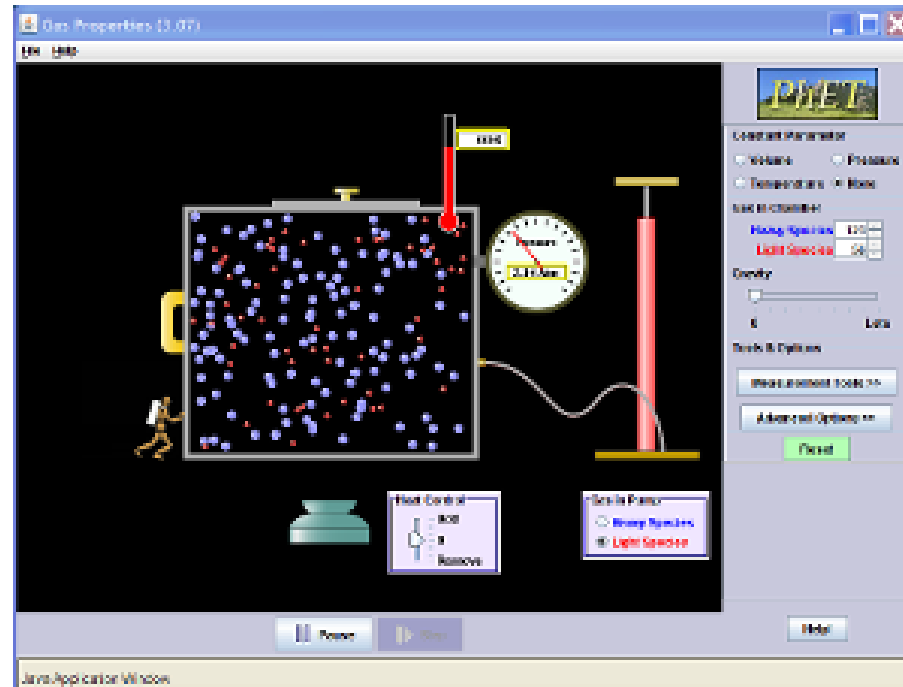
# Hammer and Feather





# Moon

- No air
- Not enough gravity to keep it on the moon.





# Prediction



If I drop a rock and a piece of paper, which will hit the ground first?

- A. Rock
- B. Piece of Paper
- C. They will hit at the same time.

# Gravity

9.8 m/s<sup>2</sup> approximately **10 m/s<sup>2</sup>**

Start at rest then speed equals

- A. 0 m/s
- B. 10 m/s
- C. 20 m/s
- D. 30 m/s
- E. Anything since you're starting

# Gravity

9.8 m/s<sup>2</sup> approximately **10 m/s<sup>2</sup>**

Start at **rest** then speed equals

- A. **0 m/s**
- B. 10 m/s
- C. 20 m/s
- D. 30 m/s
- E. Anything since you're starting

# Gravity

$$10 \text{ m/s}^2$$

Speed changes 10 m/s every second

1 second later then speed equals

- A. 0 m/s
- B. 10 m/s
- C. 20 m/s
- D. 30 m/s
- E. Anything since you're starting

# Gravity

$$10 \text{ m/s}^2$$

Speed changes 10 m/s every second

1 second later then speed equals

- A. 0 m/s
- B. 10 m/s**
- C. 20 m/s
- D. 30 m/s
- E. Anything since you're starting

# Gravity

$$10 \text{ m/s}^2$$

Speed changes 10 m/s every second

2 seconds later then speed equals

- A. 0 m/s
- B. 10 m/s
- C. 20 m/s
- D. 30 m/s
- E. Anything since you're starting

# Gravity

$$10 \text{ m/s}^2$$

Speed changes 10 m/s every second

2 seconds later then speed equals

- A. 0 m/s
- B. 10 m/s
- C. 20 m/s**
- D. 30 m/s
- E. Anything since you're starting



# Motion Diagram

- Draw a motion diagram for a falling object

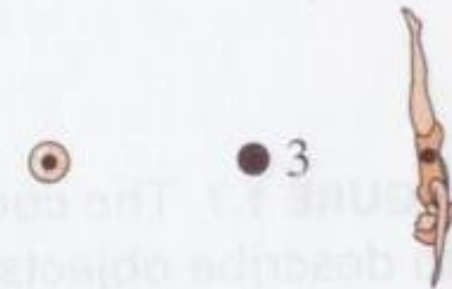
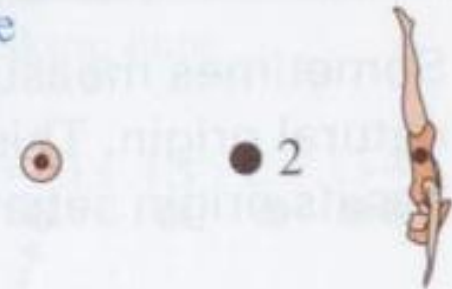
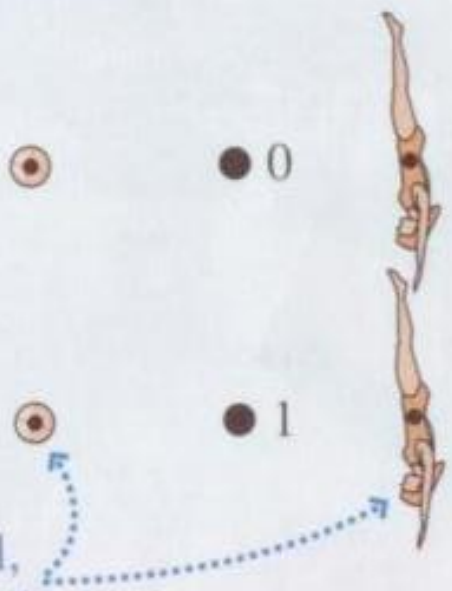
# Gravity

$$10 \text{ m/s}^2$$

Speed changes 10 m/s every second

0 second	0 m/s	●
1 seconds	10 m/s	●
2 seconds	20 m/s	●
3 seconds	30 m/s	●

By using the particle model, we see that a falling baseball and a diver have exactly the same motion diagram.



Which could be a dust particle settling to the floor at constant speed?

A. 0 ●

1 ●

2 ●

3 ●

4 ●

5 ●

B. 0 ●

1 ●

2 ●

3 ●

4 ●

5 ●

C. 0 ●

1 ●

2 ●

3 ●

4 ●

5 ●

Which is a ball dropped from the roof of a building?

- A. 0 ●
- 1 ●
- 2 ●
- 3 ●
- 4 ●
- 5 ●

- B. 0 ●
- 1 ●
- 2 ●
- 3 ●
- 4 ●
- 5 ●

- C. 0 ●
- 1 ●
- 2 ●
- 3 ●
- 4 ●
- 5 ●

Which is a descending rocket slowing to make a soft landing on Mars?

A. 0 ●  
1 ●  
2 ●  
3 ●  
4 ●  
5 ●

B. 0 ●  
1 ●  
2 ●  
3 ●  
4 ●  
5 ●

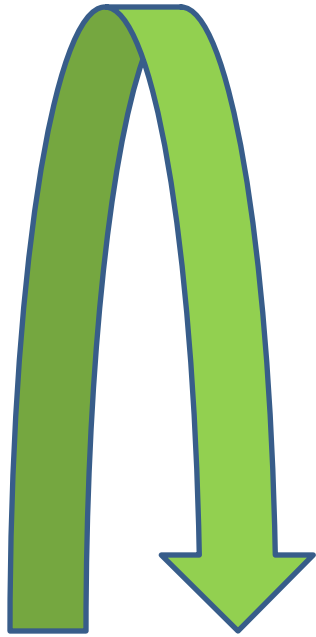
C. 0 ●  
1 ●  
2 ●  
3 ●  
4 ●  
5 ●

# Ball toss

A tennis ball is tossed up over a tall fence.

On the way up, when is it going the fastest?

- A. Maximum speed immediately after release
- B. Maximum speed quite soon after release
- C. Maximum speed about half way up
- D. Maximum speed at the top of the toss

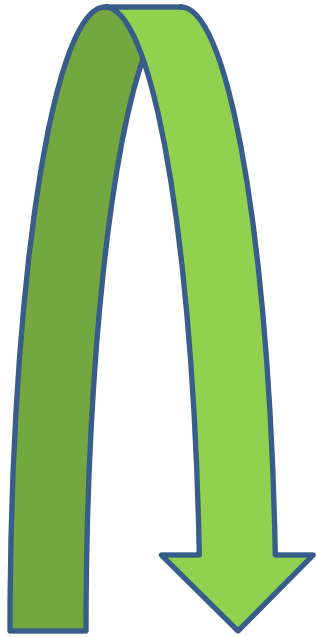


# Ball toss

A tennis ball is tossed up over a tall fence.

On the way down, when is it going the fastest?

- A. Maximum speed at the top of the toss
- B. Maximum speed quite soon after it starts falling
- C. Maximum speed about half down
- D. Maximum speed just before it hits the ground.







Both ways are “**free fall**” because the only force is gravity. Physically it’s the same.

Speed changing by 10 m/s every second in the downward direction.

If the ball was thrown up at 30 m/s then after 1 second it is going

- A. 30 m/s
- B. 20 m/s
- C. 40 m/s
- D. 0 m/s
- E. Don't know



$$g = -10 \text{ m/s}^2$$