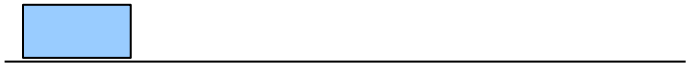
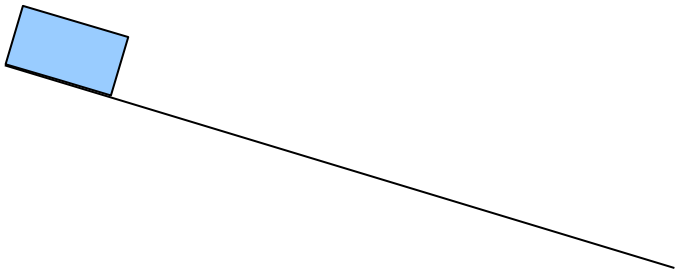
1. Carefully *read* the four problems below. Just read them for now.

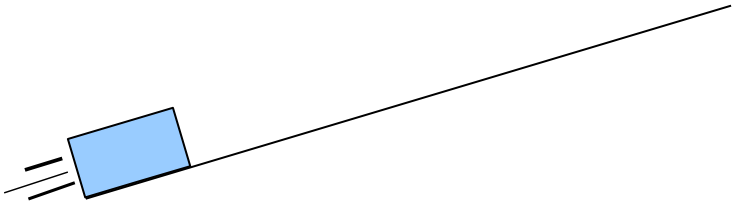
I. The box on the horizontal, frictionless surface below travels 30m in 10s.



II. The box on the frictionless, inclined ramp below starts from rest and travels 30m in 10s.



III. The box on the frictionless inclined ramp below is already moving at the bottom of the ramp (as the result, for example of a shove that occurred before the start of this problem). It travels 30m in 10s, just barely making it to the top.



IV. The box on the frictionless, curved ramp below starts from rest and travels 30m in 10s.

(a) i.. To which of the preceding four problems does the Constant Acceleration Particle Model Apply?

ii. To which of the preceding four problems does the Constant Velocity Particle Model Apply?

iii. Explain the reasons for your answer in parts (a) i and ii.

(b) For each CAPM problem you selected, draw *at least three* diagrams and/or graphs to illustrate the situation. Choose the diagrams and graphs that you find most useful.

(c) Using the constant acceleration particle model, solve for any unknown quantities. Show your work and use units.

(d) For each CVPM problem you selected, draw *at least three* diagrams and/or graphs to illustrate the situation. Choose the diagrams and graphs that you find most useful.

(e) Using the constant velocity particle model, solve for any unknown quantities. Show your work and use units.

(f) i. All four problems presented in part (a) have the same given information, 30m and 10s. Did you get the same answer for the CAPM problems and the CVPM problem? Explain why or why not.

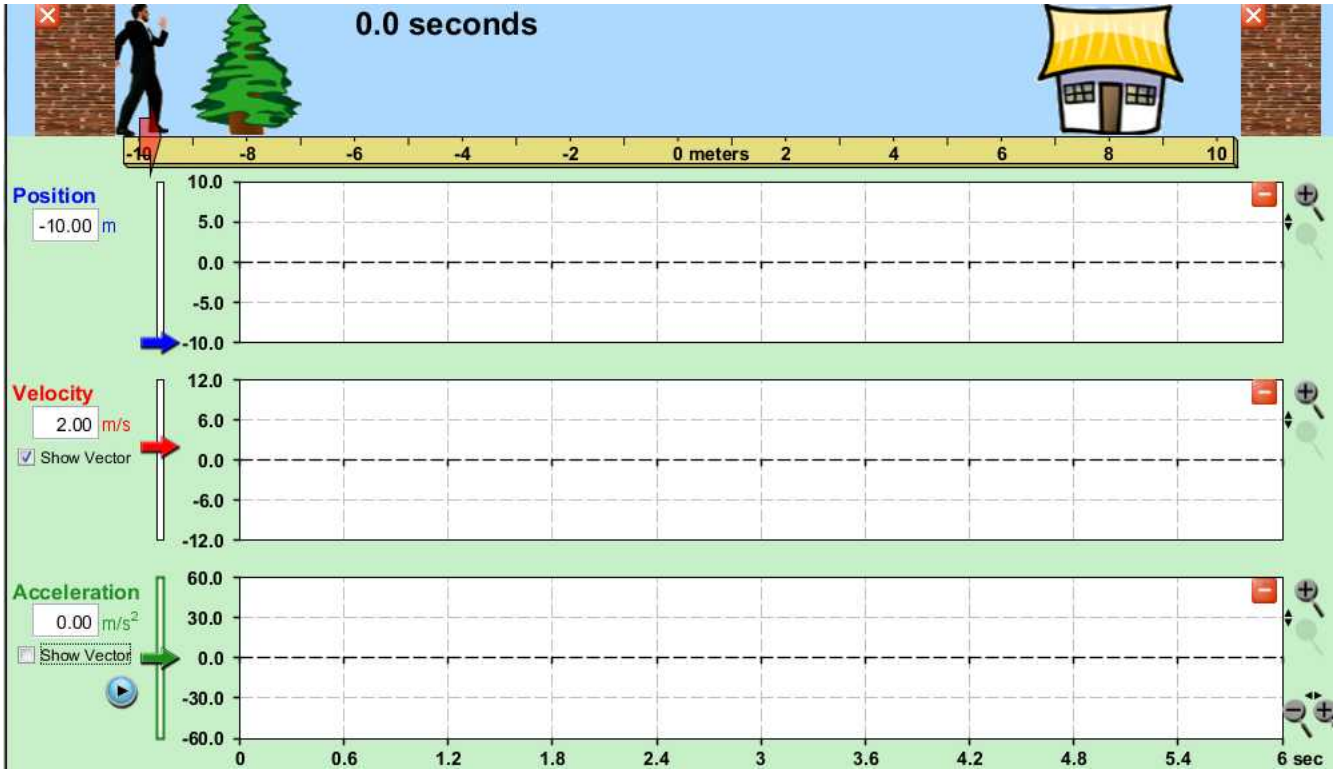
ii. If you had an appropriate model to solve the fourth problem, would you get the same answer as one or both of the ones you did solve? Explain why or why not.

Here is the points system for goalless problems.

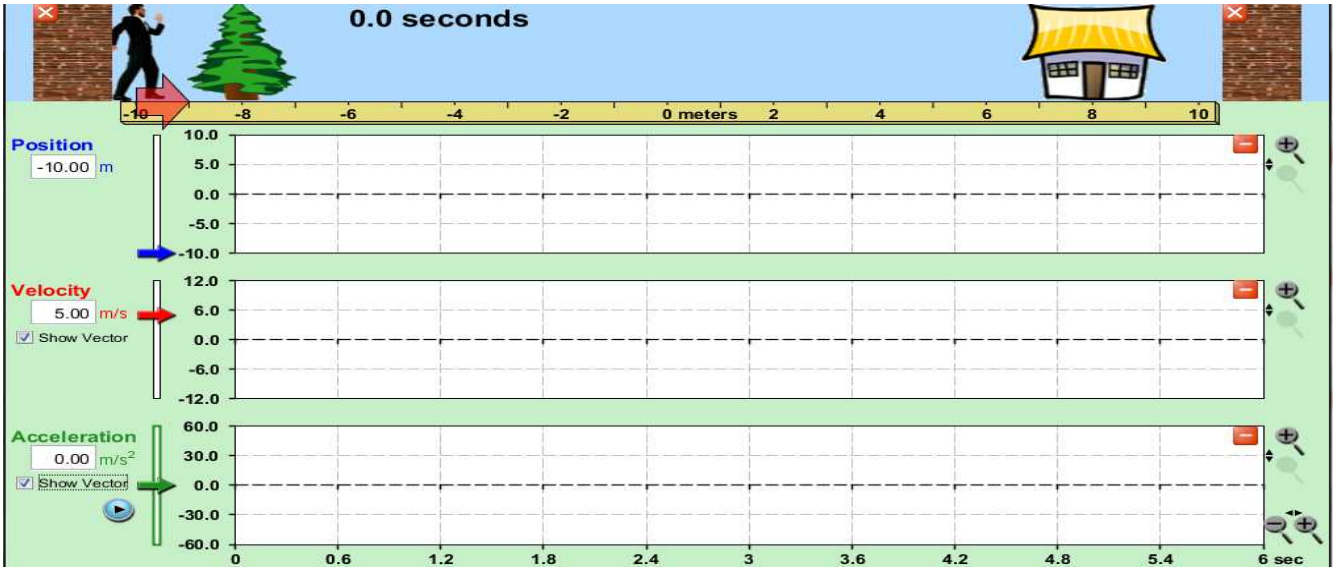
- Stating a model that applies AND WHY IT APPLIES = 1 pt
  When the BFPM does not apply, you won't be able to solve for all forces, but will be able to draw force diagrams and draw conclusions about whether some forces are greater than, less than or equal to others.
- Drawing a diagram or graph = 3 pts
  –> annotating the diagram or graph = +2 pts
  –> using the diagram or graph to calculate something = +2 pts
- Stating a fundamental principle before you use it = 1pt
- Doing a calculation = 1 pt
  –> an especially clever or complicated calculation = +1 pt
  –> carrying units throughout your calculation = +1 pt

Of course, a diagram, graph or calculation must be correct to receive points.

2. A 40,000kg subway train starts from rest and accelerates at a rate of 1.8 m/s^2 for 15s. It runs at a constant speed for 50s and then slows down at a rate of 3.5m/s^2. While rolling at a constant speed, the track exerts a frictional force to overcome a 1000N force of air resistance.



3(a) . The moving man starts at a position of -10.00m with an initial velocity of +2.00m/s. Get the moving man to his front door in exactly 5.0 seconds. Calculate anything you need and draw the predicted graphs and motion map before using the link above to test your prediction. Yes, you could get the moving man to his door in 5.0 seconds by trial and error, but you would learn nothing from your investment of time. It is important to calculate and predict first, and then test. If your test is unsuccessful, thoughtfully revise as necessary. If you check the "show vector" boxes, you can check your motion map by pausing the animation each second.



3(b) . The moving man starts at a position of -10.00m with an initial velocity of +5.00m/s. Get the moving man to his front door in exactly 5.0 seconds. Calculate anything you need and draw the predicted graphs and motion map before using the link above to test your prediction. Yes, you could get the moving man to his door in 5.0 seconds by trial and error, but you would learn nothing from your investment of time. It is important to calculate and predict first, and then test. If your test is unsuccessful, thoughtfully revise as necessary. If you check the "show vector" boxes, you can check your motion map by pausing the animation each second.

4. A speeder driving down the road at a constant 20 m/s, passes a patrolman parked on the roadside. The patrolman waits 3 seconds, then pursues the speeder, accelerating at a constant 4.0 m/s^2. How long does it take the patrolman catch the speeder? How far has he traveled before doing so?