Worksheet work and power solutions

**1.** Ralph uses a force of $\left(2x10^{3}\hat{x}-70\hat{y}\right)N$ to push his car along a road for 1x103m due east

(+x direction) essentially wrecking it. It takes him 5x102s to do this.

 A) Calculate the amount of work that wreck it Ralph did on the car.

 $W=F∙∆x=\left(\left(2x10^{3}\hat{x}-70\hat{y}\right)N\right)∙\left(1x10^{3}\hat{x}m\right)≈2x10^{6}Nm=2x10^{6}J$

 B) Calculate the amount of power that he generated.

 $P=\frac{W}{t}=\frac{2x10^{6}J}{5x10^{2}s}=4x10^{3}W$

 C) At what angle (from the positive x axis) is Ralph pushing the car?

$$θ=tan^{-1}\left(\frac{F\_{y}}{F\_{x}}\right)=tan^{-1}\left(\frac{-70N}{2x10^{3}N}\right)=-2^{o}$$

**2.** A Machamp exerts a force of 1500N as he pushes on the side of a building. After pushing for 2 minutes, to Machamp's perplexed surprise, the building has not moved. How much work did Machamp do? How do you know?

 None – nothing moved (zero distance)

**3.** Julie must lift three 1x102kg boxes up to a ledge that is 2m above the ground.

 A) Calculate the ***weight*** of one of the boxes.

$$F\_{g}=mg=\left(1x10^{2}kg\right)\left(9.8\frac{m}{s^{2}}\right)=980N$$

 B) How much ***force*** must be exerted to lift one box?

 Since weight is a force pulling downward, you would need to exert a force greater than the weight of 980N to lift a single box.

 C) Calculate the amount of work Julie does to lift one box up to the ledge.

$$W=F∆x=\left(980N\right)\left(2m\right)=1.96x10^{3}J$$

 D) How much work would have to be done to lift all three boxes up to the ledge, one box at

 a time?

 5.88 x 103 J ( 1.96 x 103 J per box times 3)

 E) Calculate the ***weight*** of all three boxes.

$$F\_{g}=3mg=\left(3\right)\left(1x10^{2}kg\right)\left(9.8\frac{m}{s^{2}}\right)=2.94x10^{3}N$$

 F) How much ***force*** must be exerted to lift all three boxes at once?

 Since weight is a force pulling downward, you would need to exert a force greater than the weight of 2.94 x 103 N to lift all three boxes at once.

 G) Calculate how much work would be done to lift all three boxes up to the ledge at the same

 time.

$$W=F∆x=\left(2.94x10^{3}N\right)\left(2m\right)=5.88x10^{3}J$$

 H) How does the amount of work done lifting the three boxes, one at a time, compare to the

 amount of work done lifting the three boxes all at once? Explain why.

 Same – same boxes moved to the same height