Physics First Marking Period Review Sheet

Fall, Mr. Wicks

Chapter 1: The Science of Physics

- I can explain how the subject of physics fits into science and into everyday life.
- I can explain the scientific method to someone not enrolled in Physics.
- I can understand the language used in the scientific method and I can distinguish between a hypothesis, an experiment, data, an independent variable, a dependent variable, a law, and a theory.
- I know the three types of zeros and I can count the number of significant digits in any given number.
- I can apply the rules for using significant figures in calculations. I remember that the rules for addition and subtraction are different from those for multiplication and division.
- I can use metric-metric and English-metric conversion factors to solve problems.

Tera-	T	trillion	10^{12} = 1,000,000,000,000	1 inch (in.) = 2.54 cm
Giga-	G	billion	10^{9} = 1,000,000,000	1 pound (lb.) = 454 g
Mega-	M	million	10^{6} = 1,000,000	1 quart (qt.) = 0.946 L
Kilo-	k	thousand	10^{3} = 1,000	
		one	10^{0} = 1	1 mL = 1 cm^3
Deci-	d	tenth	10^{-1} = 0.1	
Centi-	c	hundredth	10^{-2} = 0.01	
Milli-	m	thousandth	10^{-3} = 0.001	
Micro-	µ	millionth	10^{-6} = 0.000001	
Nano-	n	billionth	10^{-9} = 0.000000001	
Pico-	p	trillionth	10^{-12} = 0.000000000001	

- I can demonstrate how dimensional analysis is used for problem solving.
- I can compare and contrast mass with weight and explain why scientists prefer to use mass instead of weight.
- I can explain the difference between precision and accuracy.
- I can construct both hand-drawn and computer-generated graphs, which include a title, properly labeled axes, a smooth line drawn through the points, and a slope and y-intercept for linear relationships.

Chapter 2: Motion in One Dimension

- I can calculate average velocity using both $v_{ave} = \frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{t_f - t_i}$ and $v_{ave} = \frac{1}{2}(v_f + v_i)$
- I can determine average velocity graphically. In a position-versus-time graph for constant velocity, the slope of the line gives the average velocity. See Table 1.
- I can determine instantaneous velocity from the slope of a line tangent to the curve at a particular point on a position-versus-time graph.
- I can use $v_{ave} = \frac{\Delta x_{Total}}{\Delta t_{Total}}$ to calculate the average velocity for an entire journey if given information about the various legs of the journey.
- I can calculate average acceleration using $a_{ave} = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{t_f - t_i}$
- I can determine average acceleration and displacement graphically. In a velocity-versus-time graph for constant acceleration, the slope of the line gives acceleration and the area under the line gives displacement. See Table 1.

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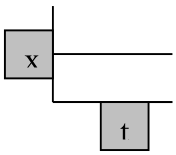
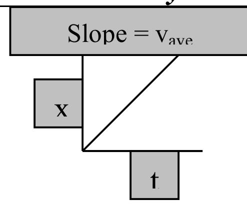
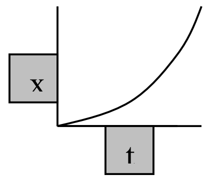
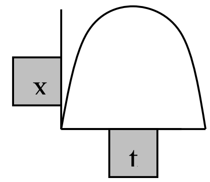
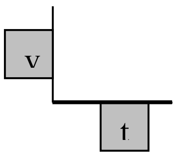
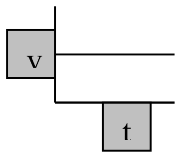
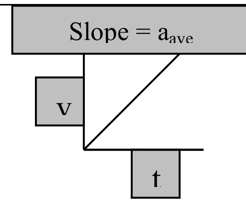
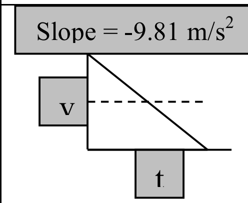
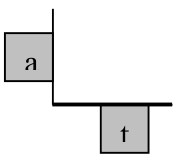
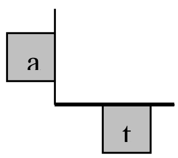
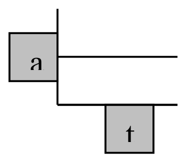
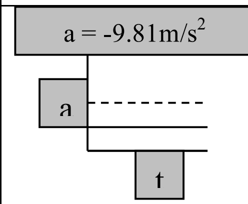
- I can use the acceleration due to gravity = g = 9.81 m/s^2 to solve problems (Recall a = - g = -9.81 m/s^2)

<table>
<tr><th colspan="5">Table 1: Graphing Changes in Position, Velocity, and Acceleration</th></tr>
<tr><th></th><th>Constant Position</th><th>Constant Velocity</th><th>Constant Acceleration</th><th>Ball Thrown Upward</th></tr>
<tr><td>Position Versus Time:</td>
<td></td>
<td></td>
<td></td>
<td></td></tr>
<tr><td>Velocity Versus Time:</td>
<td></td>
<td></td>
<td></td>
<td></td></tr>
<tr><td>Accelera-tion Versus Time:</td>
<td></td>
<td></td>
<td></td>
<td></td></tr>
</table>

- Given three of the following variables—displacement, velocity, acceleration, and time, I can determine the fourth variable from concepts and equations discussed so far.
- Given only two of the following variables—displacement, velocity, acceleration, and time, I can determine both of the unknown variables using the kinematic equations in the left column of Table 2.

Table 2: Relationship Between the Kinematic Equations and Projectile Motion Equations

Kinematic Equations	***Missing Variable***	***Projectile Motion, Zero Launch Angle***
		Assumptions made: $a = -g$ and $v_{y,i} = 0$
$\Delta x = v_{ave}\Delta t$	a	$\Delta x = v_x \Delta t$ where $v_x = a\ constant$
$v_f = v_i + a\Delta t$	Δx	$v_{y,f} = -g\Delta t$
$\Delta x = v_i \Delta t + \frac{1}{2}a(\Delta t)^2$	v_{final}	$\Delta y = -\frac{1}{2}g(\Delta t)^2$
$v_f^2 = v_i^2 + 2a\Delta x$	Δt	$v_{y,f}^2 = -2g\Delta y$

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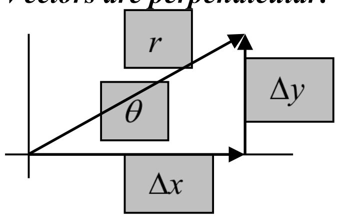
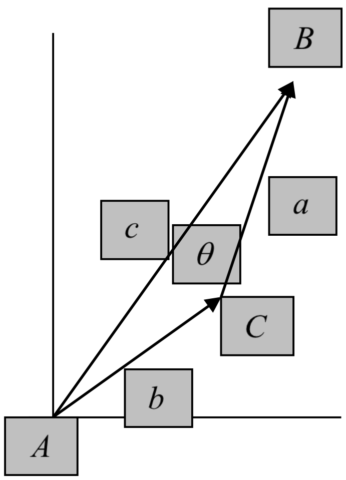
Chapter 3: Two Dimensional Motion and Vectors

- I know that a projectile is any object that is thrown or launched.
- I understand that projectiles follow a ***parabolic pathway***.
- I can use Table 2 to better understand how the zero launch angle projectile motion equations can be derived from the kinematic equations.
- I understand that the kinematic equations involve ***one-dimensional motion*** whereas the projectile motion equations involve ***two-dimensional motion***. Two-dimensional motion means there is motion in both the horizontal and vertical directions.
  - I recall that the equation for horizontal motion ($\Delta x = v_x \Delta t$) and the equations for vertical motion ($v_{y,f} = -g\Delta t$, $\Delta y = -\frac{1}{2}g(\Delta t)^2$, $v_{y,f}^2 = -2g\Delta y$) are independent from each other, and I can use them to calculate information about objects that are thrown or launched.
  - I recall that velocity is constant and acceleration is zero in the horizontal direction.
  - I recall that acceleration is g = 9.81 m/s^2 in the vertical direction.
- For projectiles launched at an angle, I can determine the ***range*** of the projectile from $\Delta x = (v_i \cos\theta)\Delta t$ and its ***time of flight*** from $\Delta y = (v_i \sin\theta)\Delta t - \frac{1}{2}g(\Delta t)^2$.
- For an object in free fall, I know that the object stops accelerating when the force of air resistance, $\vec{F}_{Air}$, equals the weight, $\vec{W}$. The object has reached its maximum velocity, the ***terminal velocity***.
- When a quarterback throws a football, I know that the angle for a high, lob pass is related to the angle for a low, bullet pass. When both footballs are caught by a receiver standing in the same place, the sum of the launch angles is 90^o.
- In distance contests for projectiles launched by cannons, catapults, trebuchets, and similar devices, projectiles achieve the farthest distance when launched at a 45^o angle.
- I know that ***vectors*** have both magnitude and direction whereas ***scalars*** have magnitude but no direction. Examples of vectors are displacement, velocity, acceleration, and force.
- I can move vectors parallel to their original position in a diagram.
- I can add vectors in any order. See Table 3 for more information about vector addition.
- For vector $\vec{r}$ at angle θ to the x-axis, I can calculate the x- and y-components for $\vec{r}$ from $\Delta x = r\cos\theta$ and $\Delta y = r\sin\theta$.
- I can calculate the magnitude of vector $\vec{r}$ from $r = \sqrt{\Delta x^2 + \Delta y^2}$ and the direction angle for $\vec{r}$ relative to the nearest x-axis from $\theta = \tan^{-1}\left(\frac{\Delta y}{\Delta x}\right)$.
- I can subtract a vector by adding its opposite.
- I understand that multiplying or dividing vectors by scalars results in vectors.
- In addition to adding vectors mathematically as shown in the last table, I can add vectors graphically. Vectors can be drawn to scale and moved parallel to their original positions in a diagram so that they are all positioned head-to-tail. The length and direction angle for the resultant can be measured with a ruler and protractor, respectively.
- I can solve relative motion problems by using a special type of vector addition. For example, the velocity of object 1 relative to object 3 is given by $\vec{v}_{13} = \vec{v}_{12} + \vec{v}_{23}$ where object 2 can be anything.
- I know that subscripts on a velocity can be reversed by changing the vector's direction: $\vec{v}_{12} = -\vec{v}_{21}$

Table 3: Vector Addition

Vector Orientation	***Calculational Strategy Used***	
Vectors are parallel:	Add or subtract the magnitudes (values) to get the resultant. Determine the direction by inspection.	
Vectors are perpendicular: 	Use the Pythagorean Theorem, $\Delta x^2 + \Delta y^2 = r^2$, to get the resultant, r, where Δx is parallel to the x-axis and Δy is parallel to the y-axis. Use $\theta = \tan^{-1}\left(\frac{\Delta y}{\Delta x}\right)$ to get the angle, θ, made with the x-axis.	
Vectors are neither parallel nor perpendicular:	***Adding 2 Vectors***	***Adding 2 or More Vectors (Vector Resolution Method)***
	Limited usefulness	***Used by most physicists***
	(1) Use the law of cosines to determine the resultant: $c^2 = a^2 + b^2 - 2ab\cos\theta$ (2) Use the law of sines to ***help*** determine direction: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$	(1) Make a diagram. (2) Construct a vector table. (Use ***vector***, ***x-direction***, and ***y-direction*** for the column headings.) (3) Resolve vectors using $\Delta x = r\cos\theta$ and $\Delta y = r\sin\theta$ when needed. (4) Determine the signs. (5) Determine the sum of the vectors for each direction, Δx_{total} and Δy_{total}. (6) Use the Pythagorean Thm to get the resultant, r: $\Delta x_{total}^2 + \Delta y_{total}^2 = r^2$ (7) Use $\theta = \tan^{-1}\left(\frac{\Delta y_{total}}{\Delta x_{total}}\right)$ to get the angle, θ.

Equations Available on Physics First Marking Period Test

$$\Delta x = v_{ave}\Delta t$$
$$v_f = v_i + a\Delta t$$
$$\Delta x = v_i\Delta t + \frac{1}{2}a(\Delta t)^2$$
$$v_f^2 = v_i^2 + 2a\Delta x$$

$$\Delta x = v_x\Delta t$$
$$\Delta y = -\frac{1}{2}g(\Delta t)^2$$

$$\Delta x = (v_i\cos\theta)\Delta t$$
$$\Delta y = (v_i\sin\theta)\Delta t - \frac{1}{2}g(\Delta t)^2$$

$$r = \sqrt{\Delta x^2 + \Delta y^2}$$
$$\Delta x = r\cos\theta$$
$$c^2 = a^2 + b^2 - 2ab\cos\theta$$

$$\theta = \tan^{-1}\left(\frac{\Delta y}{\Delta x}\right)$$
$$\Delta y = r\sin\theta$$
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$R = \left(\frac{v_i^2}{g}\right)\sin 2\theta$$

- This list of equations will be provided on the test.
- You are not allowed to use note cards, review sheets, textbooks, or any other aids during the test.
- You may use a calculator. However, you are not allowed to use any other electronic devices (*i*-Pods, *i*-Phones, smart phones, netbooks, laptop computers etc.) until the last person is finished with the test.
- Calculator sharing is not allowed.
- It is to your advantage to check your work.
- All test materials including scratch paper must be returned at the end of the test.