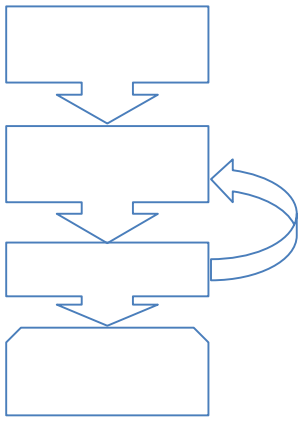
Rockets

Equipment

- LoggerPro v3.3 and VPython
- Digital video camera
- Solid fuel rocket engine and miscellaneous construction material



Objective

Data collection

- Digitize video motion

Graphical analysis

- Construct 3D numerical simulation
- Graph simulated variables and compare to experimental data

Physics Concepts

- Momentum principle, air drag

Conceptual (C-Level)

Draw a picture of a rocket launch.

- Draw a schematic diagram labeling the forces (free body diagram) for the rocket when the engine is firing.
- Draw schematic diagrams labeling the forces (free body diagram) for the rocket when the engine is finished firing and the rocket is still gaining altitude and when it is falling.

Create a flow chart for a computer program that could be used to simulate a rocket launch. This needs to be detailed enough that you can plug in the physics equations at each step.

Basic Lab (B-level)

You will be constructing a rocket and modeling its motion.

- Given a solid fuel rocket engine construct a stable rocket using "found" materials.
- Create a numerical simulation and graph both position and velocity as a function of time for your rocket
  - [3-LEVEL] Use actual force data not average force
  - [4-LEVEL] Include air drag in simulation – compare with no-drag data
- Using your simulation determine what variable is more important in maximizing height.

Advanced/Extended Lab Ideas (A-level)

Your advanced level lab should include multiple ways to improve your simulation.

- Compare your simulation to other simulations on the internet
- Changing engine mass in simulation
- Coast time and resulting recovery system ejection
- Change of air drag coefficient at apogee
- Air density changes with height
- Wind sheer (i.e. there will be wind blowing from the side)