

Problem Set #9 Heat, Temperature, Thermal Energy, and Work  
 Due Thursday February 13 A/B and Friday February 14 C/D

Name: Key

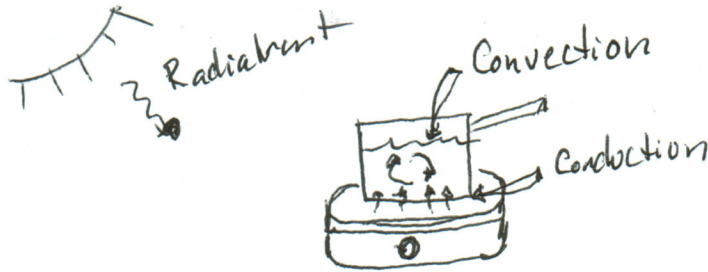
I worked with:

Equations

|                                       |                         |
|---------------------------------------|-------------------------|
| Force:                                | $F = ma$                |
| Force due to Gravity on Earth:        | $F = mg$                |
| Acceleration due to gravity on Earth: | $g = 9.8 \text{ m/s}^2$ |
| Work                                  | $W = F \cdot d$         |

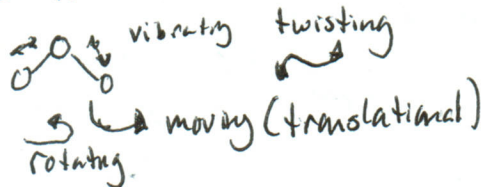
1. Using words and pictures describe the concept of Heat

Heat is the transfer/movement of thermal Energy

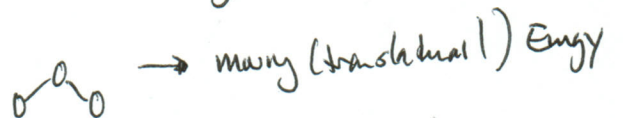


2. Using words and pictures describe Thermal Energy and Temperature. Make sure to talk about how they are different.

Thermal Energy is the total molecular kinetic Energy of a system.



Temperature is a measure of the average molecular kinetic Energy of a system



↳  $\frac{\text{Translational Thermal Energy}}{\text{\# of molecules}}$

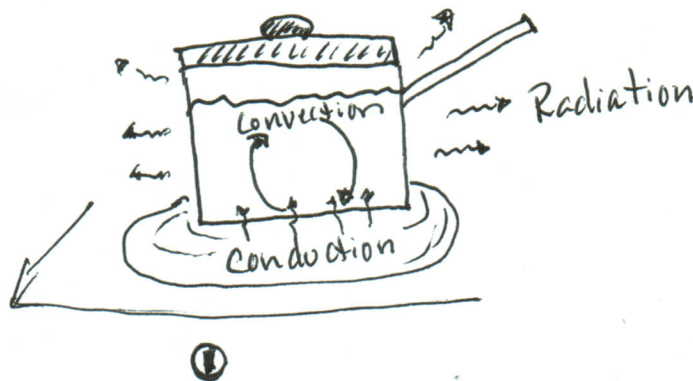
3. A crane lifts a shipping container that weighs 2300 kg fifteen meters onto the deck of a container ship. How much work did the crane do?

$$\text{Work} = \text{Force} \times \text{Distance}$$

$$\text{Force} = ma = mg = 2300 \text{ kg} \cdot 9.8 \text{ m/s}^2 = 22,540 \text{ N}$$

$$W = F \times d = 22,540 \times 15 = 338,100 \text{ J}$$

4. Last night I made spaghetti for dinner. I boiled the water for my noodles with the lid on. Below draw a model of how heat flow occurred in my boiling water (before I put the noodles in). Make sure to indicate and label the heat flow, say what kinds of heat transfer are occurring, and finally state what type of thermodynamic system my pot of boiling water is.



Closed System:

- Lid is on so water and air molecules can't leave
- Energy can get in and out of system in the form of heat transfer