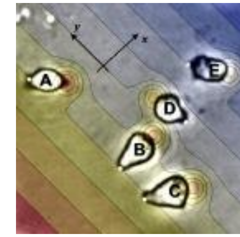
Physics 131- Fundamentals of Physics for Biologists I



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Note: Additional Course Center Hours: Tue 3-4pm

Forces and Newton's Laws

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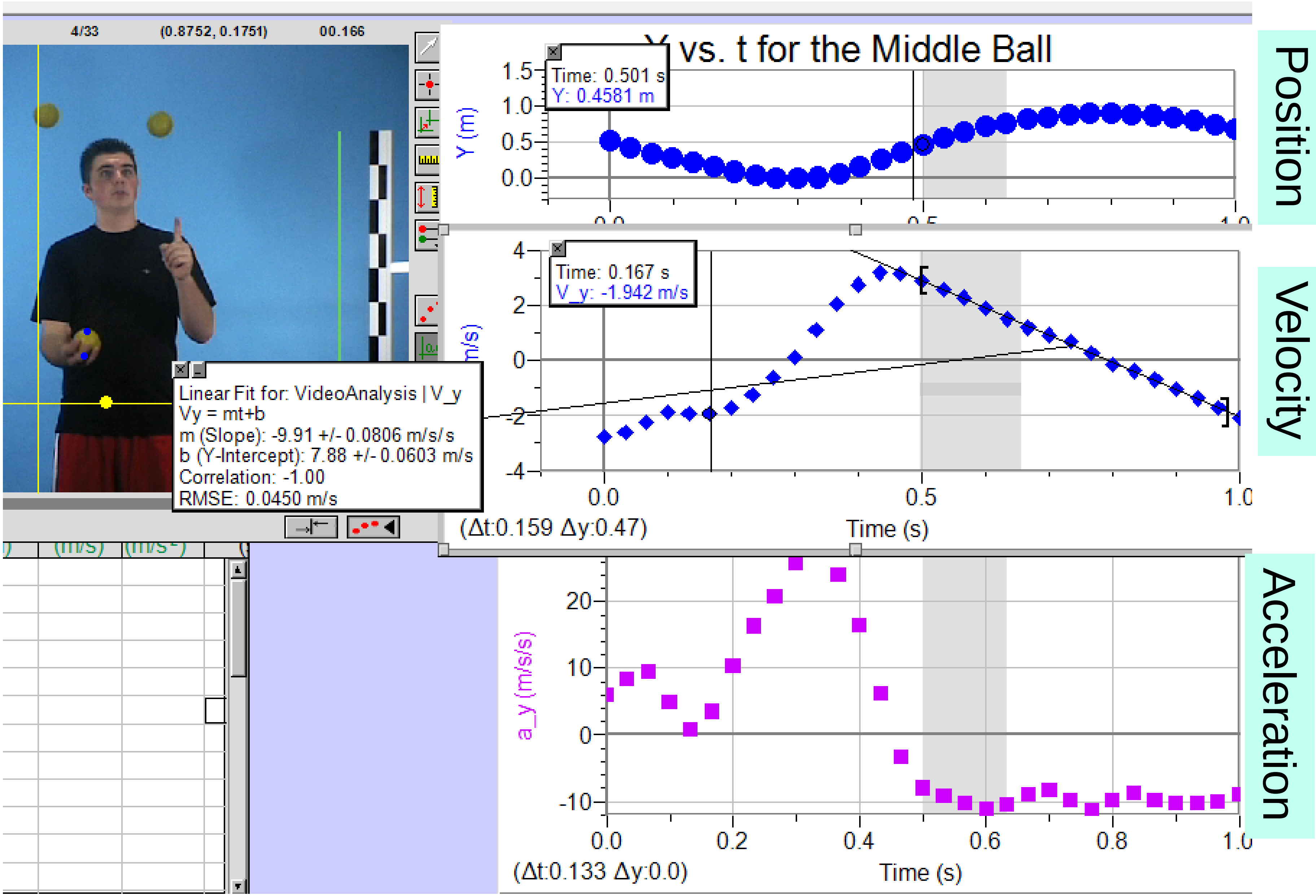
Dynamics

- Dynamics: What causes motion
  - Forces and Newton's laws (Chapter 4)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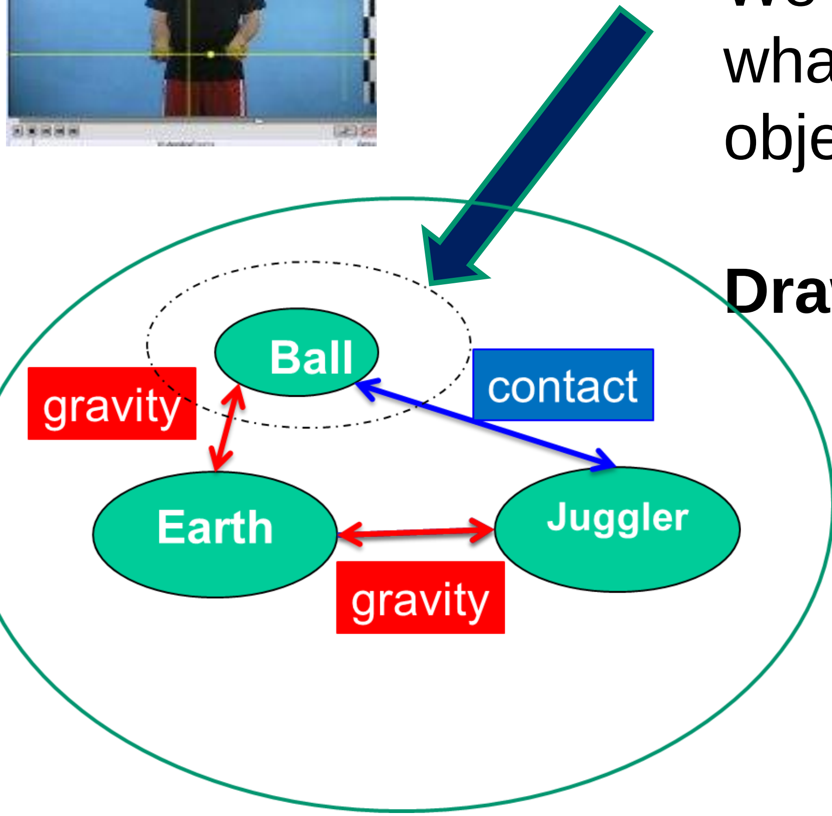
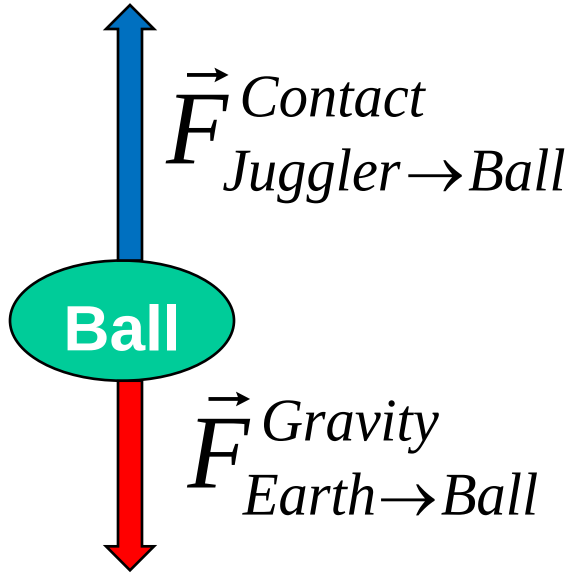
(0.8752, 0.1751)
00.166
vs. t for the Middle Ball
Time: 0.501 s
Y: 0.4581 m
Y (m)
Time: 0.167 s
V_y: -1.942 m/s
Linear Fit for: VideoAnalysis | V_y
Vy = mt+b
m (Slope): -9.91 +/- 0.0806 m/s/s
b (Y-Intercept): 7.88 +/- 0.0603 m/s
Correlation: -1.00
RMSE: 0.0450 m/s
(Δt:0.159 Δy:0.47)
Time (s)
a_y (m/s/s)
(Δt:0.133 Δy:0.0)
Time (s)
Position
Velocity
Acceleration

The Free Body Diagram

We want to understand & calculate what causes the motion of one of the objects, **the ball.**



Draw a Free Body Diagram for Ball



$$\vec{F}^{\,net} = \vec{F}^{\,Gravity}_{Earth \rightarrow Ball} + \vec{F}^{\,Contact}_{Juggler \rightarrow Ball}$$

Net force: Sum all forces; use direction BALL feels (object egotism)

Newton’s Laws 1 and 2

1. All outside effects on an object canceling out (net force of zero), the object maintains its velocity (including direction). The velocity could be zero, which would mean the object is at rest. (Inertia) [Newton 1]
2. The acceleration felt by an object (at a given instant) is the net force on the object at that instant divided by the object’s mass. [Newton 2]

$$\vec{a} = \vec{F}^{\,net} \big/ m$$

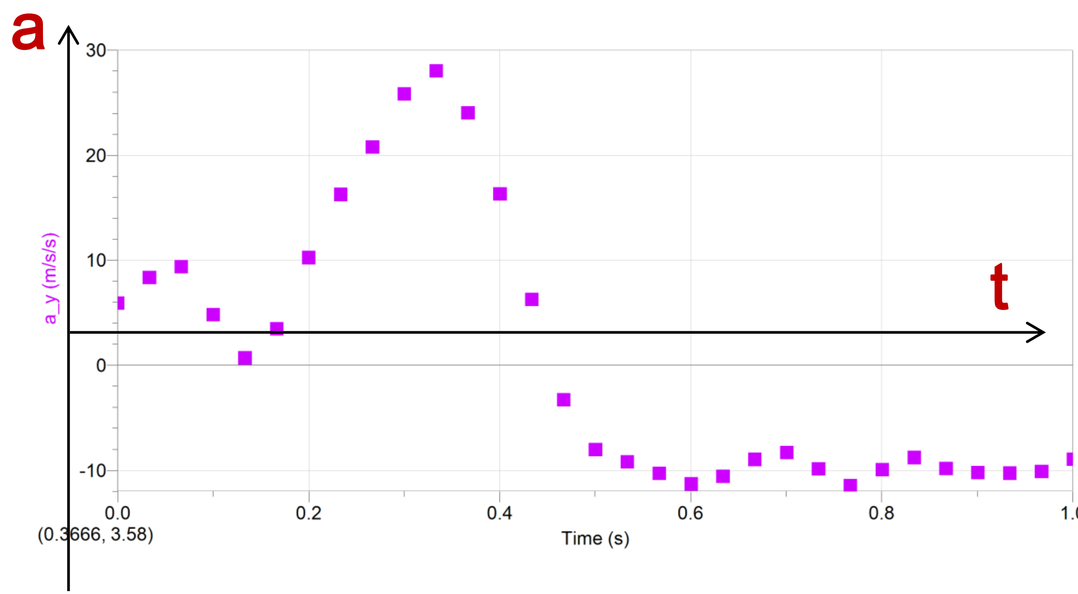
How come the law isn't written as the traditional F = ma?

Is the cause of acceleration sort of like the dimensionality of acceleration?

Draw the force vs time graph

Does the force change with time? If so why?

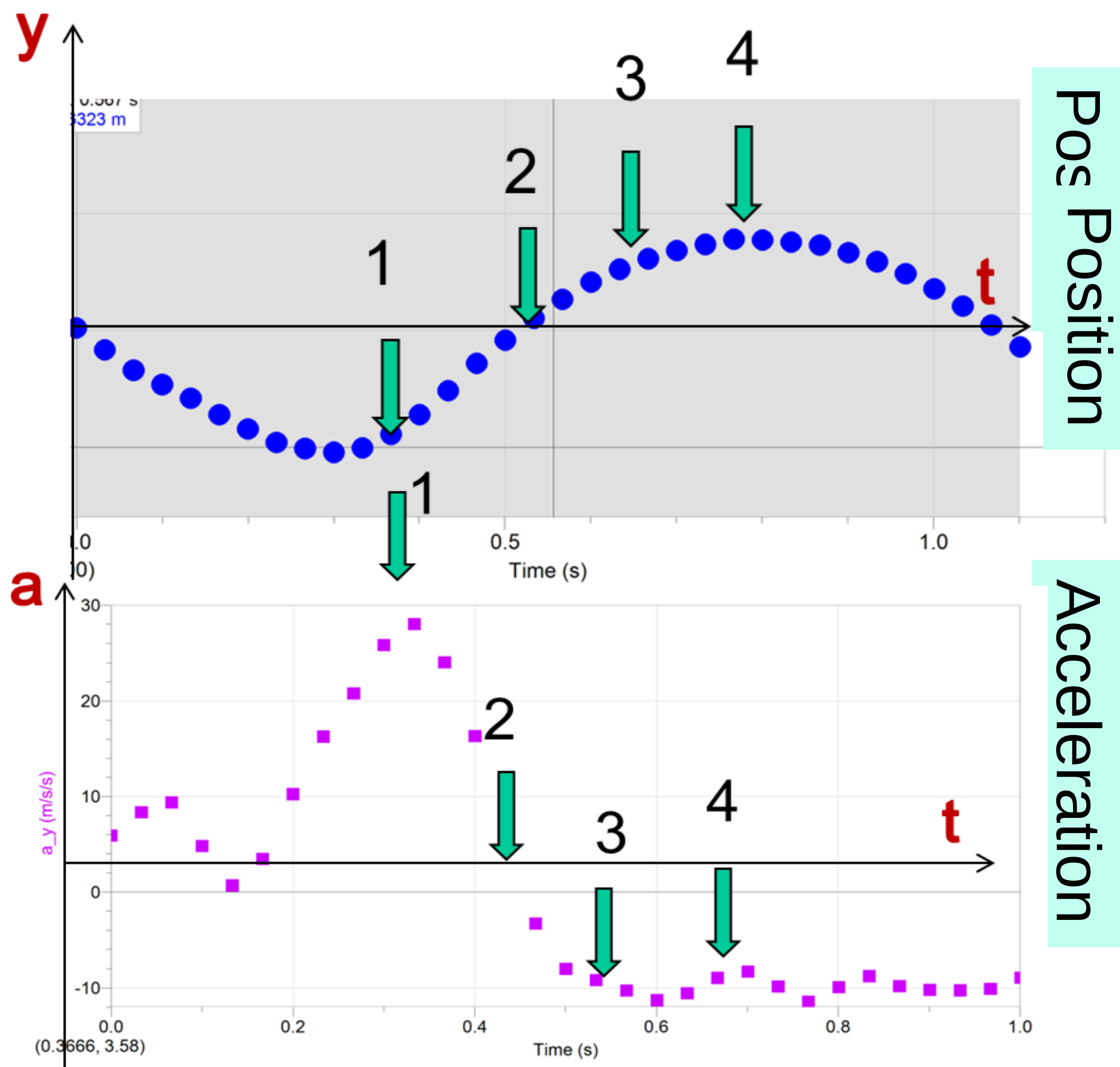
Whiteboards - TA and LA



When does the juggler no longer touch the ball?

- Explain your choice on ***whiteboard (TA & LA)***
- *If all in a group agree -> convince other groups*

1. At 1
2. At 2
3. At 3
4. At 4
5. Before 1
6. After 4



Can any force ever act upon an object without changing or altering its velocity?

Are there forces without motion?

Draw a system schema **(Whiteboard, TA & LA)**

Is it possible for both objects to change velocities after interaction? For example, two cars colliding into each other can change both velocities. How would this relate to reciprocity?

Could we use this law when thinking about a specific protein structure/chemical reaction, in determining whether it favors a kinetic or thermodynamic conformation?