Solutions

Quiz 3

1. When is the total momentum of a system conserved?

   When $\vec{F}_{ext} = 0$

2. A rocket of mass m is traveling in the $+x$-direction with velocity $v(t)$. It is ejecting fuel at a constant rate v_{ex}. The rocket is not subject to any external forces (when one considers the fuel to be in the same system as the rocket). Circle all of the following statements that are true:

   True (a) Momentum for this system (the rocket and its fuel) is conserved.

   False (b) $\dot{v} = 0$

   True or False (c) $\dot{m} = 0$ Either answer is okay, my directions in class were unclear

3. Complete the following equations for:

   (a) Time derivative of kinetic energy,

   $$\frac{dT}{dt} = \vec{F} \cdot \underline{\vec{v}}$$

   (b) Work,

   $$\Delta T = T_2 - T_1 = \int_1^2 \underline{\vec{F}} \cdot d\vec{r}$$

   (c) Work,

   $$W(1 \to 2) = \Delta \underline{T}$$

   (d) Potential energy,

   $$U(\vec{r}) = -\int_{\vec{r}_0}^{\vec{r}} \vec{F}(\vec{r'}) \cdot \underline{d\vec{r}'}$$

   where $\vec{F}$ is a conservative force.