Kinematics Test Review

Physics

FOR THE TEST, YOU SHOULD UNDERSTAND:

- How to calculate the average velocity an object.
- How to calculate the average acceleration of an object.
- Use the Big 4 to solve problems involving uniformly accelerated motion.
- Use vector mathematics (breaking vectors into components and adding components together to find a resultant).
- Use the Big 4 to solve projectile motion problems.
- How to INCLUDE PROPER UNITS (and direction, if necessary) when answering a test question.
- What a frame of reference includes, how to set one for a problem, and why it is necessary.
- What position, displacement, velocity, and acceleration tell you about the motion of an object.
- How the Big 4 uses initial values of an object's motion, along with the amount of time it has been moving, to make predictions about an object's motion at the end of that time period.
- What the "t" variable in the Big 4 tells you, when it changes during a complex problem, and how it ties the Big 4 together mathematically (even for the equations in which it does not appear!).
- How the Projectile Motion Lab relates to the Big 4 and how it could be used to create test questions.

KNOW HOW TO USE:

$v = v_o + at$

$x = x_o + v_o t + 1/2at^2$

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

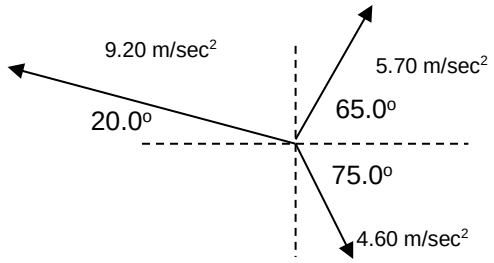
$(x - x_o)/2 = (v + v_o)/2$

acceleration of gravity = 9.8 m/sec^2 (32.2 ft/sec^2) downward

SAMPLE PROBLEMS (Please note – numbers are not contiguous so that the key matches):

1. A space craft travelling at 3250.0 m/sec suddenly fires its retro rockets (pointed forward) and the craft starts to slow down at 10.000 m/sec^2. What is the velocity of the spacecraft when the displacement of the craft is +215.00 km relative to the point where the retro rockets begin to fire? [2502.5 m/sec]

3. An astronaut in space experiences the accelerations from three planets as shown below. What is the resultant acceleration acting on the astronaut? [6.36 m/sec^2, 37.5 degrees above the negative x-axis.]



4. A cucumber, traveling at 9.70 m/sec accelerates at –1.80 m/sec^2. How long will it take to get back to the starting point? [10.8 seconds]

8. A car cruises steadily at 62.0 ft/sec. 247 feet behind, a patrol car cruises at 89.0 ft/sec. When and where will the patrol car overtake the other? [9.15 sec at 567 ft from the car's start]

9. A man jogs along at 1.70 m/sec. An attack dog, 21.0 m behind, waits for 6.00 seconds, and then takes off at 2.50 m/sec. When and where will contact be made? [45.0 sec at 97.5 m from where the dog starts]

11. Noel Ivator jumps straight up at 7.20 m/sec. How long will he remain in the air? [1.47 sec]

12. A rock is fired from a slingshot at 29.0 m/sec, 41.0 degrees above the horizontal. How far away does it land? [85.0 meters]

13. A golf ball leaves the tee, striking the ground 3.70 seconds later 221 feet away. At what angle and with what speed did the ball take off? Remember, the acceleration of gravity here is 32.2 ft/sec^2. [44.9 degrees, 84.4 ft/sec]

14. Freddy Frog makes a super leap at 35.0 ft/sec at an angle of 40.0 degrees to the horizontal. How high up a wall, 20.0 feet away, will Freddy land? He sticks to the vertical wall. [7.88 feet]

15. Bill Melater kicks a rock off the top of his apartment building. It strikes the window of another building 14.0 m away. The window is 19.0 m below the place where Bill kicked the rock off, so how fast was it moving when it left Bill's foot? Assume a horizontal initial velocity. [7.11 m/sec]