Questions of the Day

Energy

Question of the Day

- What has changed, or is in the process of changing, in each of these pictures?
- *Answer: spring's stretch, water's temperature, jumper's height, car's velocity → require energy*

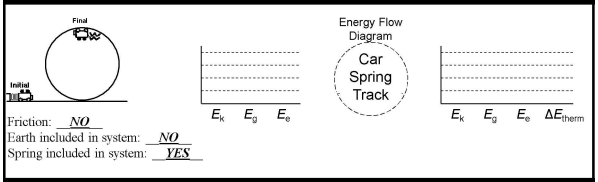
Question of the Day

- Remember our analogy regarding energy…
  - Energy is to a system as _____ is to a _____?
- *Answer: money, bank*

Question of the Day

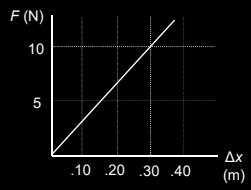
- What is the energy account associated with each of the following questions?
  - Is it moving?
  - Is it above or below height zero?
  - Is anything stretched or compressed?
  - Has friction acted within the system?
- *Answer: energy stored… kinetically (E_k), gravitationally (E_g), elastically (E_e), thermally (ΔE_{therm}).*

Question of the Day



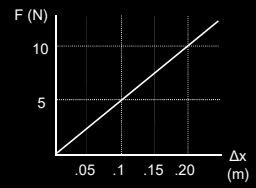
- A roller coaster is launched from rest by a spring to the top of the loop and is still in motion. Complete the energy analysis above.

Question of the Day



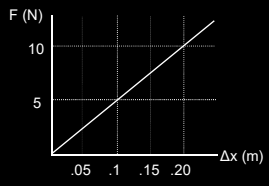
- What is the line's slope? Include units.
- How much force would be required to produce a stretch of .60 m?
- *Answer: 10 N / 0.30 m = 33.3 N/m; 20 N→.60 m*

Question of the Day



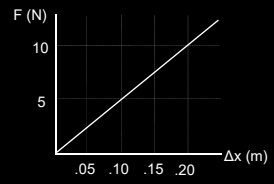
- The above data was collected from a spring. What is the "spring constant"?
- *Answer: spring constant = slope on F vs. Δx graph = 10 N / .20 m = 50 N/m*

Question of the Day



- How much energy is stored in the spring by stretching it 0.10 m?
- *Answer: E_{el} = ½*(5 N)*(0.10 m) = 0.25 J*

Question of the Day

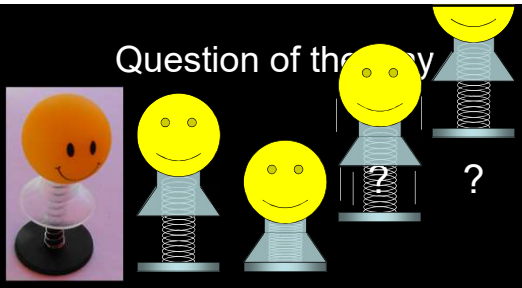


- How much energy is stored when
  - …the spring is stretched to 0.10 m?
  - …the spring is stretched to 0.20 m?
  - How do these two amounts compare to each other (by what factor do they differ)?
- *Answer: 0.25 J, 1.0 J, twice the stretch but four times the energy since E_{el} depends upon Δx^2.*

Question of the Day

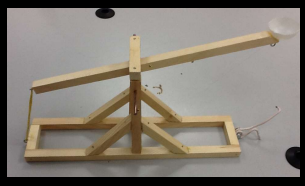
- If 10 J of energy are stored by stretching a spring 10 cm, how much energy would be stored by stretching it 30 cm?
- *Answer: Since E_{el} depends upon Δx^2, changing the length by a factor of 3 changes the E_{el} by a factor of $3^2 = 9$.*

Question of the Day



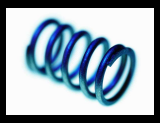
- A spring pop-up toy is compressed against a surface.
  - Where is the energy stored?
  - Then, what happens to the energy?
- *Answer: Initially the E is stored elastically in the spring, then kinetically by the toy's motion, then gravitationally when at the peak of its trajectory, then kin. as falls down.*

Question of the Day



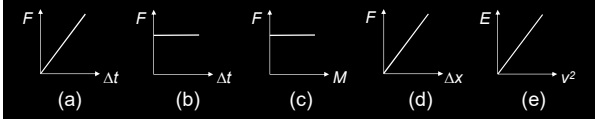
- Describe ways that your catapult illustrates the Law of Conservation of Energy.
- *Answer: transfer E into system by pushing on arm and stretching spring, E stored elastically, then E_k, then E_g*

Question of the Day



- Stretching a spring twice as far requires ___ times as much **force**.
- Stretching a spring twice as far requires ___ times as much **energy**.
- *Answer: twice as much force, four times as much energy*

Question of the Day



- The area on which of these graphs represents energy?
- *Answer: Area on Force vs. displacement (Δx or Δy) represents energy.*

Question of the Day

- Which requires more energy, lifting 9 kg a vertical distance of 2 m, or lifting a 500 g mass a distance of 36 m?
- *Answer: (9 kg)(9.8 N/kg)(2 m) = 176.4 J = (.500 kg)(9.8 N/kg)(36 m)*

Question of the Day

- A box is being pushed across a floor at a constant velocity. Is energy being transferred to the system?
- *Answer: Yes, since force is being applied across a distance, but speed is not increasing, the E_{therm} in system is increasing.*

Question of the Day

- Complete the following:
  - If a spring is stretched twice as far, it will store ___ times as much energy elastically.
  - If a mass is lifted twice as far, it will store ___ times as much energy gravitationally.
  - If a mass is pushed twice as far across a surface, it will store ___ times as much energy thermally.
  - If a mass is moving twice as fast, it will have ___ times as much energy stored kinetically.
- *Answer: four, two, two, four*

Question of the Day

- The total amount of the energy in the universe is:
  a. Increasing
  b. Decreasing
  c. Constant
- *Answer: "c. Constant", The Law of Conservation of Energy, energy is never created or destroyed, only stored or transferred*