Physics Test – Q1T2 – 6 October 2015

Topics

- Remember that all previously tested material is still part of the body of knowledge to progress in the understanding of Physics.
- Keeping in mind the qualitative relationships between acceleration and velocity makes it easier to avoid mistakes.
- Whenever velocity and acceleration are both zero, the object is at rest and remains at rest.
- Whenever velocity is zero and acceleration is not, the object is at rest but begins to move in the direction of the acceleration.
- Whenever velocity is not zero and acceleration is, the object has a constant velocity (magnitude and direction).
- Whenever velocity and acceleration are in the same direct, the object's speed increases.
- Whenever velocity and acceleration are in opposite directions, the object's speed decreases.
- The equations necessary for problems involving uniform acceleration:

$$x = x_0 + v_0 t + \tfrac{1}{2} a t^2$$
$$v = v_0 + at$$
$$v^2 = {v_0}^2 + 2a\Delta x$$

- It must be remembered that these equations are only correct when an object undergoes uniform (constant) acceleration.
- Also, the third equation cannot give the direction of either the initial or the final velocity.
- Once two or three dimensional motion is analyzed, the above equations must be considered in their vector form and the equations involving *x* must be understood to be the *x* components of the vector equations:

$$\mathbf{d} = \mathbf{d}_0 + \mathbf{v}_0 t + \tfrac{1}{2} \mathbf{a} t^2$$
$$\mathbf{v} = \mathbf{v}_0 + \mathbf{a} t$$

- The *x* equations must be modified as shown and there are corresponding equations in the *y* and *z* dirtections.

$$x = x_0 + v_{0x} t + \tfrac{1}{2} a_x t^2$$
$$v_x = v_{0x} + a_x t$$
$$v_x^2 = {v_{0x}}^2 + 2a_x \Delta x$$

- Vector quantities have both magnitude and direction and two dimensional vectors can be expressed in either POLAR (r, θ) form or COMPONENT (x, y) form.
- Since they can be expressed either way, it must be possible to convert from either form to the other.
- Converting from polar form to component form is called "**resolving into components**."
- There is no specific term for converting from component to polar form.
- The usual convention is used. That the positive *x* axis is to the right and the positive *y* axis is up.
- Also, as usual, clockwise angles are considered negative and counter–clockwise angles are positive.
- Angles are stated with values between –180º and +180º.
- Components are found using: $x = r\cos\theta$ and $y = r\sin\theta$.
- Magnitude is found using: $r = \sqrt{x^2 + y^2}$.

- Direction is found using: $\tan\theta = \frac{y}{x}$.
- Note that when using the inverse tangent function on a calculator, only angles between –90º and +90º are returned by the calculator. If the vector lies in the second or third quadrant, the angle must be corrected by 180º.
- The sum of two or more vectors is referred to as a "resultant".
- Vectors can be added either analytically or graphically.
- Co–linear vectors add algebraically. Vectors that do not lay on the same line add geometrically.
- Adding and subtracting vectors analytically is easy. Each vector is resolved into its component. The *x* components are added and subtracted as necessary. The *y* components are added and subtracted as necessary. This yields the *x* and *y* components of the resultant and then they are converted to (r, θ) form.
- Adding and subtracting graphically is done by constructing precisely scaled drawings representing the vectors with each vector beginning at the origin. Then a parallelogram is constructed using two vectors as sides. The diagonal of the resulting parallelogram is the sum of the two vectors. Its magnitude and direction must be measured.
- Subtraction is accomplished by first constructing the negative or opposite of the appropriate vector and then adding it to the other vector.
- Addition of three or more vectors is accomplished by first adding two and then adding that resultant to the third and so on until all vectors are added.
- The analytical method is both easier and more precise and is therefore preferred.
- The precision of the graphical method is limited by both the quality of the tools used and the skill of the person doing the work.