Name_____

Date_____Pd____

Energy Model Worksheet 3:
Qualitative Energy Storage & Conservation with Bar Graphs

<u>For each situation shown below:</u>
1.   List objects in the system within the circle. **Always include the earth's gravitational field in your system.**
2.   On the physical diagram, indicate your choice of zero height for measuring gravitational energy.
3.   Sketch the energy bar graph for position A, indicate any energy flow into or out of the system from position A to position B on the System/Flow diagram, and sketch the energy bar graph for position B.
4.   Write a qualitative energy equation that indicates the initial, transferred, and final energy of your system.

1a.   In the situation shown below, a spring launches a roller coaster cart from rest on a <u>frictionless</u> track into a vertical loop. Assume the system consists of the cart, the earth, the track, and the spring,
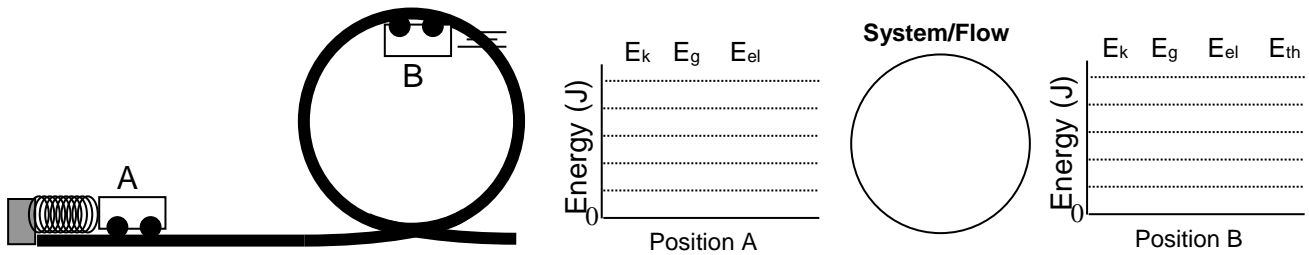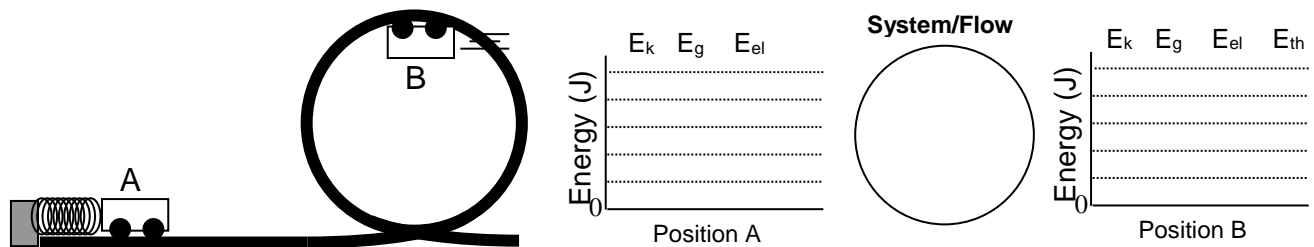

Qualitative Energy Conservation Equation:

1b.   Repeat problem 1a for a frictionless system that includes the cart, the earth, and the track, but not the spring.
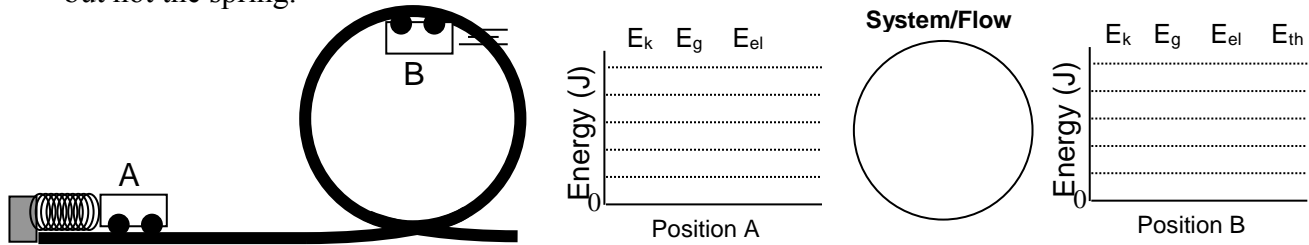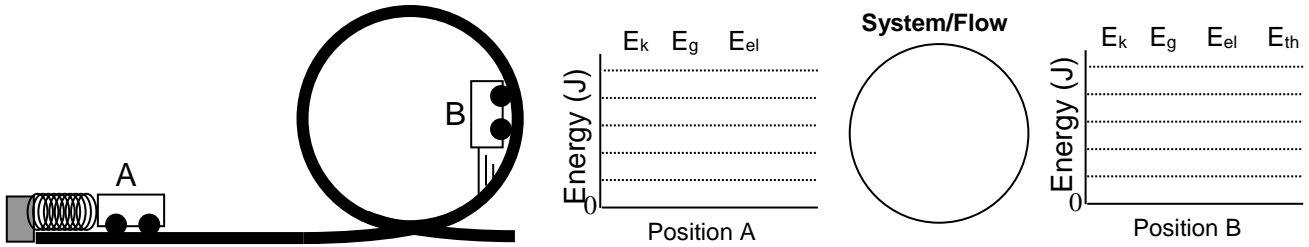

Qualitative Energy Conservation Equation:

1c.   Use the same system as problem 1a, but assume that there is friction between the cart and the track.
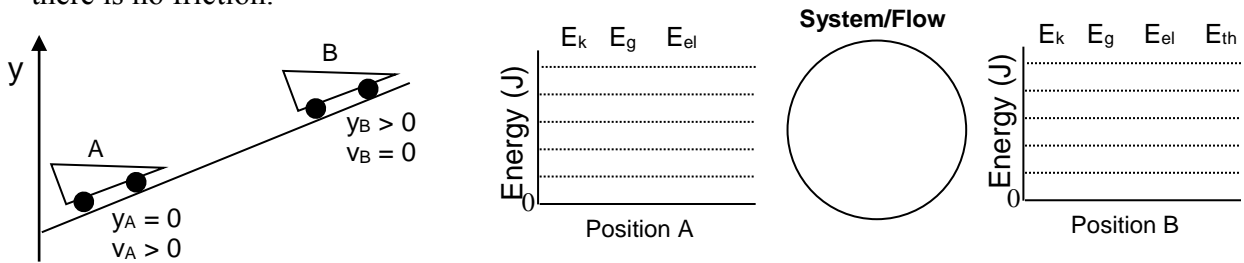

Qualitative Energy Conservation Equation:

1d. This situation is the same as problem 1a except that the final position of the cart is lower on the track. Make sure your bars are scaled consistently between problem 1a and 1d. Assume the system consists of the cart, the earth, the track, and the spring.
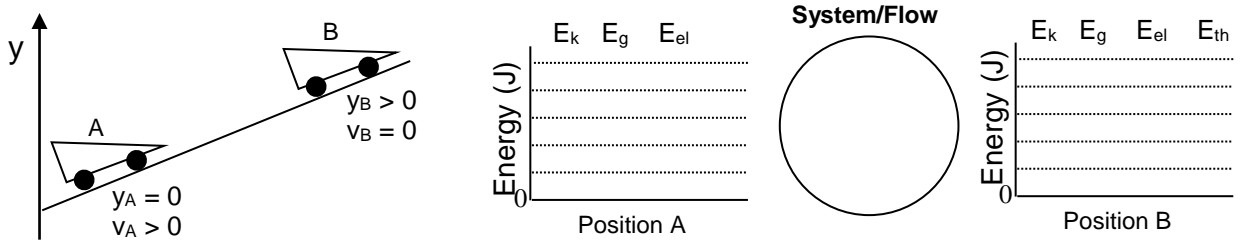
E_k E_g E_{el}	System/Flow	E_k E_g E_{el} E_{th}
Energy (J)		Energy (J)
Position A		Position B

Qualitative Energy Conservation Equation:

2a. A moving car rolls up a hill until it stops. Do this problem for a system that consists of the car, the road, and the earth. Assume that the engine is turned off, the car is in neutral, and there is no friction.
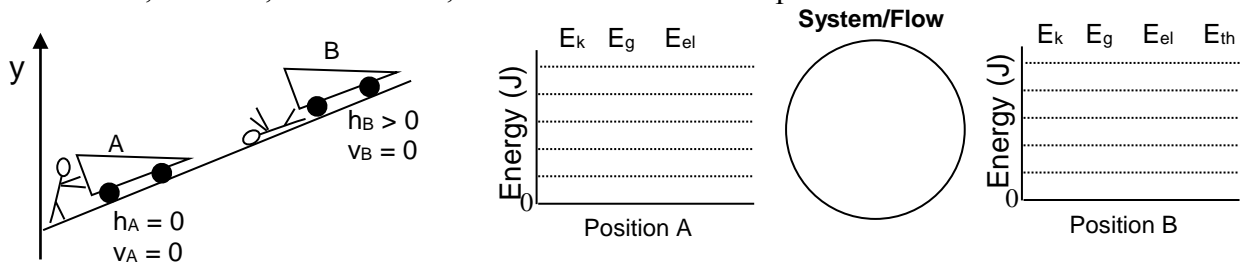
$y_B > 0$
$v_B = 0$

$y_A = 0$
$v_A > 0$

E_k E_g E_{el}	System/Flow	E_k E_g E_{el} E_{th}
Energy (J)		Energy (J)
Position A		Position B

Qualitative Energy Conservation Equation:

2b. Repeat problem 2a for the same system with friction.

$y_B > 0$
$v_B = 0$

$y_A = 0$
$v_A > 0$

| E_k E_g E_{el}	System/Flow	E_k E_g E_{el} E_{th}
Energy (J)		Energy (J)
Position A		Position B

Qualitative Energy Conservation Equation:

3a. A person pushes a car, with the parking brake on, up a hill. Assume a system that includes the car, the road, and the earth, but does not include the person.

$h_B > 0$
$v_B = 0$

$h_A = 0$
$v_A = 0$

E_k E_g E_{el}	System/Flow	E_k E_g E_{el} E_{th}
Energy (J)		Energy (J)
Position A		Position B

Qualitative Energy Conservation Equation:

3b. Repeat problem 3a for a system that includes the person.

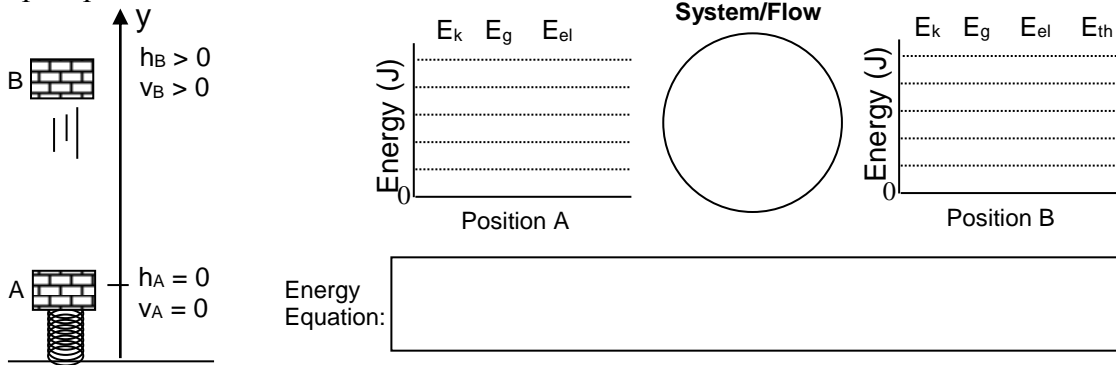| E_k E_g E_{el}	System/Flow	E_k E_g E_{el} E_{th}
Energy (J) ... Position A	◯	Energy (J) ... Position B
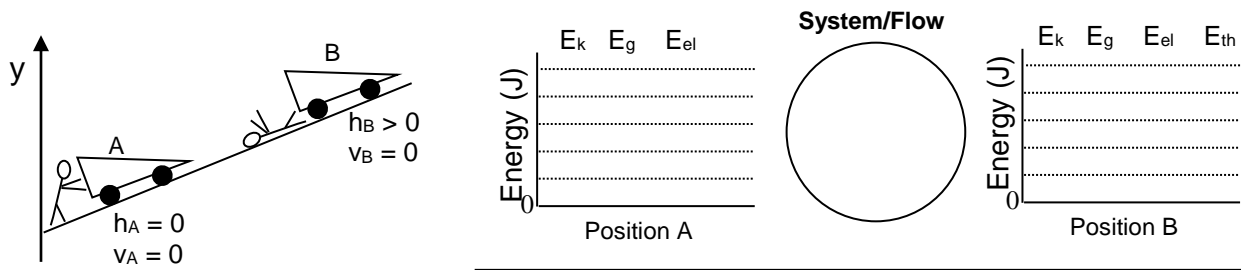
Qualitative Energy Conservation Equation:

4a. A load of bricks rests on a tightly coiled spring and is then launched into the air. Assume a system that includes the spring, the bricks and the earth. Do this problem without friction.
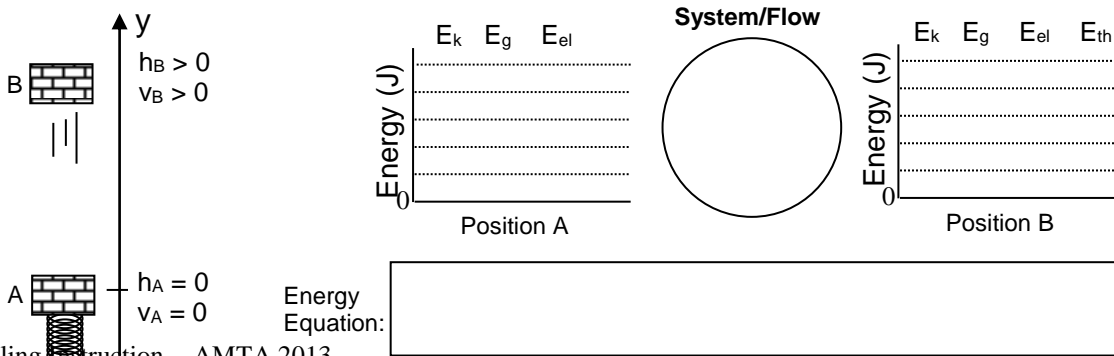

E_k E_g E_{el}	System/Flow	E_k E_g E_{el} E_{th}
Energy (J) ... Position A	◯	Energy (J) ... Position B
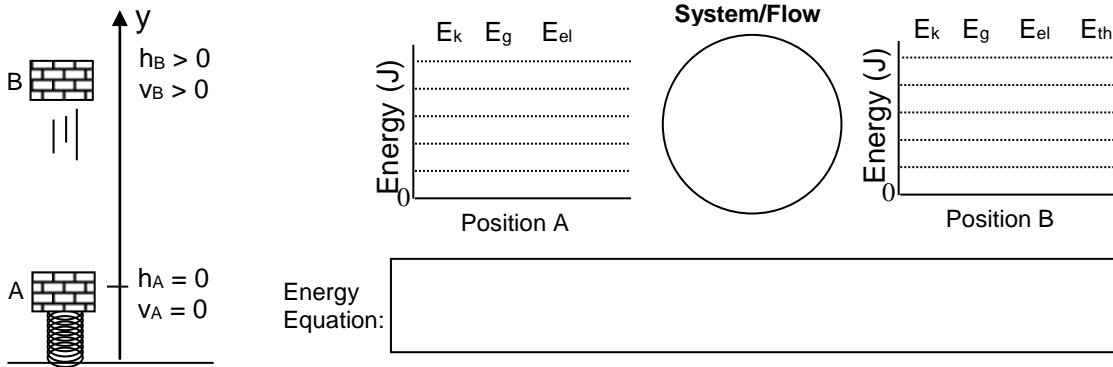
Energy Equation:

4b. Repeat problem 4a with friction.

E_k E_g E_{el}	System/Flow	E_k E_g E_{el} E_{th}
Energy (J) ... Position A	◯	Energy (J) ... Position B

Energy Equation:

4c. Repeat problem 4a for a system that does not include the spring.

E_k E_g E_{el}	System/Flow	E_k E_g E_{el} E_{th}
Energy (J) ... Position A	◯	Energy (J) ... Position B

Energy Equation:

5a. A crate is propelled up a hill by a tightly coiled spring. Analyze this situation for a frictionless system that includes the spring, the hill, the crate, and the earth.

y

B $h_B > 0$
   $v_B > 0$

A

0

$h_A = 0$
$v_A = 0$

Ek Eg Eel

Energy (J)

Position A

System/Flow

Ek Eg Eel Eth

Energy (J)

Position B

Energy Equation:

5b. Repeat problem 5a for a system that does not include the spring and does have friction.

y

B $h_B > 0$
   $v_B > 0$

A

0

$h_A = 0$
$v_A = 0$

Ek Eg Eel

Energy (J)

Position A

System/Flow

Ek Eg Eel Eth

Energy (J)

Position B

Energy Equation:

6a. A bungee jumper falls off the platform and reaches the limit of stretch of the cord. Analyze this situation for a frictionless system that consists of the jumper, the earth, and the cord.

$h_A > 0$
$v_A = 0$

y   A

y

0

B $h_B > 0$
   $v_B = 0$

0

Ek Eg Eel

Energy (J)

Position A

System/Flow

Ek Eg Eel Eth

Energy (J)

Position B

Energy Equation:

6b. Repeat problem 6a if the cord is not part of the system.

$h_A > 0$
$v_A = 0$

y   A

y

B $h_B > 0$
   $v_B = 0$

Ek Eg Eel

Energy (J)

Position A

System/Flow

Ek Eg Eel Eth

Energy (J)

Position B

Energy Equation: