CHEM 103: Chemistry in Context

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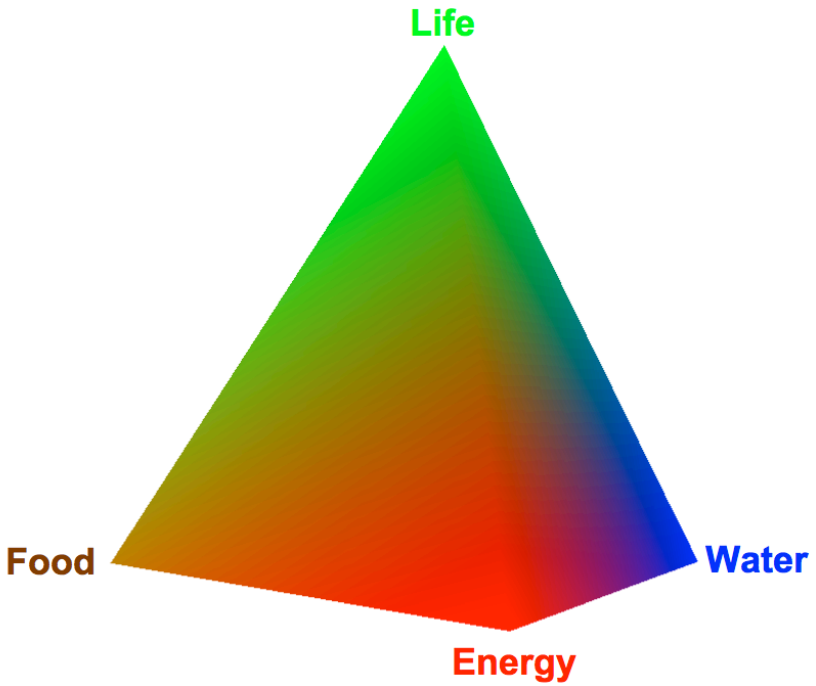


Colorado State University

If you were going to do one thing to help the world's energy security, energy supply, sustainable environment challenge which one of the following should you do?

1. Recycle paper

2. Drive slower

3. Eat less red meat

How do we address this question?

How much do “we” use?
How much energy does the process take?

1. Find 1’s
2. Multiply by 1’s

Recycling paper:
There are 314,000,000 of us in US
we use between 70,000,000 and 110,000,000 tons of paper each year

So 314,000,000 people = 70,000,000 tons of paper

$$\frac{314{,}000{,}000 \text{ people}}{314{,}000{,}000 \text{ people}} = \frac{70{,}000{,}000 \text{ tons of paper}}{314{,}000{,}000 \text{ people}} \Rightarrow 1 = 0.22 \text{ tons/person}$$

& 314,000,000 people = 110,000,000 tons of paper

$$\frac{314{,}000{,}000 \text{ people}}{314{,}000{,}000 \text{ people}} = \frac{110{,}000{,}000 \text{ tons of paper}}{314{,}000{,}000 \text{ people}} \Rightarrow 1 = 0.35 \text{ tons/person}$$

How do we address this question?

Each of us uses between 0.22 & 0.35 tons per year

It takes 2,400,000 Calories of energy to produce a ton of paper

2,400,000 Calories of energy = a ton of paper

$$\frac{1 \text{ ton of paper}}{1 \text{ ton of paper}} = \frac{2{,}400{,}000 \text{ Calories}}{1 \text{ ton of paper}} \Rightarrow 1 = 2{,}400{,}000 \text{ Calories/ton}$$

Mutliply by 1

$$\frac{0.22 \text{ tons}}{\text{person}} \times \frac{2{,}400{,}000 \text{ Calories}}{\text{ton}} = 530{,}000 \text{ Calories/person}$$

$$\frac{0.35 \text{ tons}}{\text{person}} \times \frac{2{,}400{,}000 \text{ Calories}}{\text{ton}} = 840{,}000 \text{ Calories/person}$$

Recycling yields a 40% reduction in energy

Note: virgin paper uses tree scrap for heat
recycled paper uses fossil fuels

$$530{,}000 \text{ Calories/person} \times 0.4 = 212{,}000 \text{ Calories/person}$$
$$840{,}000 \text{ Calories/person} \times 0.4 = 336{,}000 \text{ Calories/person}$$

Recycling paper can save 212,000 & 336,000 Calories/person/year

Driving Slower

18-25 year olds drive 15,000 miles/year

"average" car gets 25 miles/gallon

a gallon of gas contains 24,000 Calories of energy

$$\frac{15{,}000 \text{ miles}}{\text{person}} \times \frac{\text{gallon}}{25 \text{ miles}} \times \frac{24{,}000 \text{ Calories}}{\text{gallon}} = 14{,}400{,}000 \text{ Calories/person}$$

10% savings (75 to 65 mph)= 1,440,000 Calories

DOE Driving Tips

Red Meat

"We" eat 25,600,000,000 pounds of red meat a year
& there are 314,000,000 of us

$$\frac{25{,}600{,}000{,}000 \text{ pounds of red meat}}{314{,}000{,}000 \text{ people}} = 75 \text{ pounds red meat/person}$$

A steer eats 13,000 pounds of grain/grass & produces 580 pounds of meat

$$\frac{13{,}000 \text{ pounds of grain/grass}}{580 \text{ pounds of red meat}} = 22 \text{ pounds grain/pound red meat}$$

Grain contains 1,840 Calories of energy per pound

$$\frac{75 \text{ pounds red meat}}{\text{person}} \times \frac{22 \text{ pounds grain}}{\text{pound red meat}} \times \frac{1{,}840 \text{ Calories}}{\text{pound grain}} = 3{,}036{,}000 \text{ Calories/person}$$

Eating 10% less red meat can save 303,600 Calories/person

Summary

Recycling can save 212,00 to 336,000 Calories/person

Driving slower (75->65 mph) can save 1,440,000 Calories/person

Eating 10% less meat can save 303,600 Calories/person

Recycling:

$$530{,}000 \text{ Calories/person} \times 0.4 = 212{,}000 \text{ Calories/person}$$

Double sided printing:

$$530{,}000 \text{ Calories/person} \times 0.5 = 265{,}000 \text{ Calories/person}$$

Not printing:

$$530{,}000 \text{ Calories/person} \times 1 = 530{,}000 \text{ Calories/person}$$

Fracking

Have you heard of it?

What is it?

Why are people concerned?

- uses water
- impacts ground water if not done right
  - BTX (benzene, toluene, xylene)
  - heavy metal ions

What you'll learn in the course

1. Molecular structure: function/activity follows structure
    - like dissolves like
    - what do biological molecules look like
        - sugars
        - proteins
        - fats
        - nucleic acids

2. How much (quantity) matters
    - a. mass
    - b. energy

3. Types of reactions
    - a. condensation reaction
    - b. acid-base reaction
    - c. oxidation-reduction reaction

CHEM 103, Unit 1.1

Chemistry Bootcamp

Structural Chemistry—building up molecules from atoms, introducing solubility issues

(target example: active ingredient in chiles)

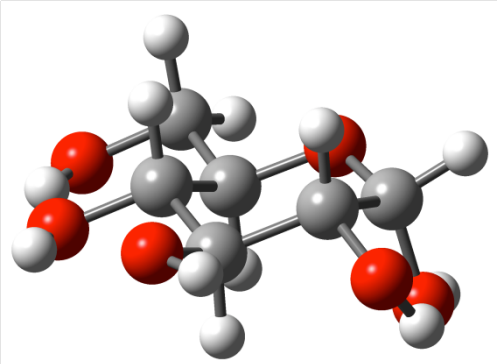
Structural Chemistry: Sweet, Fatty & Spicy

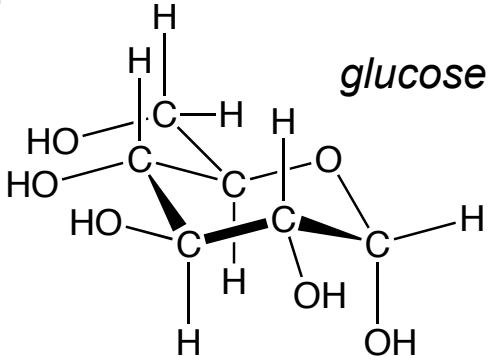
Molecular structure helps us understand:

How compounds react & are changed

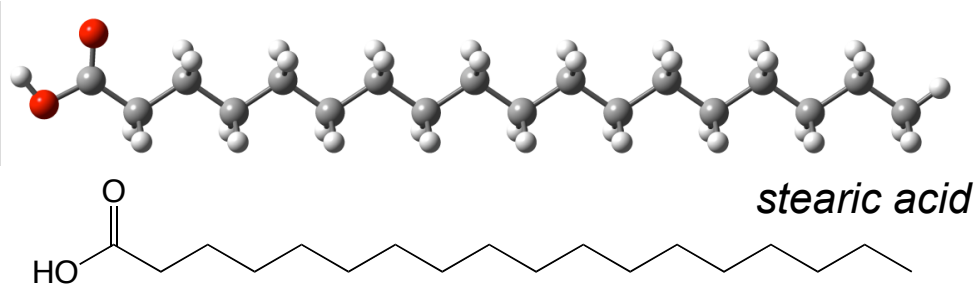
What will dissolve in (be soluble in) what

What biological molecules look like
& a bit about how they work

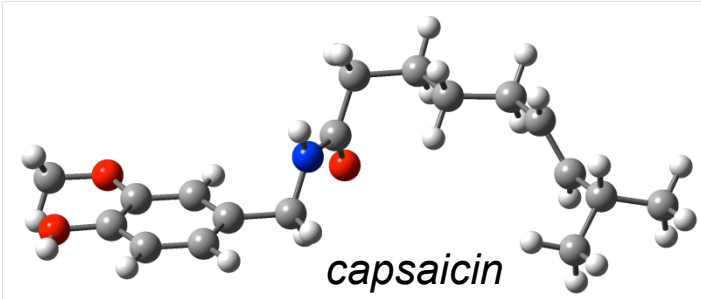




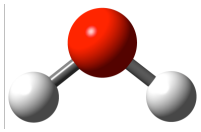
glucose



stearic acid



capsaicin



water