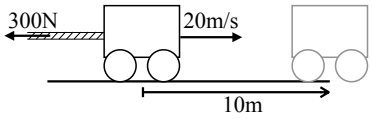
Physics 2130 Sample Exam 2 Solutions

1. A 1000 kg cart is moving to the right at 20 m/s, initially. A 300 N force is applied to the left to try to slow it down. The cart travels for 10 m. Friction does no work on the cart.



3 (a) C What is the work done by the rope on the cart?

A) 0 J **B)** +3,000 J **C)** -3,000 J
D) +6,000 J **E)** -6,000 J

3 (b) B The work done by the floor on the cart is

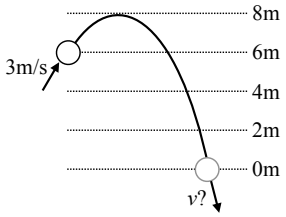
A) positive **B)** zero **C)** negative

3 (c) The cart's initial kinetic energy is 200,000 J.What is its final kinetic energy?

$200,000 - 3,000 = 197,000\,\text{J}$

4

2. A 2 kg ball flies upward into the air at 3 m/s, as shown. Find the speed v of the ball at the end of its flight.

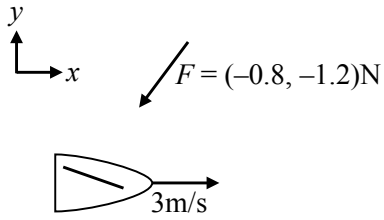


$v =$ **11.25**

Final Energy E_f	**Initial Energy** E_i	**Work**
$KE = \frac{1}{2}(2)v^2 = v^2$ $PE = 0$	$KE = \frac{1}{2}(2)(3)^2 = 9$ $PE = (2)(9.8)(6) = 117.6$	0

$$v^2 + 0 = 9 + 117.6 \implies v = \sqrt{127} = 11.25\,\text{m/s}$$

3. A 4 kg toy sailboat starts off moving at 3 m/s in the $+x$ direction. Wind blows on the sailboat for 8 seconds, imparting a force of $\vec{F} = (-0.8, -1.2)$ N on the boat.



3 (a) **B** What is the initial momentum $\vec{p}_i$ of the sailboat?

A) $(3, 0)$ Ns **B)** $(12, 0)$ Ns **C)** $(-0.8, -1.2)$ Ns
D) $(0, 12)$ Ns **E)** $(0, 3)$ Ns

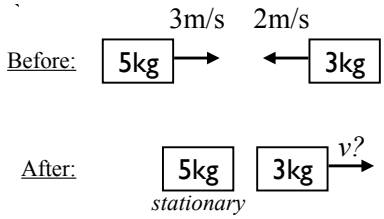
3 (b) **B** What is the final momentum of the sailboat?

A) $(3.0, 0)$ Ns **B)** $(5.6, -9.6)$ Ns **C)** $(-6.4, -9.6)$ Ns
D) $(11.2, -1.2)$ Ns **E)** $(12.0, 0)$ Ns **F)** $(18.4, 9.6)$ Ns

$\vec{p}_f = \vec{p}_i + \vec{J} = (12, 0) + 8(-0.8, -1.2)$

4. Two blocks collide as shown. After the collision, the 5 kg block is stationary.

3 (a) What is the velocity of the 3 kg block after the collision?



$$p_i = 5(3) + (3)(-2) = 9\,\text{Ns}$$

$$p_f = 5(0) + (3)(v) = 3v$$

$$3v = 9 \implies v = 3\,\text{m/s}$$

2 (b) **B** This collision is

A) elastic **B)** inelastic **C)** maximally (or perfectly) inelastic

$$KE_i = \frac{1}{2}(5)(3)^2 + \frac{1}{2}(3)(2)^2 = 28.5\,\text{J}$$

$$KE_f = 0 + \frac{1}{2}(3)(3)^2 = 13.5\,\text{J}$$