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Physics 201

Weekly Quiz 1 | Corvallis Campus

9/30/2020

Collaboration is strictly prohibited. You will have 25 minutes to download, solve, take pictures, AND upload the exam to Gradescope.

1. (a) The dimensions of kinetic energy are equal to those of a force multiplied by a distance. The dimensions of a force are equal to those of an acceleration multiplied by a mass. The dimensions of acceleration are equal to those of a speed divided by time. The dimensions of speed are equal to those of a distance divided by time. Find the dimensions of energy in terms of the fundamental dimensions of mass [M], length [L], and time [T]. Show all work using only the information provided in this problem statement, i.e. don't start with the dimensions to acceleration used in class.

$[D]_E = [D]_F [D]_L$

$\hookrightarrow [D]_F = [D]_a [M]$ (fundamental)

$\hookrightarrow [D]_a = [D]_s [T]^{-1}$ (fundamental)

$\hookrightarrow [D]_s = [L][T]^{-1}$

Working Backwards

$[D]_a = \frac{[L]}{[T]^2} \Rightarrow [D]_F = [M]\frac{[L]}{[T]^2} \Rightarrow \boxed{[D]_E = [M]\frac{[L]^2}{[T]^2}}$

Rubric (a)

1 pt - Working with dimensions
1 pt - Dimensions for speed
1 pt - Dimensions for acceleration
1 pt - Dimensions for force
1 pt - Dimensions for energy

(b) The change in kinetic energy of a system is equal to $\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$, where **m** represents mass, v_f represents final speed, and v_i represents initial speed. If the change in kinetic energy is equal to a force (**F**) multiplied by a displacement (**Δr**), algebraically find the final speed in terms of the variables, **m**, v_i, **F**, and **Δr**. Show all your work, do not skip algebraic steps. Note: part (a) is a dimensional analysis while part (b) is working with the physical quantities involved with energy.

$\Delta K = \frac{1}{2}mV_f^2 - \frac{1}{2}mV_i^2 \quad \& \quad \Delta K = F\Delta r$

So, $\frac{1}{2}mV_f^2 - \frac{1}{2}mV_i^2 = F\Delta r$

$\frac{1}{2}mV_f^2 = F\Delta r + \frac{1}{2}mV_i^2$

$V_f^2 = \frac{2}{m}\left(F\Delta r + \frac{1}{2}mV_i^2\right)$

$\boxed{V_f = \sqrt{\frac{2}{m}(F\Delta r) + V_i^2}}$

Rubric (b)

1 pt - Change in KE = 1/2*m*v^2 - 1/2*....
1 pt - Change in KE = F*delta_r
1 pt - Setting both forms of change in KE equal to each other
1.5 pts - algebra
0.5 pts - correct answer