





nutrient availability and taste (leg of catch of the day fallen into a cave fire)







Scientific Method

Scientific approach to ice cream

- initial questions – how can we make fat free ice cream

- Hypothesis is generated to drive the experiment
 - Solves the problem or question and designs experiments to support or falsify (not prove) the hypothesis
- Hypothesis might be that the addition of a nondigestible fat will make the ice cream tasty
 - Then design an experiment to test the hypothesis...







































| The Science of Cooking | Hydrogen Bonds | | |
|--|---|--|--|
| Electronegative covalent bonded | Increasing Electronegativity | | |
| atoms will have a partially negative (polar) bond when bonded to a less electronegative atom The result is a slightly negative and slightly negative and Basility in the second strength of the second strengt | H B C T F B C T F B C T F B C T F B C T F B C T T F B C T T F B C T T F B C T T F B C T T F B C T <tht< th=""> <tht< th=""> <tht< th=""> <tht< th=""></tht<></tht<></tht<></tht<> | | |
| bond between two atoms. | K Ca Sc II V OF Nin Pe Co Ni Cu Zn Ga Ga Sc Sc </td | | |
| N or S are bonded to H | Col Dis Limit for the transformation of the t | | |
| This is a special type of dipole- | **Action service Target Target <thtarget< th=""> <t< td=""></t<></thtarget<> | | |
| This allows the partially positive charged H to bond to a partially negative acceptor atom (primarily O and N atoms in food) | | | |





Hydrophobic Interaction

Water molecules can not H bond to nonpolar molecules (non charged) and the water molecules are forced to H bond with each other forming an ordered shell around the molecule



Entropy – is the state order of a system • The second law of thermodynamics is that for a process to proceed entropy must increase • This means the more disorder the more favorable a process



Simple Acid and Base Chemistry

Acids are any compound that produces a hydrogen ion (H⁺) Bases can be thought of as a compound that removes H+ or adds OH-

Acids and bases react to neutralize each other as they form water H^{*} + OH^{-} -> H_{2}O

The pH scale is a measure of the balance of both protons and hydroxide ions; it ranges from the most acidic (pH=0; 10¹ H⁺ and 10^{-14} OH⁻ moles/liter concentration) to the most basic (pH=14; 10^{-14} H⁺ and 10^1 OH⁻ moles/liter concentration).



The Latin term for vinegar, *acetum* is related to the *acidus*, and has been around since antiquity to describe our food and drink.

- Muscle acid Lactic acid
- Vinegar acetic acid
 Eruit acid citric acid
- Fruit acid citric acid
 Candy acid Oxalic
- Candy acid Oxa acid



H+ = sour



The Science of Cooking

Under the right conditions some strains of bacteria will produce lactic acid or acetic acid making food sour and curdle

Ceviche is a raw or partially cooked shrimp and seafood acidified by citric acids in lemon and limes – the lower pH reduces many harmful bacterial growth and denatures/tenderizes the seafood

Use of acids in food and cooking



Using Weak Acids to Make Ceviche. Raw shrimp is made tender and tangy by weak acids in citrus juices.













Protein Function

Proteins play many roles in cells

- Transport compounds in and out of the cell
- Structural components
- · Catalysts (enzymes)
- ✓ Lipases digest fats in aged cheese
- ✓ Proteases breakdown proteins creating umami flavor and tenderizing meat













Starch

Unreactive sugar polymer important in cooking

- Bonds to many water molecules at a time
- Forms shells of water
- Binds and interacts with other molecules
- Acts as a thickener due to the long polymer shape think of tangles of hair
- With minimal water forms solid gel

Found in tubers (roots) and rice, seeds (corn)

 Makes things sticky (rice, noodles) and can act to separate proteins from binding to each other!













• Fatty acids are bonded to the backbone by an ester bond



| Fats and Fatty Acids Melting point | | | |
|--|---|---------------------|--|
| Hydrophobic interaction between fatty acid chains depends on shape and "stacking" | | | |
| The more ordered and well stacked the more the van der Walls forces - hydrophobic contacts | | | |
| Triglycerides from different food sources | | | |
| Source | Fatty acids in triglycerides are | Physical appearance | |
| Animal triglycerides (<u>e.g</u> . butter, lard, tallow from cow, pig etc) | 50% Saturated, 50% unsaturated (1- 5% of the unsaturated is <i>trans</i>) | Solid (fat) | |
| some Fish triglycerides (<u>e</u> .g. fish oil) | Cis unsaturated and polyunsaturated (contain omega-3 fatty acids) | Liquid (oil) | |
| Plant triglycerides (e.g. peanut oil, olive oil, corn oil) | 85% Cis unsaturated and polyunsaturated, 15% saturated | Liquid (oil) | |
| Most animal fats saturated fatty ar unsaturated/poly | have a high proportion of cids, plant oils are higher in vunsaturated | | |





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