

Exercises in Physics

Assignment # 11

Date Given: June 23, 2022

Date Due: June 30, 2022

- P1.** (2 points) For the force $\mathbf{F} = \mathbf{r}$, define the potential energy (if exists). Compute the work done by this force along the helical path $\mathbf{r}(t) = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$, where $x(t) = a \cos t$, $y(t) = a \sin t$, $z(t) = bt$, when the parameter t is changing from $t = 0$ (start point) to $t = 2\pi$ (end point).
- P2.** (2 points) For the force $\mathbf{F} = \mathbf{k} \times \mathbf{r}$, define the potential energy (if exists). Compute the work done by this force along the helical path $\mathbf{r}(t) = x(t)\mathbf{i} + y(t)\mathbf{j} + z(t)\mathbf{k}$, where $x(t) = a \cos t$, $y(t) = a \sin t$, $z(t) = bt$, when the parameter t is changing from $t = 0$ (start point) to $t = 2\pi$ (end point).
- P3.** (2 points) The 10 kg collar slides on the smooth vertical rod and has a velocity $v_1 = 2 \text{ m/s}$ in position A where each spring is stretched 0.1 m. Calculate the velocity v_2 of the collar as it passes point B.

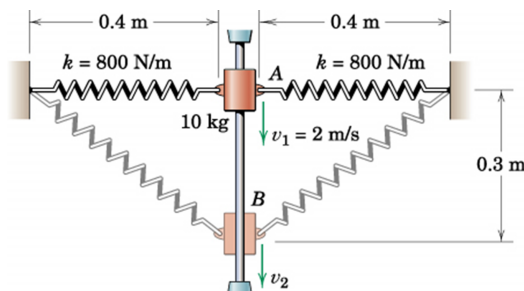


Figure 1: Illustration to Problem 3.

- P4.** (2 points) The collar has a mass of 2 kg and is attached to the light spring, which has a stiffness of 30 N/m and an unstretched length of 1.5 m. The collar is released from rest at A and slides up the smooth rod under the action of constant 50 N force. Calculate the velocity v of the collar as it passes position B.

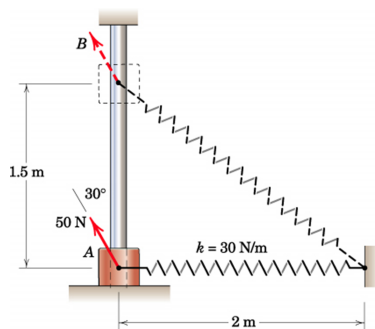


Figure 2: Illustration to Problem 4.