Unit 4: Intro to Energy

Name: ________________________________ Period: _________ Date: _________________

Homework :	Due Date

Vocabulary	Sentence that correctly uses the word	Pattern, Diagram, or Equation
Energy		
Kinetic Energy		
Gravitational Potential Energy		
Energy Transfer		
Energy Transformation		
Work		
Power		

For questions 1 – 6 compete the four representations for the four patterns below.

- Motion Energy-
Kinetic Energy vs velocity
mass = 10

- Potential Energy-
E_g vs height
mass = 10

- Total Energy-
E_T vs height
mass = 10, starting height = 10,
Starting velocity = 0

- Rate of Energy Transfer -
Power vs time
Energy Transferred = 100

1.Mathematically

$E_k = \frac{1}{2}mv^2$

$E_g = mgh$

$E_T =$

$P =$

2. Data Tables:

v	E_k
1	
2	
5	

h	E_g
1	
2	
5	

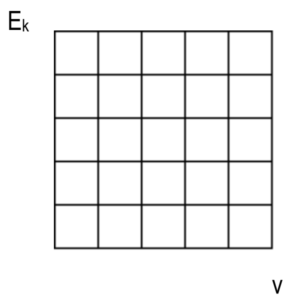
h	E_T
5	
2	
1	

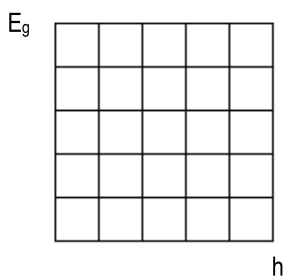
t	P
1	
2	
5	

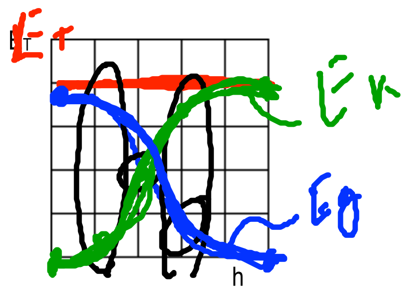
$E_k = 5v^2$

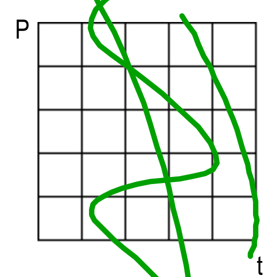
$E_g = 98h$

3. Graphically









4a. Pattern:

b. Pattern:

c. Pattern:

d. Pattern:

5. Compare and Contrast important aspects of E_k and E_g:

Compare (similarities):

Contrast (differences)

6. **Ranking Task:** Rank the vehicles in order of total energy:

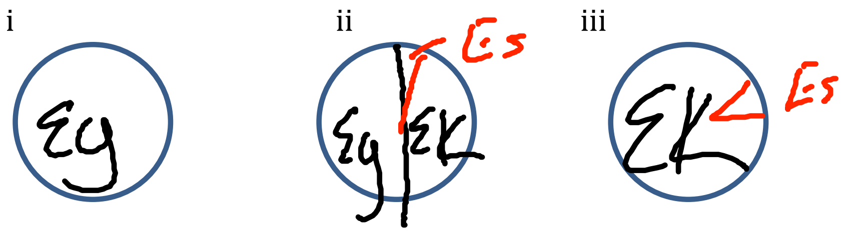
a. a Tesla Roadster (2000 kg) speeding 40 m/s down a closed track at sea level.
b. a semi-truck (10000 kg) stopped at a rest stop 60 m above sea level.
c. a Cadillac (2500 kg) cruising down a highway 20 m/s at sea level.

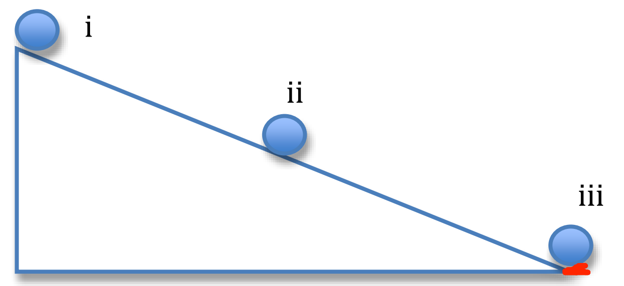
B>A>C

Energy Storage (pie) Charts

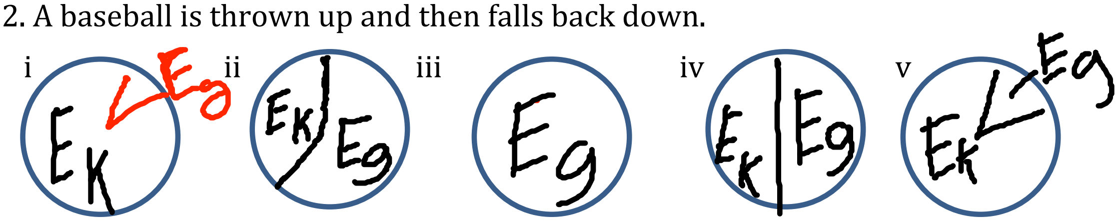
- The pies should be accurately sized, divided and labeled with the energy storage mechanisms involved: ($E_{kinetic}$, E_{sound}, $E_{thermal}$, $E_{gravitational}$, $E_{elastic}$, $E_{chemical}$).

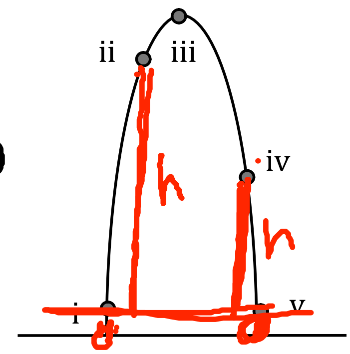
1. A ball rolls down a ramp with minimal friction.



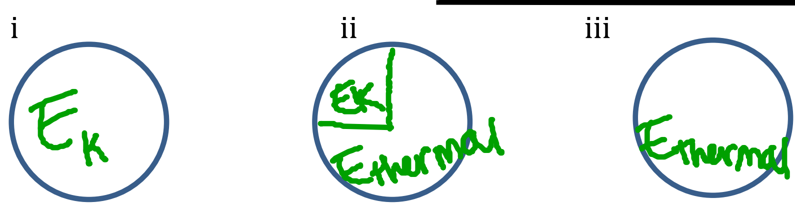


2. A baseball is thrown up and then falls back down.

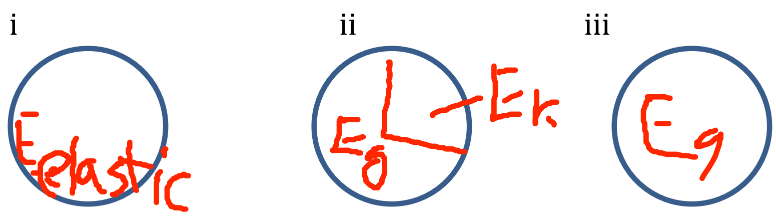


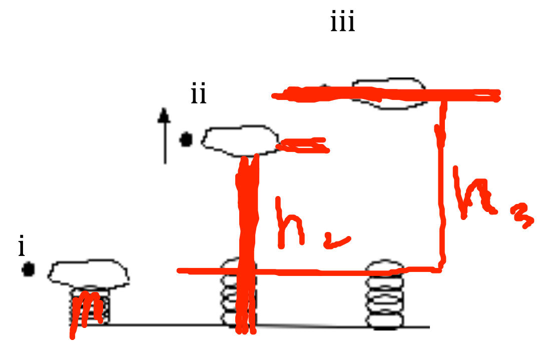


3. A ball rolls to a stop on the floor.

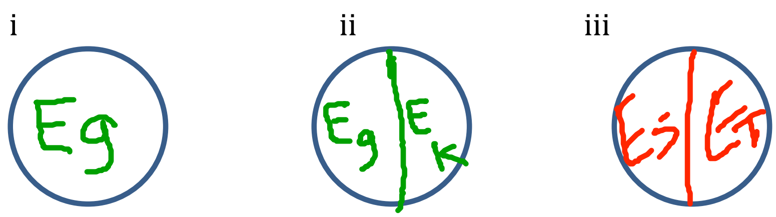


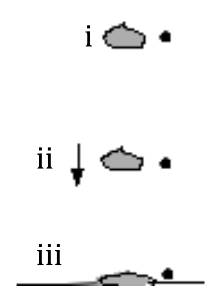
4. An object rests on a coiled spring, and is then launched upwards.



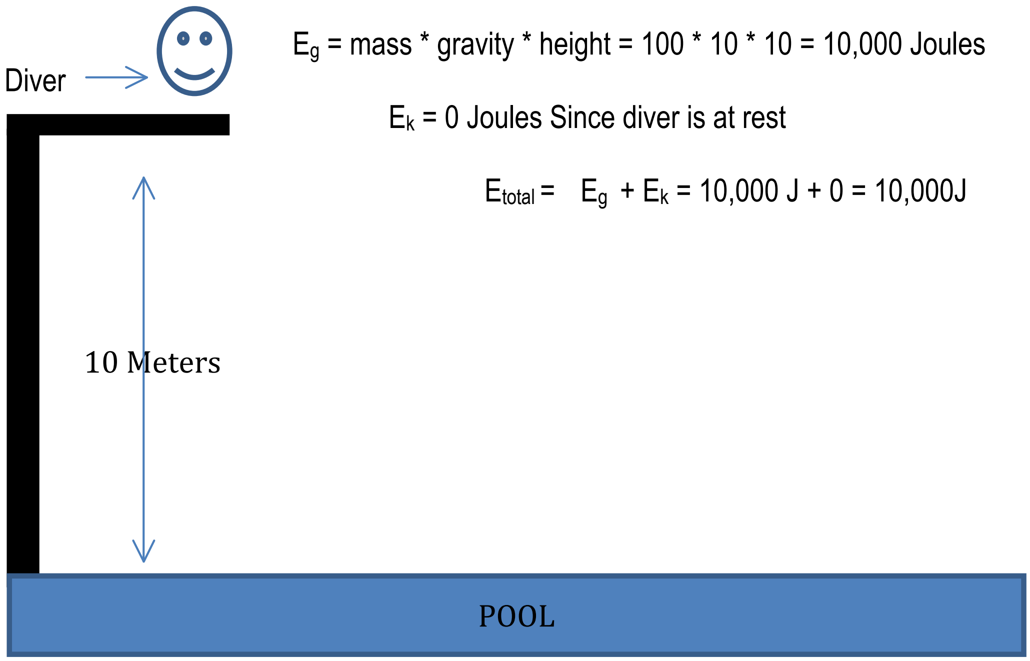


5. A piece of clay is dropped to the floor.





For the following problem we will assume that a diver (100 kg) is standing atop a 10 meter tall diving board. The diver then jumps from the tower into the pool below. For the heights specified below, find the E_g and E_k of the diver. Also create an energy pie chart for each of the heights. The initial height is done for you.



E_g = mass * gravity * height = 100 * 10 * 10 = 10,000 Joules

E_k = 0 Joules Since diver is at rest

E_{total} = E_g + E_k = 10,000 J + 0 = 10,000J

Energy Pie Chart

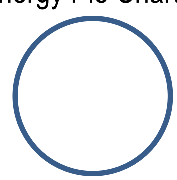
At height 8 meters above the pool

Energy Pie Chart

E_g =

E_k =

E_{total} =



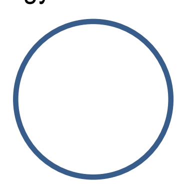
At height 5 meters above the pool

Energy Pie Chart

E_g =

E_k =

E_{total} =



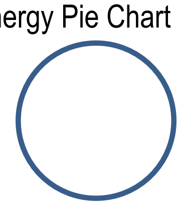
The instant before hitting the water

Energy Pie Chart

E_g =

E_k=

E_{total} =



Problem Solving with Energy & Energy Transfer

A student pulls a block up ramps of various lengths using a spring scale. Each ramp gets up to the same height, but has a different length. Their data is logged below. Complete the data table using correct concepts of work

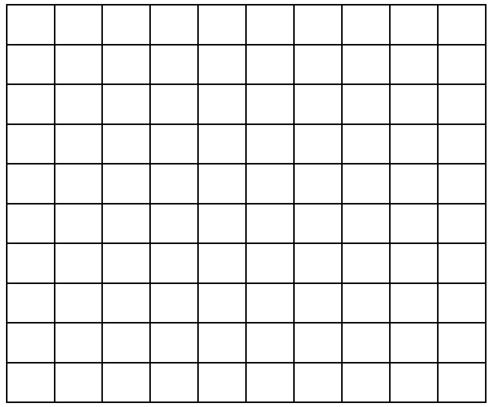
Force pull (N)	Force Friction (N)	Distance Ramp (m)	Energy transferred into cart by pull (J) Work$_{pull}$ = ______	Energy transferred to Thermal Energy (J) Work$_{Friction}$ = ______	Net Energy transferred to cart (J) E_{net} = ________	Energy Transferred to E_g (J) E_g = mgh
16	**11.0**	**10**				**50**
19	**9.0**	**5**				**50**
20	**7.5**	**4**				**50**
32	**7.0**	**2**				**50**
55	**5.0**	**1**				**50**

Generating and Analyzing Graphs of Energy

1. The Engineering Club constructs an essentially frictionless large wind turbine and uses some string to hang a 2 kg load from the wind turbine's axle. As the mass falls the string begins to turn the axle causing the wind turbine blades to actually make 1 kg of air start moving – that is, it creates some wind. Draw a diagram, including Energy Pie Charts, the energy transformations and transfers below:

2. Complete the table to the right for this situation assuming all of the kinetic energy in the blades gets transferred immediately to the air (wind).

Height of Load (m) +/- 0.2	E_g Gravitational Potential Energy of Wind Turbine (J) +/- 4 E_g =	E_K Kinetic Energy Transferred to the Wind (J) +/- 4 E_k = E_k =	E_T Total Energy of the System (J) +/- 4 E_T =	Velocity of the Wind (m/s) +/- 0.2 v =
1.8	36			0
1.6		4		
1.0			36	



2. Using the technical terminology *energy transformation* and *energy transfer* describe how energy is conserved as the 2 kg load falls.

3. More realistically, the wind turbine would likely have some friction. Explain how and why the data table above would change using the following terms and concepts: E_t (thermal energy), E_T (Total energy), E_k, E_g, and conservation of energy, velocity of the wind.