

## Rocket Science Activity

**Purpose** : To plot d, v, and a vs. time, and to use the 3 equations of motion

**Materials** : “Tidal Wave” Model Rocket, launch stand, electric ignition system

**Data** : All data has been collected ahead of time

### Important equations for rocket science!

$$v = v_o + a \cdot t$$

$$x - x_o = v_o \cdot t + \frac{1}{2} a \cdot t^2$$

$$v^2 - v_o^2 = 2a \cdot (x - x_o)$$



**Figure 1. Sketch the rocket motion and label the stages.**

### Discussion :

1. *Tidal Wave* was launched from ground zero with an acceleration of  $12.1 \text{ m/s}^2$ . After 4.5 s, stage 1 is complete.

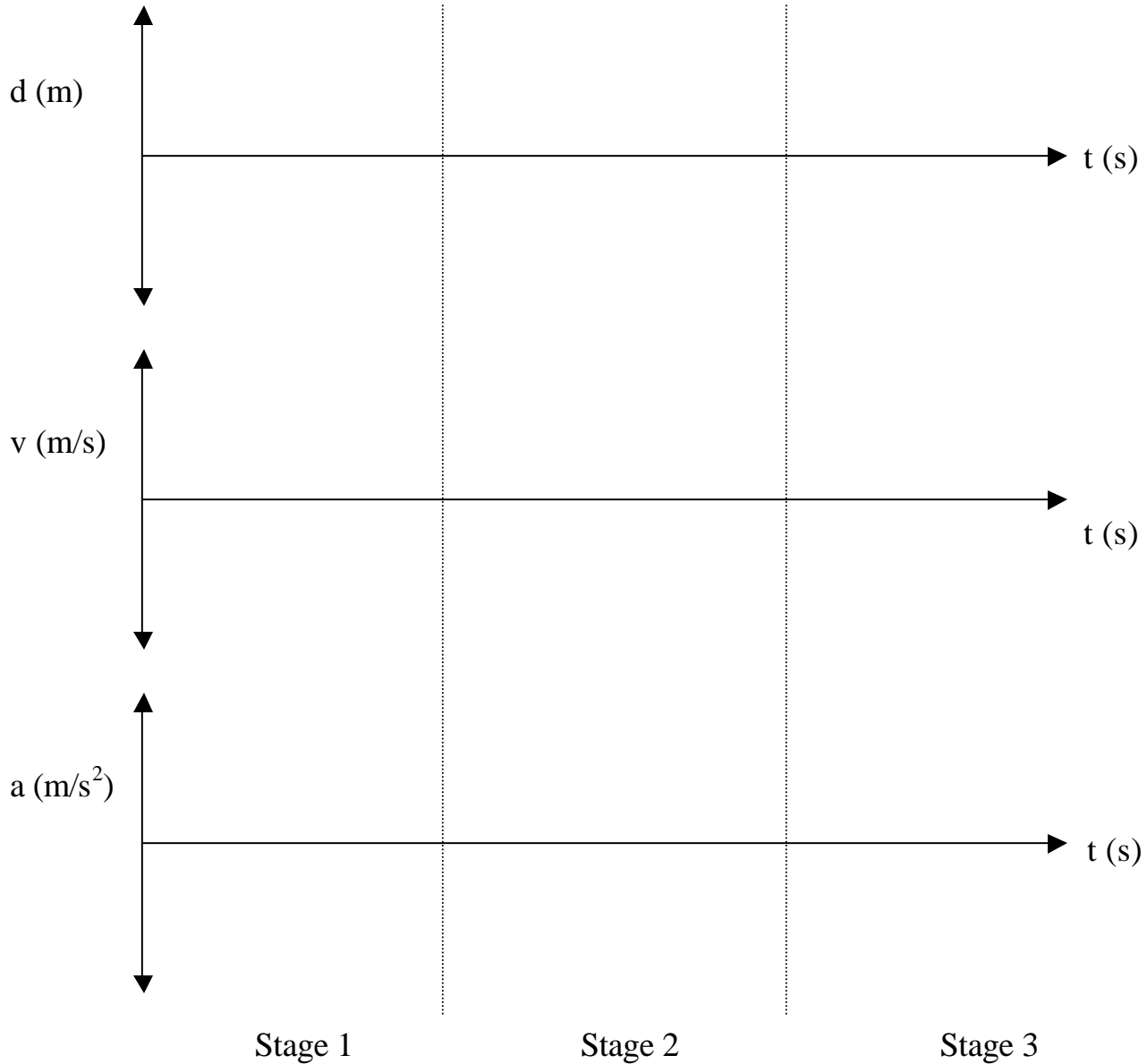
(a) What is the final height at the end of stage 1?

(b) What is the final velocity at the end of stage 1?

2. Calculate the height of the rocket at the end of stage 2?

3. Houston we have a problem, assume the rocket parachute fails. Calculate the final velocity of the rocket when it hits the Earth.

Make sketches below



**Extra credit - engineering problem.** To break free of the Earth's gravitational pull, the Space Shuttle must reach a velocity of 11,200 m/s. Calculate the acceleration needed to reach this velocity so that the shuttle's altitude is  $2.16 \times 10^6$  m. Now, consider that the average person loses consciousness when they are accelerated at 8 times the value of gravity ( $8 g$ 's). Do you think the astronauts on the shuttle will pass out based on your calculation?

*This worksheet created by LEAPS Graduates Logan McLeod and Chuck Schelle, and LEAPS Undergraduates Kok Cheng and Shera Wu.*