Problem Solving Approach

Solving problems in physics can become much easier for you when you have a regular pattern to follow. 3D BE SNUB is the mnemonic used at BYU to help students remember the steps used by experienced problem solvers everywhere.

D_1 Diagram or draw the situation described in the problem. Label the picture with symbols (you may include numbers too) to represent the information given and needed.

D_2 Define the symbols when the diagram doesn't explain them enough. List them in a short table, giving their numerical value. Identify the ones you are solving for.

D_3 Describe what is happening, and what needs to be found in the problem. One line will do. List any assumptions that you are making about the situation.

These three D steps comprise what we might describe as making a representation of the problem.

BE Identify the Basic Equation that you will use for your solution. At this step we require that you write a very short essay. Describe why this is the correct equation by identifying the assumptions it makes, and the concept it uses; Examine your choice carefully; Why does this equation work and not others? . . . Select the equation that fits the physics involved and box the variable you are looking for, and check the variables whose values you know. If you are not sure which equations to use, list all of the equations that are likely, boxing, checking and examining each equation as above.

S Using the basic equations(s) and math, rearrange the equation until you have Solved for the variable needed. It is indeed usually a bad mistake to plug numbers in at this stage. (It is often helpful, however, to plug in the zeros that apply.)

N After S, then plug in the Numbers. **Every number must include its units**. Plug in the numbers as given, and keep three significant figures.

U Check the Units to make sure they match the expected answer. If you have not done the algebra on the units earlier, do it here.

BeSNU steps comprise what we might describe as the olve step.

B Check the numerical answer for Ballpark accuracy. Use a B✓ to indicate if you believe the answer is reasonable, and a B? to indicate that you have no experience with this kind of situation that would help you judge whether the answer is reasonable.

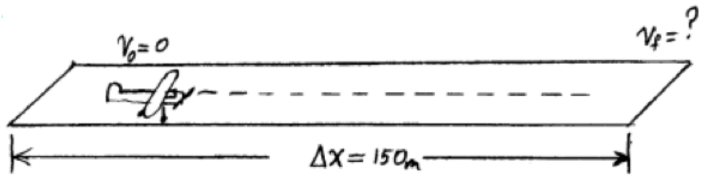
Expert problem solvers constantly apply **B** to each step. *Does what I'm doing fit? Does it make sense? Does it really describe* ***my*** *situation.*

The last step could be called the work assess step.

Sample Homework Problem

The Problem: You are designing an airport for small planes. One kind of craft used in the community must reach a speed of 100 km/hr (27.8 m/s) in order to lift off. Its steady acceleration is 2.0 m/s^2. If the runway is 150 m long, will it take off, or crash and burn?

D$_1$



D$_2$

$v_0 = 0$, the plane starts from rests.
$v_f = ?$, the speed at the end of the runway. (We hope this is 100 km/hr or more.)
$a = 2.0$ m/s^2, the *constant* acceleration of the plane.
$\Delta x = 150$ m, the difference between beginning and ending positions.

D$_3$

With the airplane we have, we need to know if our runway is long enough. That is, with $v_0 = 0$ m/s, $a = 2.0$ m/s^2, and $\Delta x = 150$ m, will $v_f \overset{?}{>} 100$ km/hr?

Be

The equations listed are OK for motion if the acceleration is <u>constant</u>, and it is in this problem. Notice that the first two equations have a clock reading- the time- in them. I do not know the time, *nor do I want to!* The last of the three equations is exactly what we need.

$$\boxed{v_f} = \overset{\checkmark}{v_i} + \overset{\checkmark}{a}\overset{?}{t}$$
$$\overset{\checkmark}{\Delta x} = \overset{\checkmark}{v_i}\,\overset{?}{t} + \frac{1}{2}\overset{\checkmark}{a}\overset{?}{t^2}$$
$$\boxed{v_f^2} = \overset{\checkmark}{v_i^2} + 2\overset{\checkmark}{a}\overset{\checkmark}{\Delta x}$$

S

$$\sqrt{v_f^2} = \sqrt{v_i^2 + 2a\Delta x}, \text{ so } v_f = \sqrt{v_i^2 + 2a\Delta x}$$

N

$$v_f = \sqrt{(0 \text{ m/s})^2 + 2(2.0 \text{ m/s}^2)(150 \text{ m})} = \sqrt{600 \text{ m}^2/\text{s}^2} = 24.5 \text{ m/s}$$

NO! This plane won't be taking off from this runway.

U

We got units of m/s, and we were looking for a speed. Yup! Our units match our goal.

B

Well, 24.5 m/s is in the neighborhood of the 27.8 m/s speed we were hoping for. Our answer claims the plane is going too slow. Nevertheless, our answer is a speed that we could reasonably expect a plane to have near takeoff.