Problem Set I

Physics
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Problem 1.1. Calculate the velocity of the rocket when the engine failed:

Solution.
Using the following equation of velocity:
$v(t) = v_0 + a(t - t_0)$
We may determine that the velocity at said time was no other than $v(5) = v_0 + 30(5 - t_0) = 0 + 30(5 - 0) = 150 {}^{m}\!/\!{}_{s^2}$ ■

Problem 1.2. Calculate the maximum height the rocket would reach:

Solution.
Firstly, the height reached once the engine failed must be calculated. In order to calculate the latter, one must observe the following equation: $x(t) = x_0 + v_0(t - t_0) + 0.5at^2$*. Applying the equation to the scenario described, we may set* $x_0 = 0, v_0 = 0, t_0 = 0, t = 5, a = 30$ *and therefore:* $x(5) = 0 + 0(5 - 0) + 0.5 * 30 * 5^2 = 15 * 25 = 375_m$
Now, we may calculate the distance that the rocket travelled after the failure of the engine: To do so, we must first calculate the duration of time the rocket's height resumed increasing despite the engine no longer functioning.
We may do so using the following system of equations: $v(t) = 0 \wedge v(t) = v_0 + a(t - t_0)$*, as* $v_0 = 150, a = -9.87, t_0 = 5$*, therefore:* $0 = 150 - 9.87(t - 5) \Longrightarrow t = 20.19$
. We shall use the following equation: $x(t) = x_0 + v_0(t - t_0) + 0.5at^2$*, we may define the parameters to suit our needs:* $x_0 = 375_m, v_0 = 150 {}^{m}\!/\!{}_{s^2}, t_0 = 5, t = 20.19, a = -9.87 \Longrightarrow$
$x(20.19) = 375 + 150 * (20.19 - 5) + 0.5(-9.87)(15.19)^2 = 1514.8173465$
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