1. Define the following terms: **(3M)**

   (a) Energy

   (b) Power

   (c) Law of Conservation of Energy

2. Read the following four statements and determine whether or not they represent examples of work. If work is being done, state WHO/WHAT is doing the work. If no work is being done, explain why not. **(3M)**

   (a) My coffee cup falls off a table and free falls to the ground.

   (b) A waiter carries a tray full of meals above his head by one arm straight across the room at constant speed.

   (c) Mr. Santowski's car accelerates through the City Center parking lot.

3. For the following questions, show your reasoning/solution as you answer the questions. **(6M)**

(a) Zach and Aziz are pulling identical boxes. Who does more work: Zach who pulls a box with three times more force than Aziz although Aziz pulls his box four times as far as Zach.

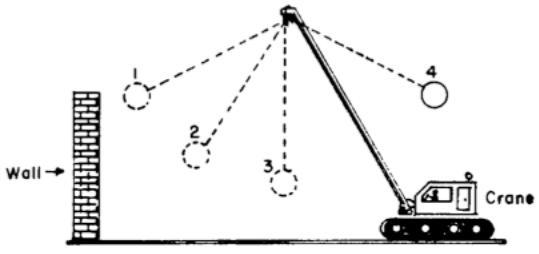
(b) If Manu can do the same amount of work as Ali does but in less time, who is more powerful ?

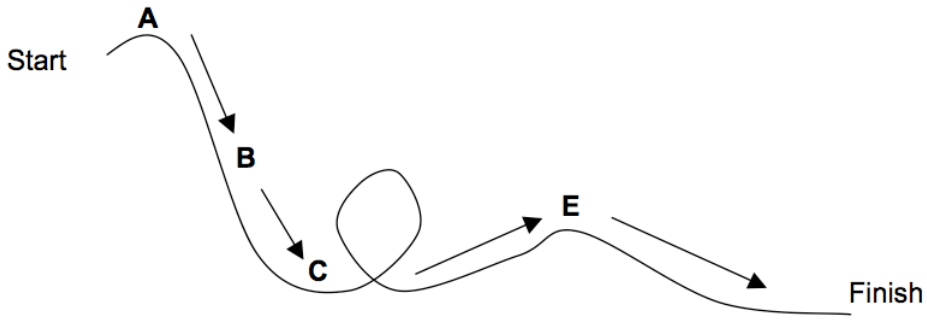
(c) You raise 2 objects through the same height. One object is double the mass as the other. Which object has the greater potential energy after being raised?

(d) Rica runs twice as fast as Mira. Compare the KEs of Rica and Mira.

(e) Where is the PE the highest on a pendulum or a swing?

(f) The wrecking crane shown below is moving toward a brick wall which is to be torn down. At what point in the swing of the wrecking ball should the ball make contact with the wall to make a collision with the greatest kinetic energy? Explain your answer.





4. Look at the picture of the roller coaster above. Select the most appropriate location(s) and briefly explain your reasoning. **(5M)**

(a) At what position(s) (A, B, C, D, E) would the roller coaster have the greatest KE? Explain.

(b) At what position(s) (A, B, C, D, E) would the roller coaster have the greatest PE? Explain.

(c) At what position(s) (A, B, C, D, E) would the roller coaster have the least KE? Explain.

(d) At what position(s) (A, B, C, D, E) would the roller coaster have the least PE? Explain.

(e) At what position(s) (A, B, C, D, E) would the roller coaster increase its KE while decreasing its PE? Explain.

For the following word problems, remember the required presentation method. First, list your given & unknown information, write the appropriate formula, show the necessary work and make sure units are included in the final answer.

5. Calculate the work done by a 47 N force pushing a pencil 0.26 m. **(3M)**

6. How much work is it to lift a 20 kg sack of potatoes vertically 6.5 m? **(3M)**

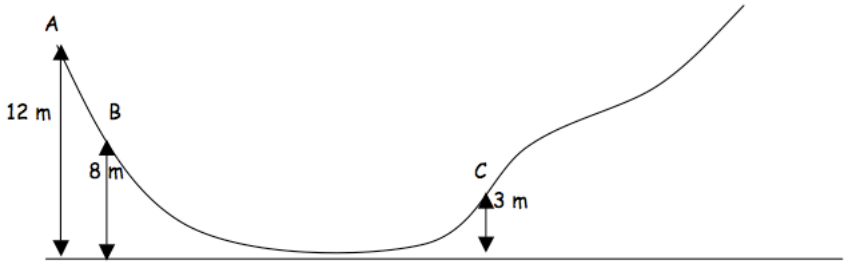
7. Calculate the kinetic energy of a 45 g golf ball traveling at 20 m/s. **(3M)**

8. A force of 25N is used to push a 50 kg box a distance of 8 meters in a time of 15 seconds. How much power is used? **(3M)**

9. What is the potential energy gained by a 7.0 kg ball that has moved up to the top of a 5.0 m hill? **(3M)**

For the following word problems, remember the required presentation method. First, list your given & unknown information, write the appropriate formula, show the necessary work and make sure units are included in the final answer.

10. At point "A" on the hill, there is a 60 kg skier moving at a speed of 8 m/s. **(9M)**



a) Find the skier's total mechanical energy at position A.

b) How fast will the skier be moving at point C?

c) How far up the other hill will the skier be able to go?

11. Henry can do 30 "reps.", lifting a 600 N weight up 50 cm in 1 minute. Noah can do 50 reps., lifting a 300 N weight up 48 cm in 45 seconds. **(11M)**

a) Calculate the amount of **energy** Henry is exerting in 1 "rep". (Energy exerted is equal to the **work** done.)

Equation: *Solution*:

Answer _____

b) Calculate the **total** energy Henry is using in 60 seconds. (He is doing 30 reps.)

Answer _____

c) Calculate the total **power** output of Henry.

Equation: *Solution*:

Answer _____

d) Calculate the **total energy** exerted by Noah.

Equation: *Solution*:

Answer _____

e) Calculate the **power** output of Noah.

Equation: *Solution*:

Answer _____

f) Who is more powerful, Henry or Noah? _____

12. Tarek came in during flex period the other day to recollect data for the Pendulum Lab, wherein we were trying to determine whether or not energy was conserved in the swinging of a simple pendulum. He collected the following data:

ITEM	
Rest height of pendulum was 10 cm	Release Height of pendulum was 25 cm (which was 15 cm above the rest height)
Mass of pendulum was 200g	Velocity as determined by the computer was 1.68 m/s
Diameter of pendulum was 2.804 cm	Use g = 9.81 m/s^2

Show the sample calculations that Tarek must do in order to decide whether or not energy was conserved as the pendulum swung through its cycle. **(7M)**

(a) potential energy at the start (PE_i):

(b) kinetic energy at the start (KE_i):

(c) total mechanical energy at the start (TME_i):

(d) potential energy at the lowest point (PE_f):

(e) kinetic energy at the lowest point (KE_f):

(f) total mechanical energy at the lowest point (TME_f):

(g) Ratio of total mechanical energy (initial) to the total mechanical energy (final) = (TME_i/TME_f):

Conclusion: Does Tarek's new data show that energy was conserved in this experiment? Explain your reasoning. **(2M)**

13. Mr Santowski sets forth the following hypothesis: In a stair climbing lab similar to the one we performed in class, I believe that people who climb the stairs quickly are the ones who generate the most power.

I have collected the following data from my classes:

Subject	Mass (kg)	Time (s)	work	Power
Climber #1	60	8.3		
Climber #2	65	9.1		
Climber #3	70	6.1		
Climber #4	90	8.2		
Climber #5	65	8.9		
Climber #6	70	6.3		

The height of the stair is 5 m and you will use $g = 10\ m/s^2$ to make the calculations easier.

(a) Determine the work done by Climber #1. Show your work. **(2M**

(b) Determine the work done by the other climbers. Do NOT show this work, but simply write your answer in the table. **(2M)**

(c) Determine the power generated by Climber #1. Show your work. **(2M)**

(d) Determine the power generated by the other climbers. Do NOT show this work, but simply write your answer in the table. **(2M)**

(e) Data Analysis - I have included a graph, which is unlabeled and unscaled. Use the graph in an appropriate manner so that you can analyze your calculated results and experimental data so that you can tell me whether my hypothesis is true or not. **(3M)**

(f) Is my hypothesis true? **(1M)**

(g) Explain how your data analysis helped you decide whether or not my hypothesis is true or false. **(2M)**