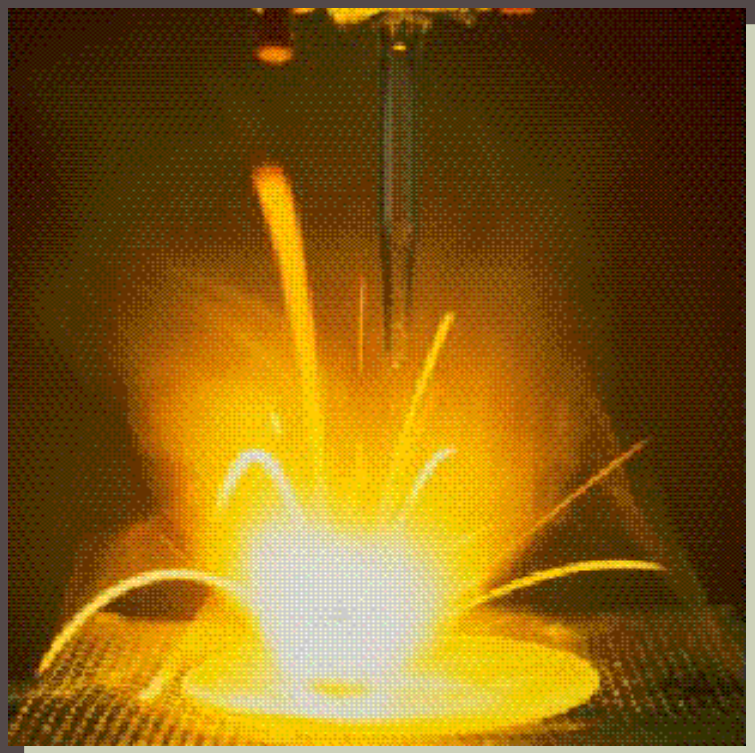
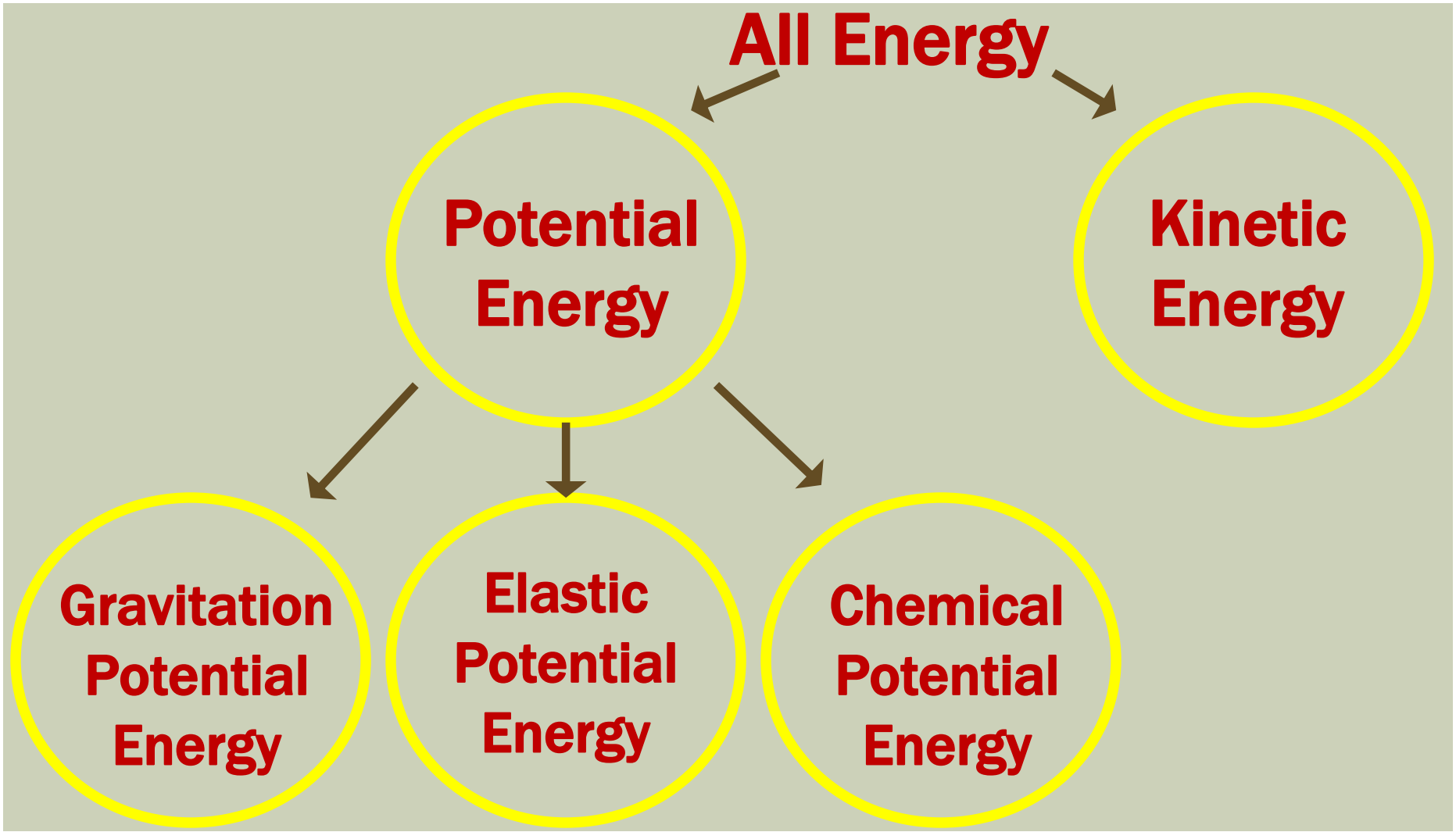
ENERGY & CHEMICAL CHANGE



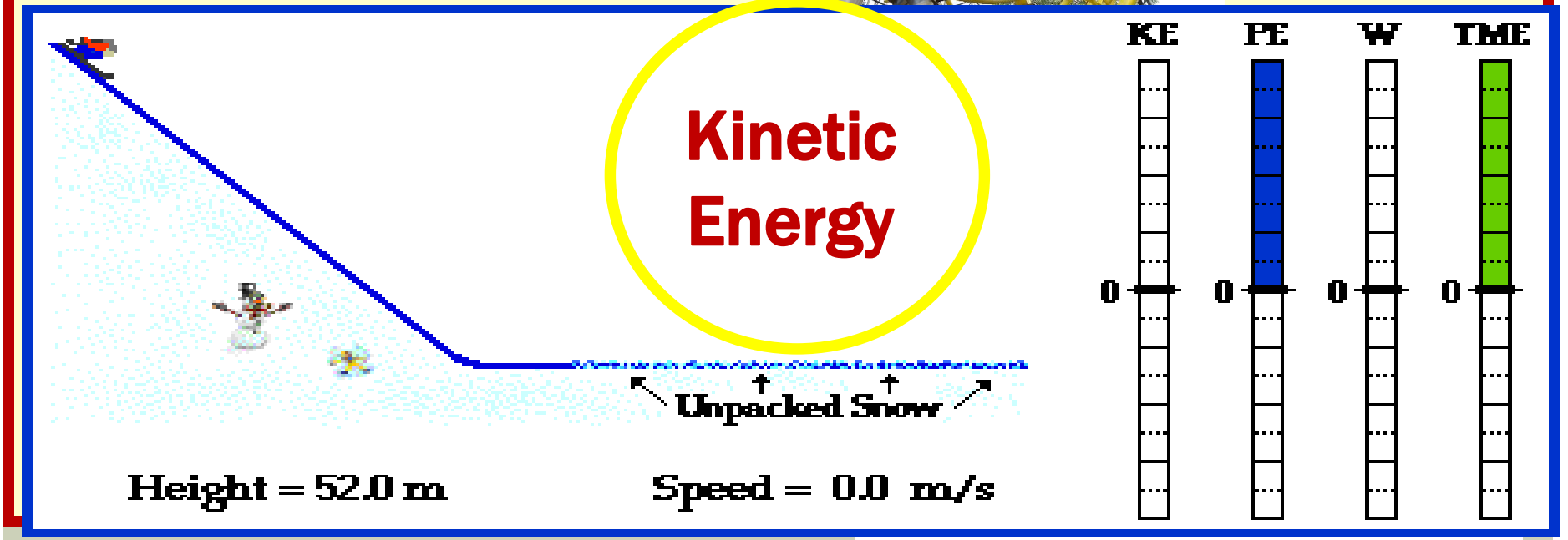
Chapter 16

ENERGY: CAPACITY TO DO WORK!



KINETIC ENERGY

- Energy an object ho
  due to its motion

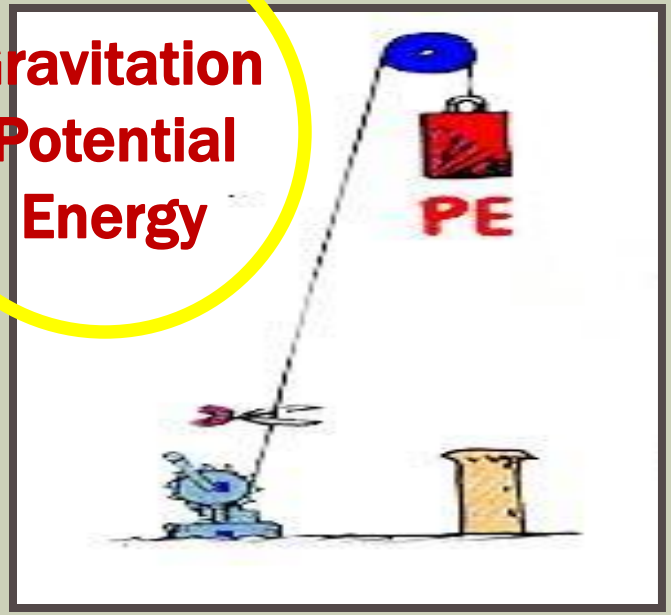


POTENTIAL ENERGY

- Energy that is stored and waiting to be used later

Elastic Potential Energy

Gravitation Potential Energy



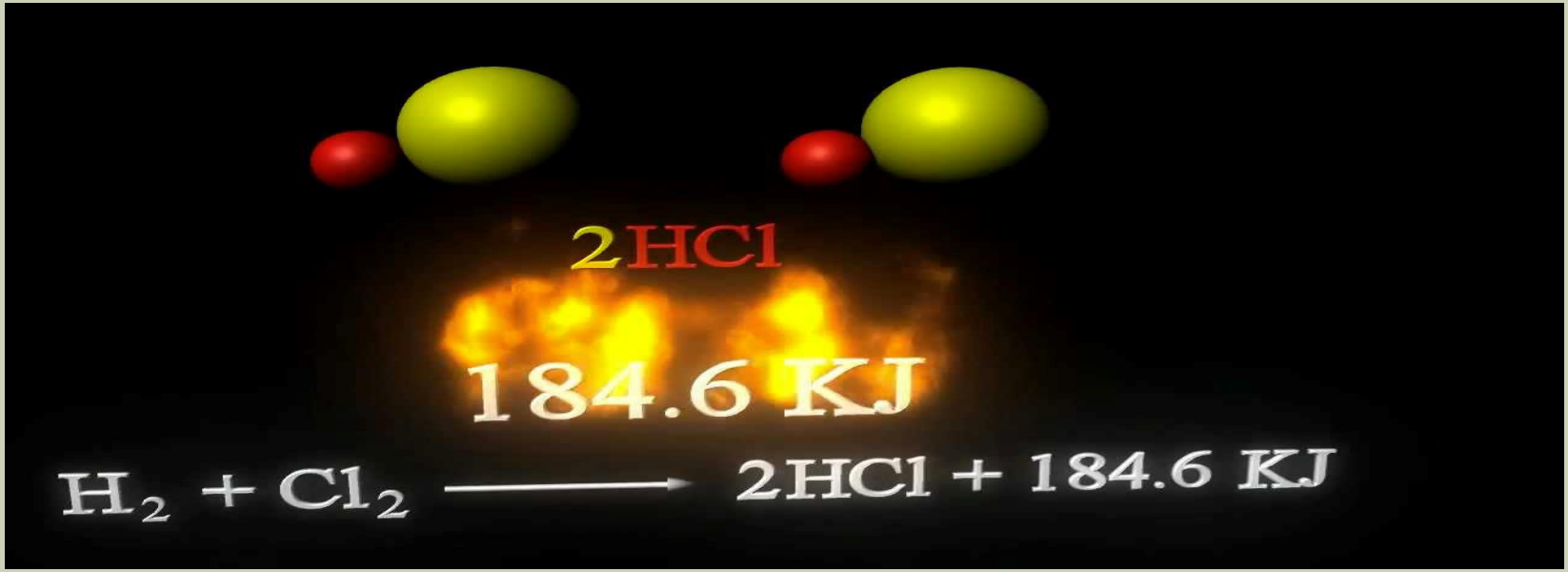
CHEMICAL POTENTIAL ENERGY

- Potential energy stored within the chemical bonds of an object

Chemical Potential Energy

THERMOCHEMISTRY

- Study of energy changes during chemical reactions

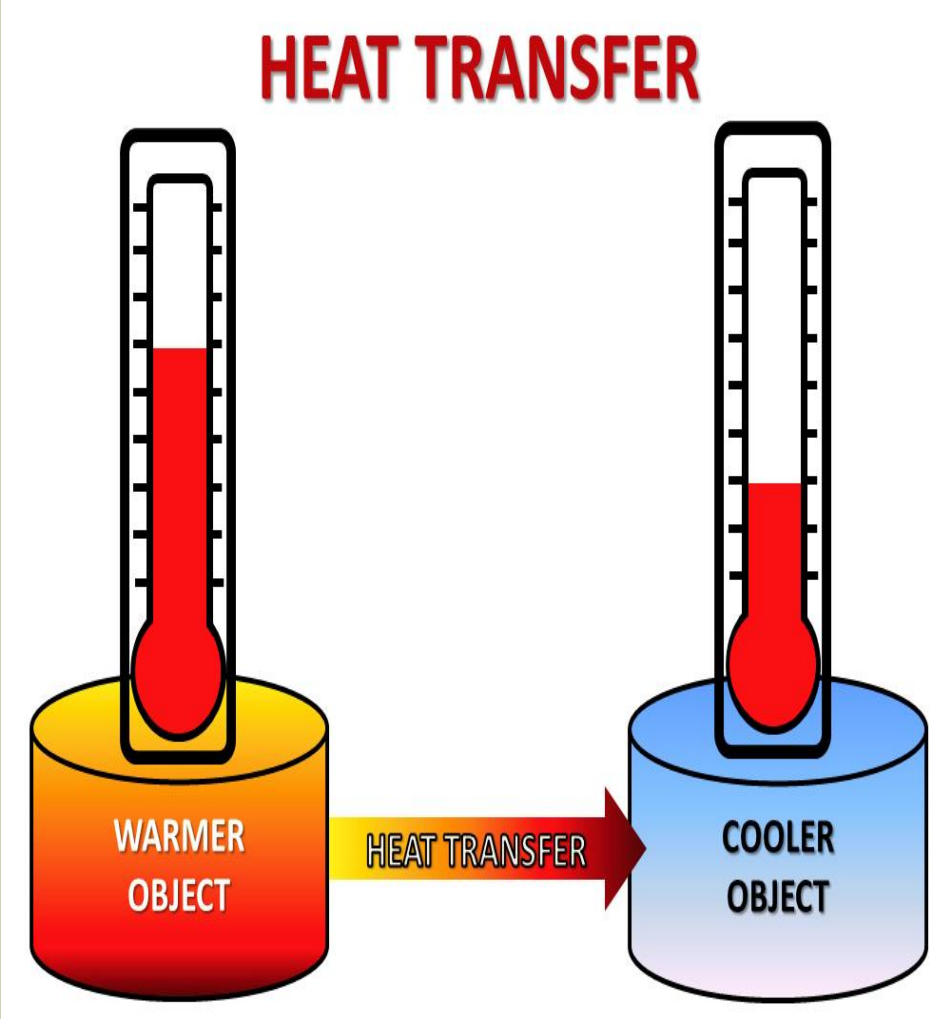


HEAT (Q)

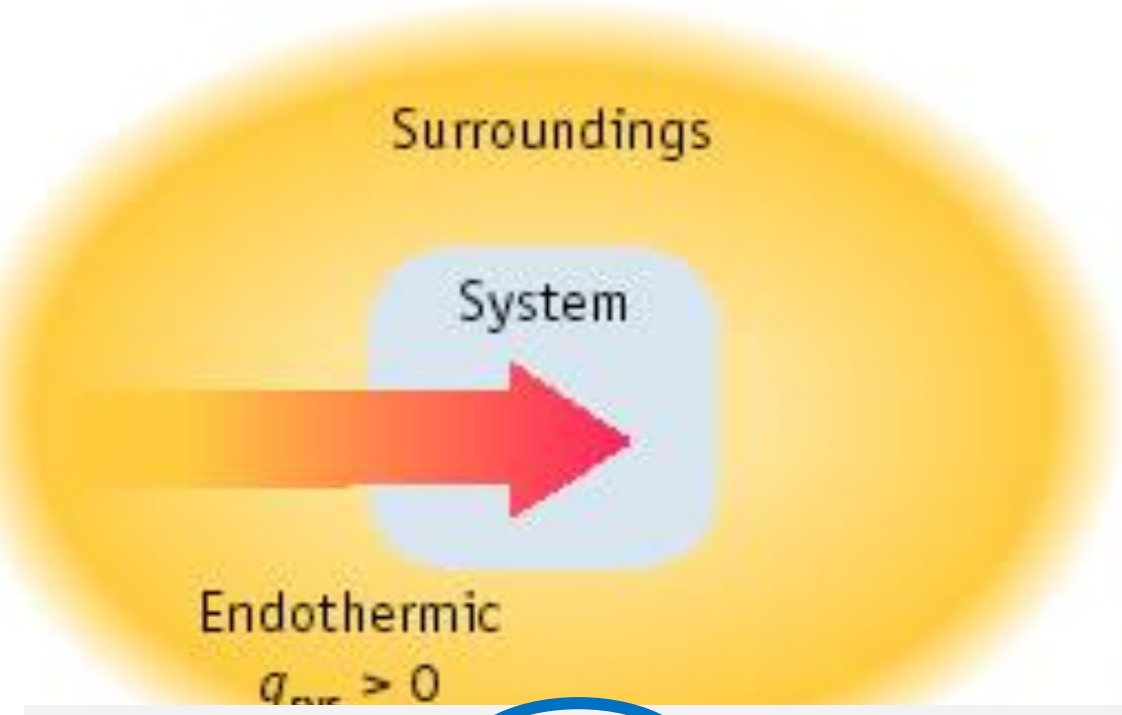
- Energy transferred from warmer objects to cooler ones.

- **System** – the part you are studying

- **Surroundings** – everything else



ENDOTHERMIC: HEAT TRANSFERS FROM SURROUNDINGS TO THE SYSTEM.

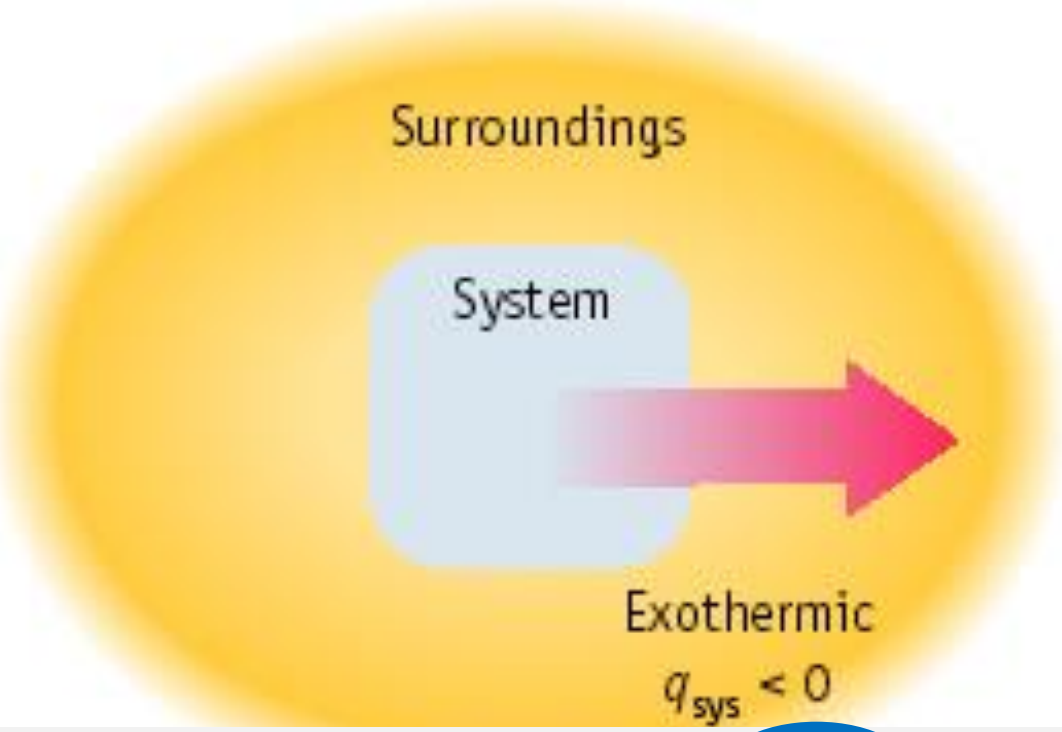


Heat is gained or lost?

So, temp in system goes? UP

Temp of the surroundings goes DOWN.

EXOthermic: heat transfers from SYSTEM to SURROUNDINGS.

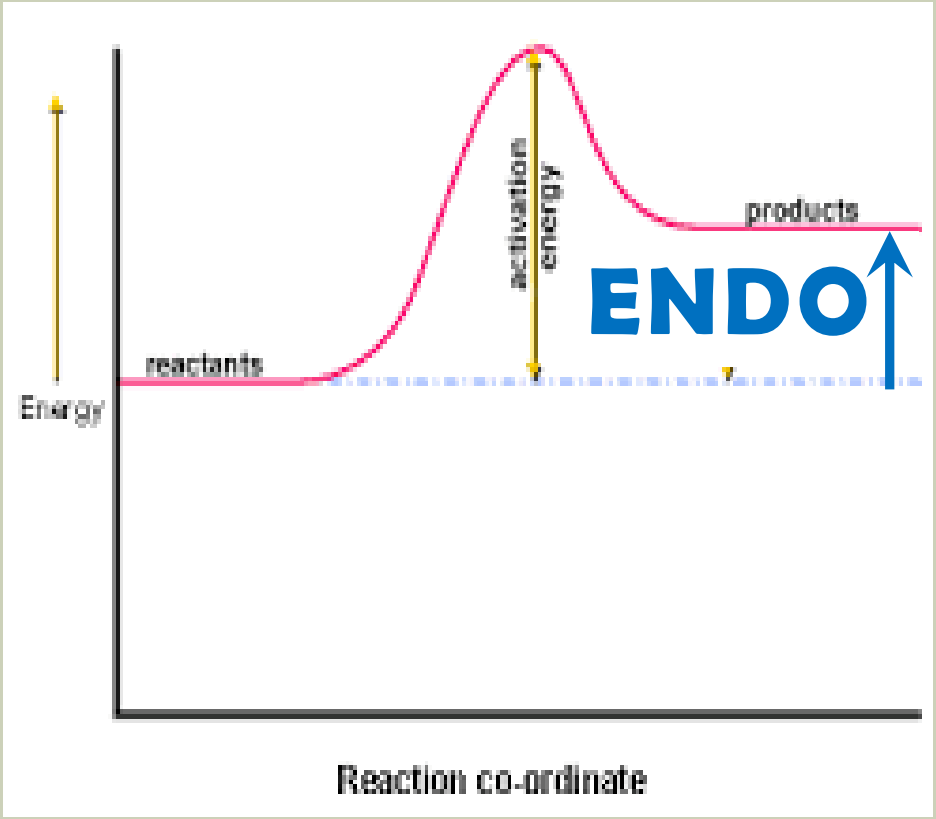


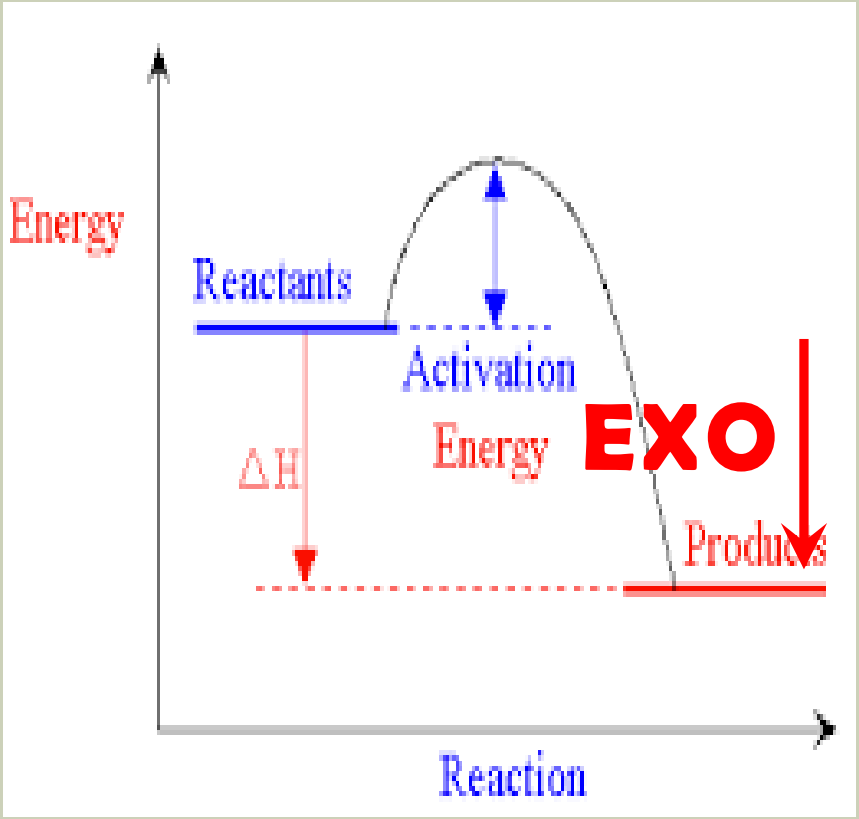
Heat is gained or lost?

So, temp in system goes? DOWN

Temp of the surroundings goes UP.

EXO- OR ENDO- THERMIC?



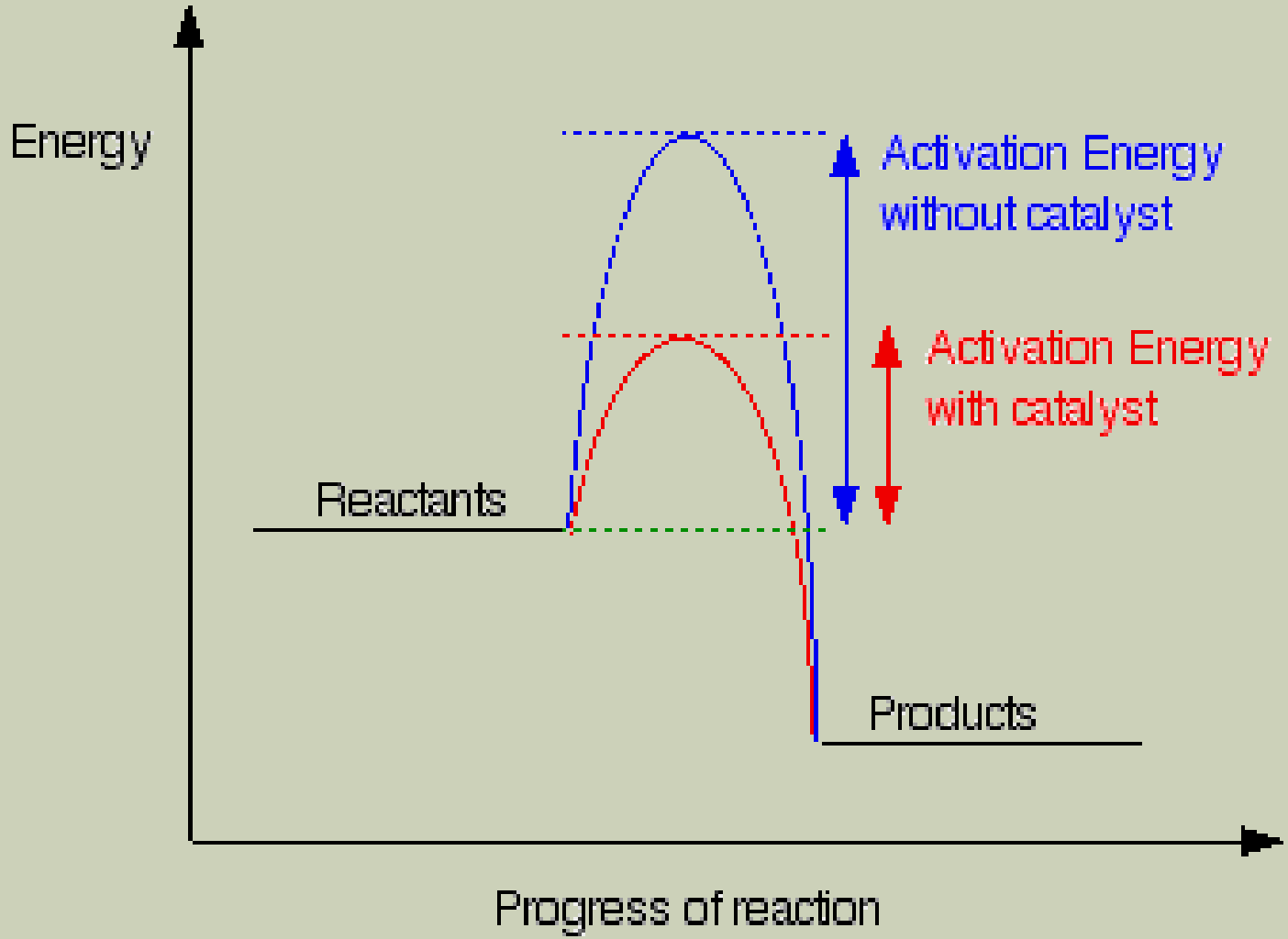


- Activation energy – energy required to start a reaction

FIND ONE PARTNER… EXOTHERMIC VS. ENDOTHERMIC

- Exothermic – person on the right
- Endothermic – person on the left
- Become an expert and then share
  - Heat Transfer?
  - System vs. Surroundings?
  - Temp change? How does it feel?
  - What does the graph look like? (Looking for the one with the hill in it)

CATALYST – SPEEDS UP a reaction by lowering the activation energy



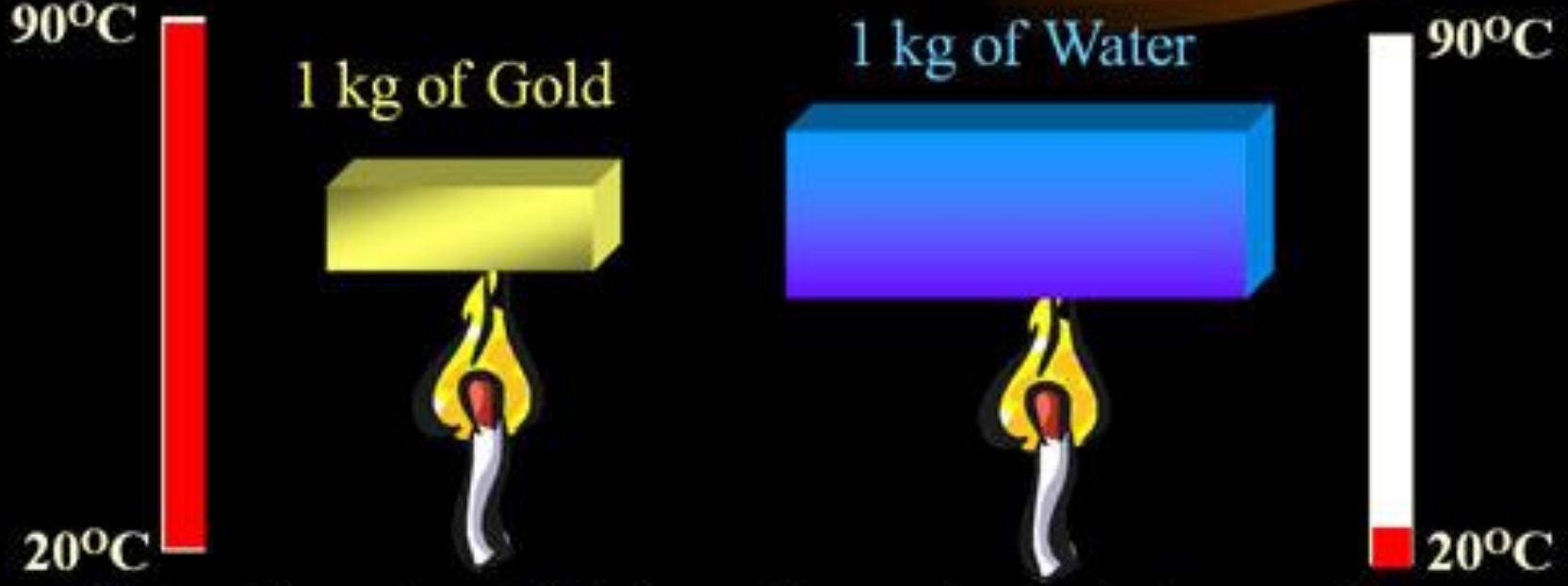
HEAT CAPACITY

The heat required to raise an object's temp(T) by **1°C**.

Which has the larger heat capacity?

- Depends on mass and matter
- **greater mass = greater heat capacity**

Different materials store different amounts of heat energy.

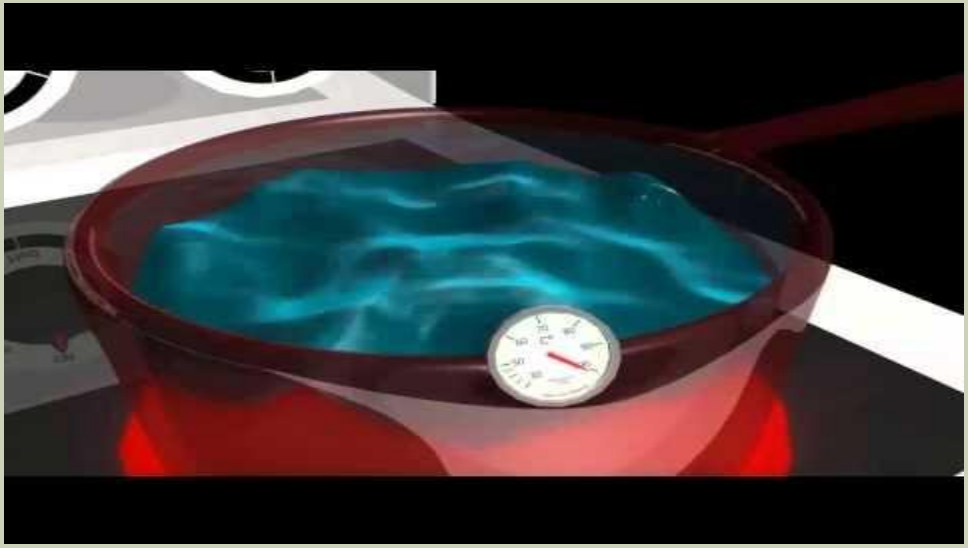


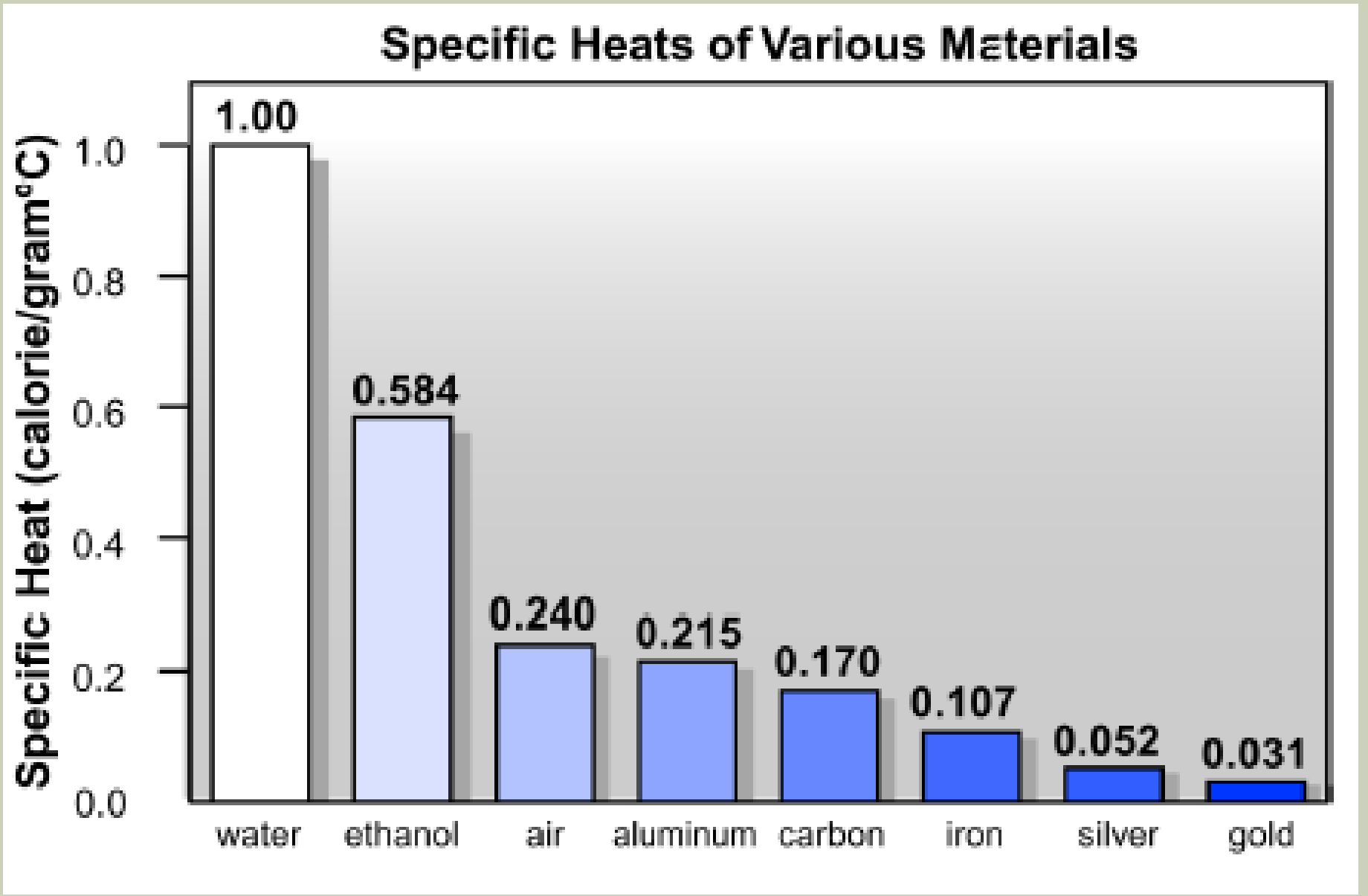
Water takes about 30 times longer to heat than gold, meaning it stores about 30 times more calories.

SPECIFIC HEAT (C)

- The amount of heat it takes to raise the temp of 1 g of a substance 1°C.
  - Water has a high specific heat of 4.184 J/g°C

    Higher C = slower heating = takes more energy (J)




Specific Heats of Various Materials
Specific Heat (calorie/gram°C)
1.0
0.8
0.6
0.4
0.2
0.0
1.00
0.584
0.240
0.215
0.170
0.107
0.052
0.031
water
ethanol
air
aluminum
carbon
iron
silver
gold

ENERGY EQUATION

$$q = m\,C\,\Delta T$$

- **q** = Heat (joules)
- **m** = mass (grams)
- **C** = Specific Heat (J/g°C)
- **ΔT** = change in temp ($T_{final} - T_{inital}$)

PRACTICE PROBLEM

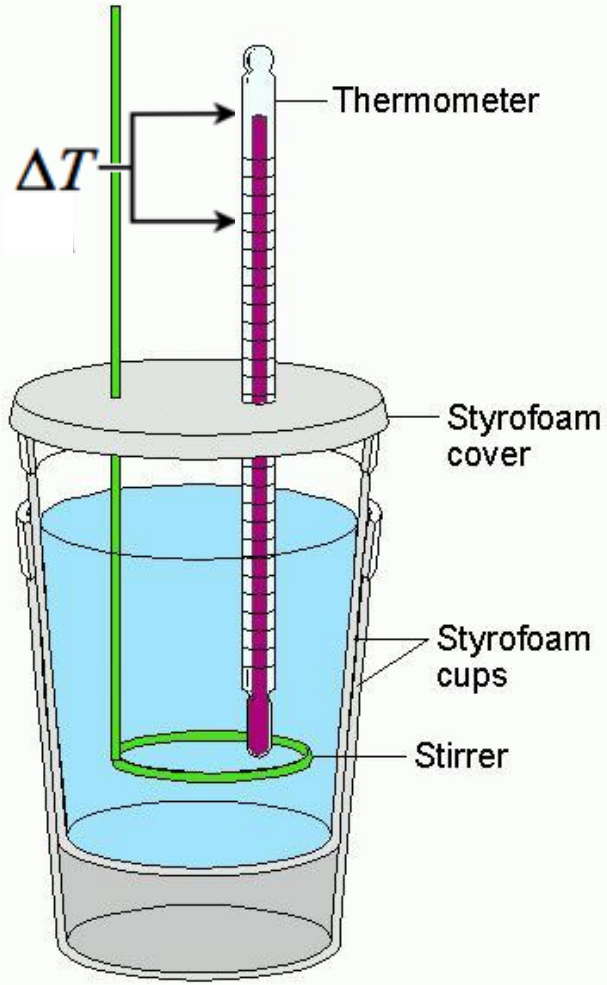
- Heat is added to a beaker containing 55.0 g of water at 52°C is boiled at 100.0°C. How much heat is needed?

CALCULATING SPECIFIC HEAT

1. The temperature of a piece of copper with a mass of 95.4 g increases from 25.0°C to 48.0°C when it absorbs 849 J. What is the specific heat of the metal?

2. When 435 J of heat is added to 3.4 g of olive oil at 21.0°C the temperature increases to 85.0°C. What is the specific heat of the oil?

CALORIMETRY



If T drops in system:

ΔT & q will be negative :

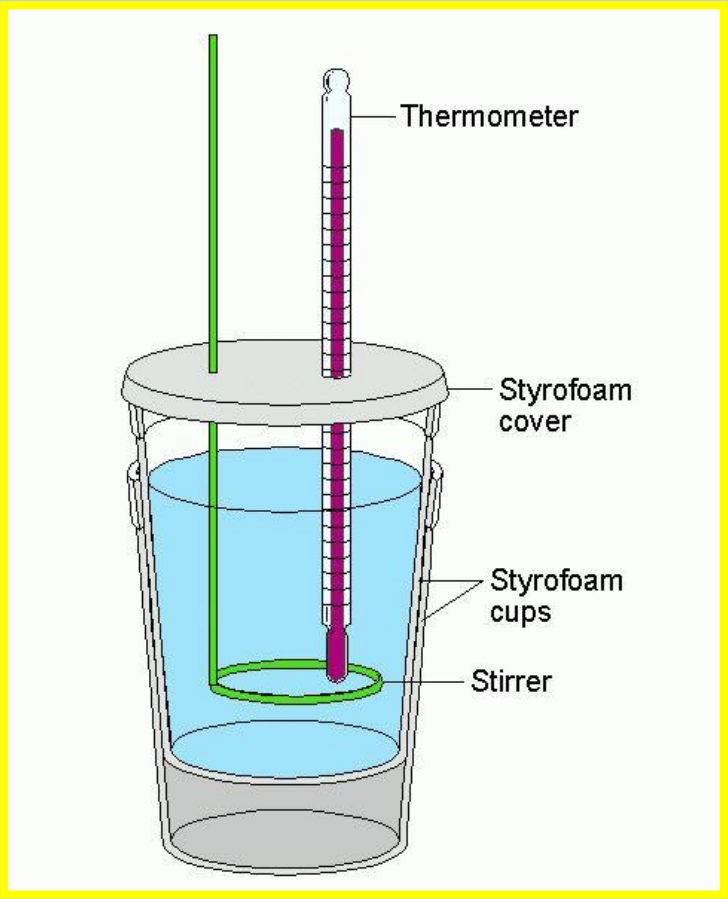
exothermic

If T rises in system:

ΔT & q will be positive :

endothermic

CALORIMETRY



1. If dissolving a solid lowers the temp of 100ml of water 3.5°C, how much energy was released?

2. If 335g of water at 65.5°C loses 9750 J of heat, what is the final temp of the water?

ENERGY PRACTICE…

1. If heat is released by a chemical system, an equal amount of heat is _____
   a. Absorbed by the surroundings
   b. Released by the surroundings
   c. Absorbed by the universe
   d. Released by the universe

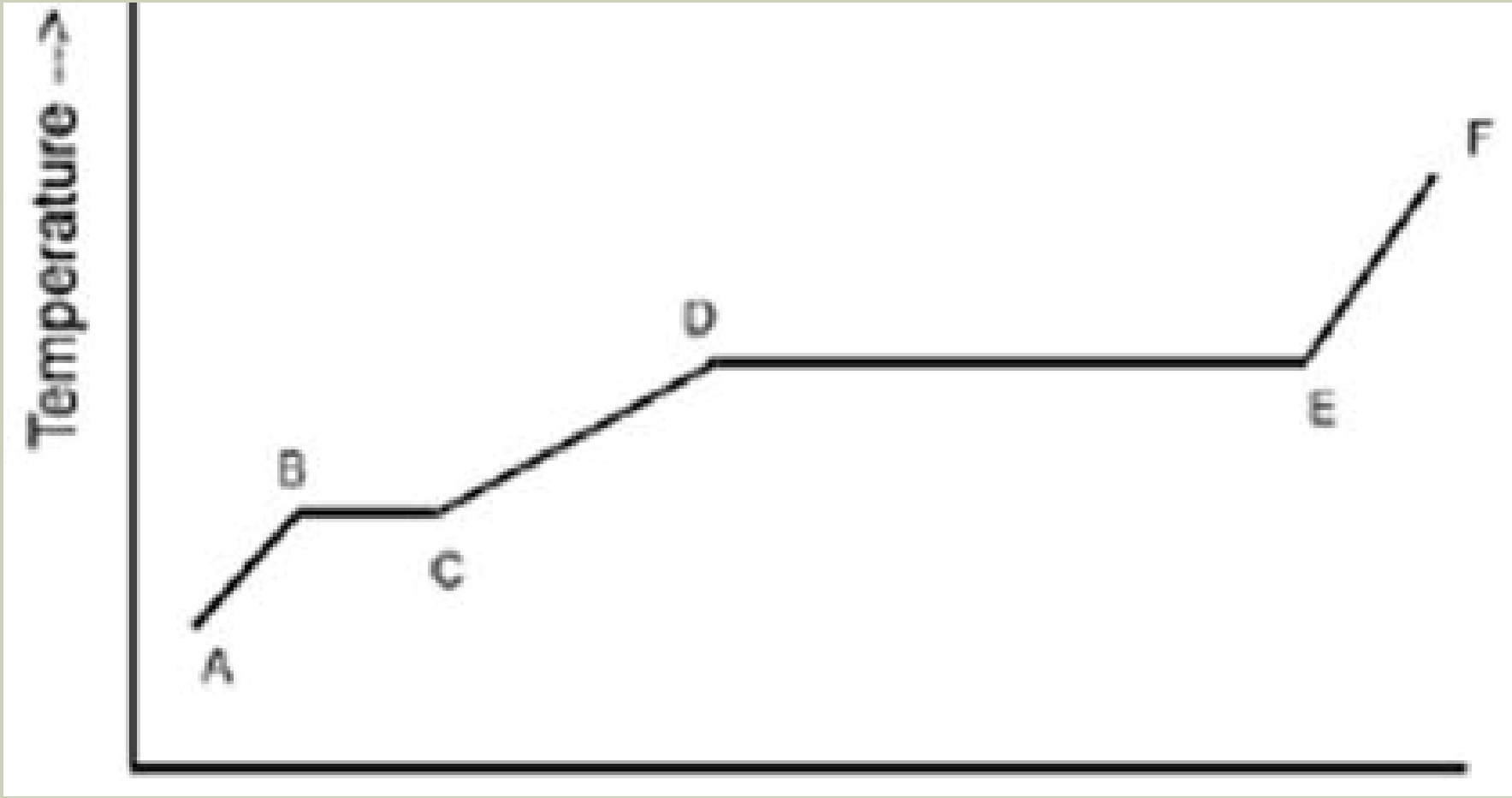
2. Which element has 8 valence electrons?
   a. Potassium
   b. Oxygen
   c. Helium
   d. Neon

BELL RINGER – PACKET, CALCULATORS

1. Draw the graph for exothermic and draw a line showing the addition of a catalyst.

2. Which of the following is exothermic?
   a) Freezing of water
   b) Melting of iron
   c) Vaporization of ethanol
   d) Sublimation of iodine

WHAT DOES THIS SHOW??



MATH EXAMPLES

1. How much energy is needed to change the temperature of 4.56 g water from 35.0^{0}C to 85.0^{o}C?

2. How much energy is needed to change 2.5g of ice at -13.0^{o}C to steam at 112.0^{c}C?

3. How much energy is needed to boil 53.7g of water?

4. How much energy is needed to raise the temperature of 100.0 g ice from -50.0^{0}C to -10.0^{0}C?

BELL RINGER – YELLOW PACKET, CALCULATOR

1. 6.00 g of gold was heated from 20.0 C to 22.0 C. How much heat was applied?

2. How much energy is absorbed when 4.56 g of ice melts?