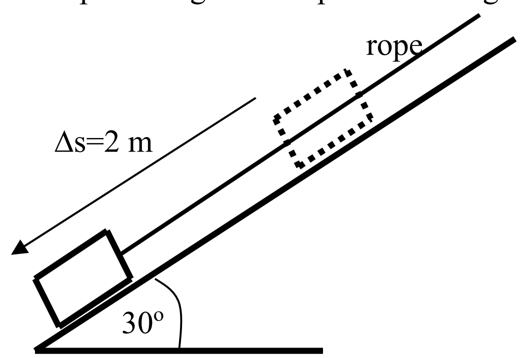
Physics 211 **Problem Set 7** **Due Fri, 10/18/19**
Last Name:___________________________________ First Name _______________
Workshop time or section:___________________TA name or Room # ___________

Please submit your homework on this sheet. If you need more space than is available, please attach additional sheets of paper.

1. A block of mass 5.0 kg is moving down a frictionless incline that makes an angle of 30° with the horizontal. While the block is moving a distance of 2 m, a rope exerts a constant force of 15 N upward along the ramp. Throughout the problem use g=10 m/s^2.

(a) Draw all forces on the block.



(b) Draw a vector to represent the net force on the block (label it clearly) and determine its magnitude.

(c) Is the block speeding up or slowing down? Explain.

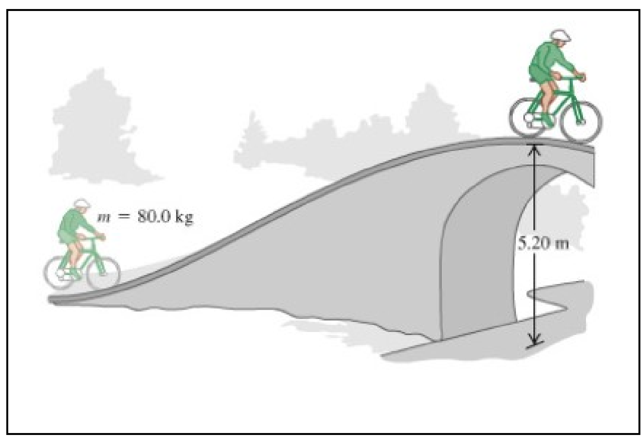
(d) Find the work done by the net force ($W_{net} = \vec{F}_{net} \bullet \Delta\vec{s}$)

(e) Find the work done by each of the individual forces.

(f) Find the total work done by adding up individual contributions you found in part (e). Is your answer equal to the value you found in part (d).

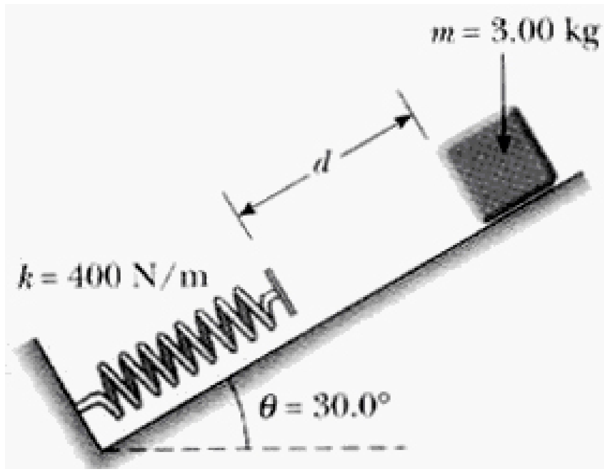
2. You and your bicycle have a combined mass 80.0 kg. When you reach the base of a bridge, you are traveling along the road at 5.00 m/s (see the figure). At the top of the bridge, you have climbed a vertical distance of 5.20 m and have slowed to 1.50 m/s. You can ignore work done by friction and any inefficiency in the bike or your legs.

(a) What is the total work done on you and your bicycle when you go from the base to the top of the bridge?



(b) How much work have you done with the force you apply to the pedals?

3. A 3 kg mass starts from rest and slides a distance *d* down a frictionless 30^0 incline. While sliding, it comes into contact with an unstressed spring of negligible mass, as shown below. The mass slides an additional 0.2 m as it is brought momentarily to rest by compression of the spring (k=400 N/m). Find the initial separation *d* between the mass and the spring.



Answering questions below will help you find the solution.

i. Sketch the initial and final position of the system.

ii. What is the initial kinetic energy?

K_i=

iii. What is the initial potential energy of the spring?

Us_i=

iv. What is the initial gravitational potential energy? (You need to decide at which height Ug is zero, before you can answer. Depending on your choice, the formula may contain *d*, θ and Δx=0.200m)

Ug_i=

v. What is the final kinetic energy?

K_f=

vi. What is the final potential energy of the spring? (You need to make use of the fact that the spring gets compressed by Δx=0.200m)

Us_f=

vii. What is the final gravitational potential energy? (Use the same convention for Ug=0 as in point iv above. The formula may contain *d*, θ and Δx.)

Ug_f=

viii. Write conservation of mechanical energy using the formulae from above.

$$E_i = E_f$$

$$K_i + Ug_i + Us_i = K_f + Ug_f + Us_f$$

ix. Solve it for *d*.