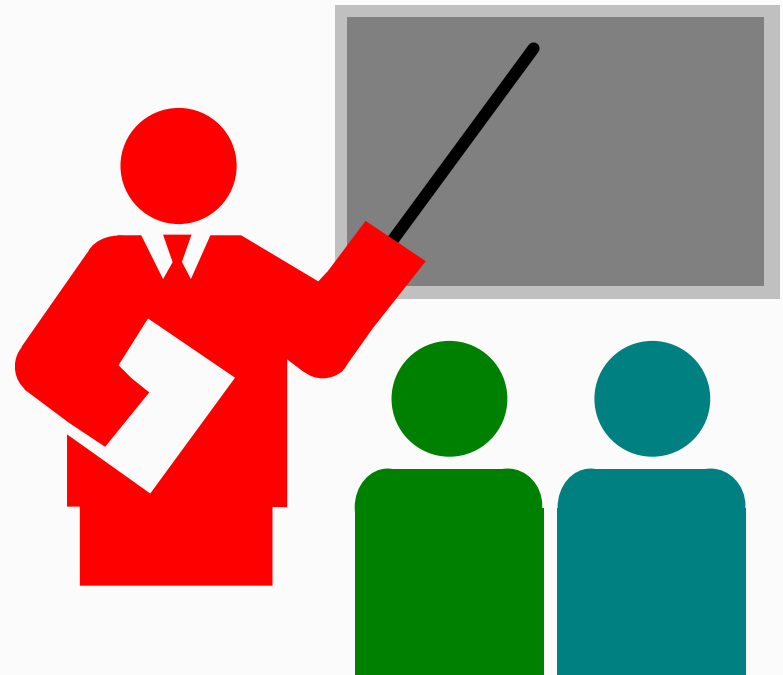




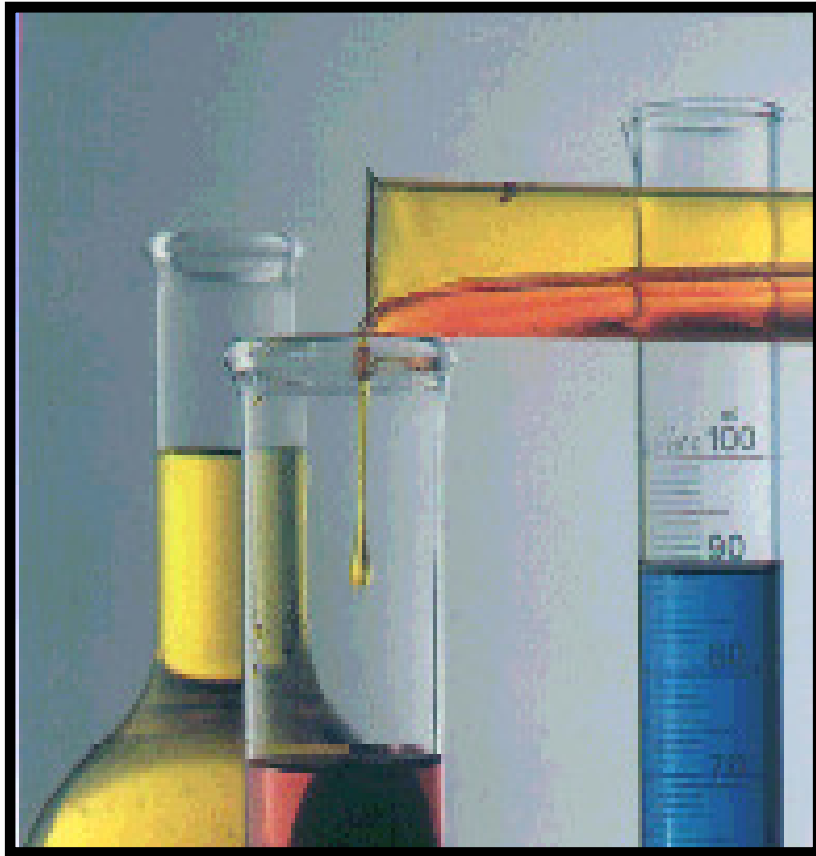
INTERACTIVE TRAINING

Module I: “Creating The Right Chemistry”

***Introduction and review of:
Basic Cleaning Chemistry,
Applications and Terminology***



PURPOSE OF MODULE



***To familiarize you with
the Janitorial /Sanitary
Maintenance industry***

***To assist you in choosing
the right product for a
particular application***

***To make you more
familiar with terminology
used in our industry***

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TOPICS FOR REVIEW



- ◆ ***History of Soaps & Detergents***
- ◆ ***Basic Cleaning Chemistry***
 - Principles of T.E.C.H.
 - How Detergents Work
 - Other Cleaning Terminology
 - The pH Scale - Alkaline, Acid and Neutral
 - Effects of pH on Cleaning Products
 - The Seven Cleaning Mechanisms
 - Soils and their Cleaning Mechanisms
- ◆ ***Soils Have a Multitude of Combinations***
- ◆ ***Role of Water in Cleaning***
- ◆ ***General Cleaning Products for Building Maintenance***
- ◆ ***Review Questions***

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◆ Early Soap Making / Cleaning



- *Use of water/ burning of fats with ashes by pre-historic man*
- *Pharmeceutical use of soaps dates back to 1500 BC*

◆ Evolution of Cleaning through the ages

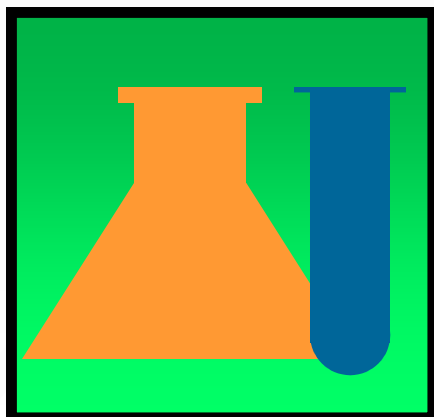
- *Lack of sanitation led to great plagues of Middle Ages*
- *Soapmaking becomes an established craft by 1600's*
- *Discovery by chemist Michel Chevreul of fatty acid components of soaps*

◆ Development of modern day detergents

- *Modern detergents had their genesis during WW I, when oils & fats were scarce in Germany*
- *Crude oils are widely used today as replacement for fat & oils*

The Principles of T.A.C.T.

| | |
|--|---|
| <p>Time Action <i>(Physical Action)</i> Chemical Temperature</p> | <p><i>Amount of dwell time that solution has contact on surface</i> <i>Amount and method of force used during cleaning</i> <i>Strength of the chemical solution</i> <i>Temperature of cleaning solution</i></p> |
|--|---|



TACT should be considered a cleaning equation which should be kept in balance in order for effective cleaning to take place. If one of the TACT components is not to optimum level, it probably will need to be compensated by a higher amount of one or more of the other components to maximize cleaning efficiency.

◆ Defining Some Terminology

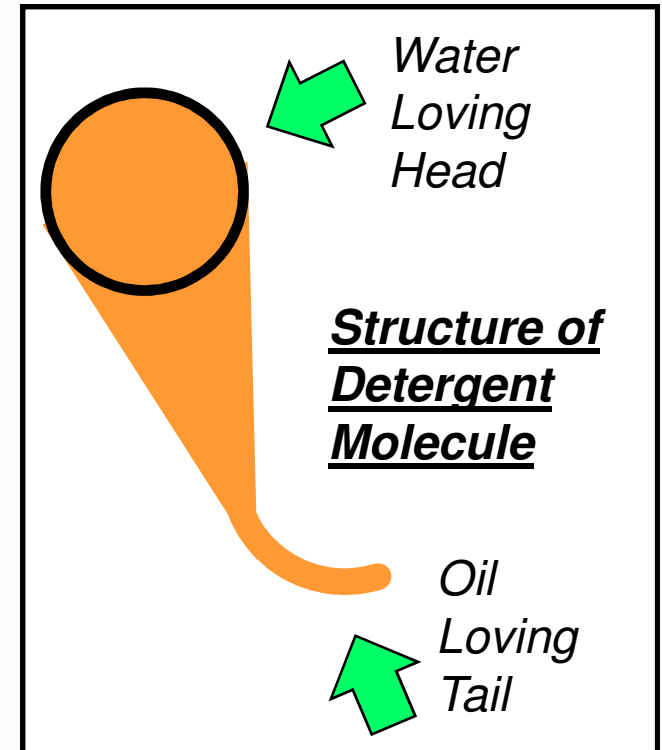
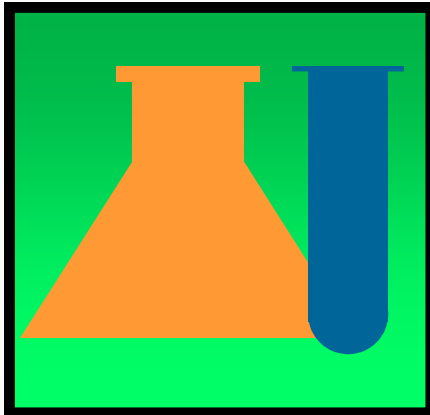
- Soap
- Detergent
- Synthetic Detergent

Hydrophobic - Water Fearing

Hydrophilic - Water Loving

Lipophobic - Oil Fearing

Lipophilic - Oil Loving



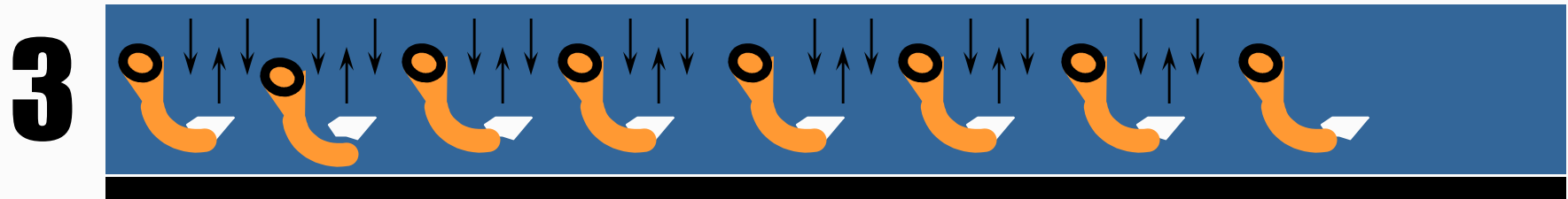
HOW DETERGENTS WORK



Plain water with soil on surface



Water & detergent (molecules latching to oily soil)



Assisted by Agitation (Mop, Brush, Sponge, etc.), detergent molecules surround oily soils and lift them from surface.

Other Cleaning Terminology

pH

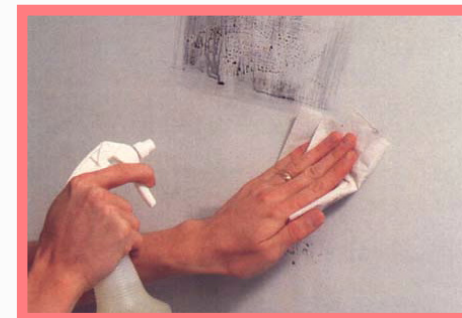
Detergent

Surfactants (Surface Active Agents)

Anionic (-) Negative Charge

Cationic (+) Positive Charge

Nonionic (0) No charge



Solvent -

A product that dissolves a material completely.

Used in cleaning to dissolve grease, oil and other

Soils.

Enzyme- Protein molecules produced by living organisms that aid breaking down organic soils.

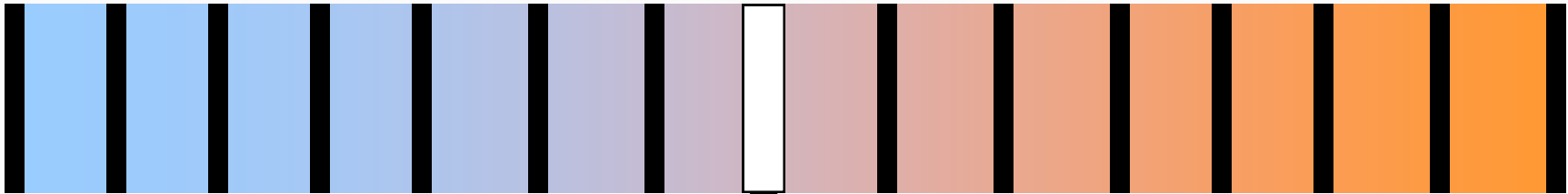
Disinfectant-

A product that destroys bacteria on hard surfaces.



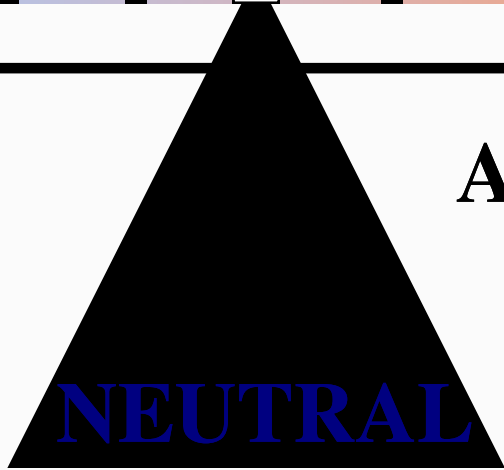
The pH Scale

0 1 2 3 4 5 6 7.0 8 9 10 11 12 13 14



ACIDIC

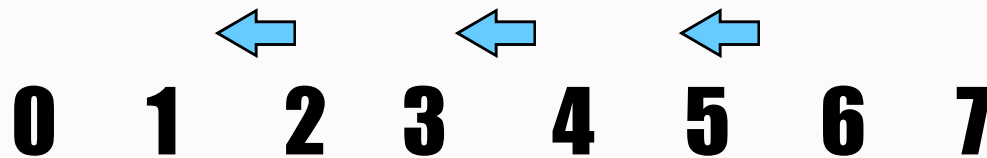
ALKALINE



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ACID BASE PRODUCTS

Acid base products range on the pH Scale from 7 to 0. As you drop down the scale, each number to the left of 7 is measured by an exponent of 10; for example, a product with a pH of 6.0 is 1 times as aggressive as a 7.0 pH, while a product with a 5.0 pH is 10 times more aggressive than the 7.0 pH. Products that are high in acid content can be up to 10 Million times more powerful than a neutral pH!



Acid base products work most effectively in areas where soil conditions are alkaline in nature.

EXAMPLES :

- Restroom Cleaning
- Locker Rooms
- Shower Areas

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | X |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | X | X | 0 |
| 0 | 0 | 0 | X | 0 | 0 | 0 |
| 0 | 0 | X | 0 | 0 | 0 | 0 |
| 0 | X | 0 | 0 | 0 | 0 | 0 |
| X | 0 | 0 | 0 | 0 | 0 | 0 |



Examples of acid base products include:

Toilet bowl cleaners

Shower room cleaners

Tub & Tile cleaners

Lime removers

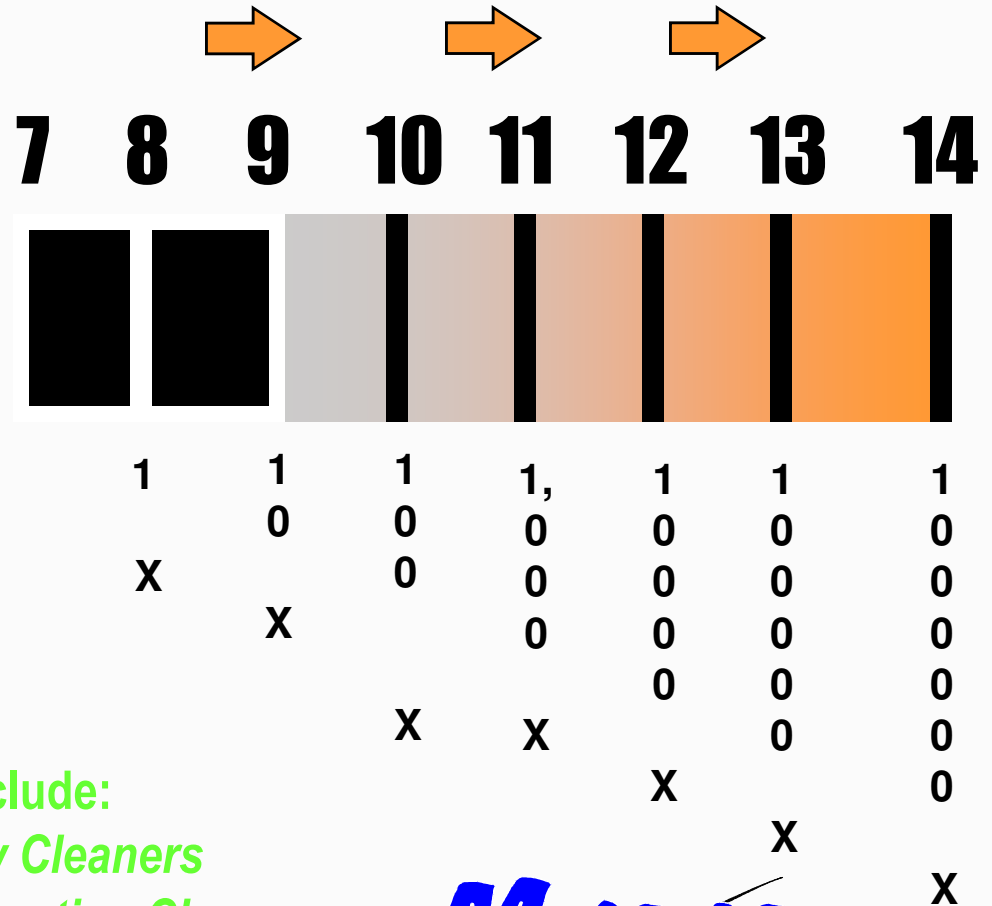
ALKALINE BASE PRODUCTS

Alkaline base products, like acids, increase in aggressiveness by a factor of 10 for each number that you increase on the scale.

Typically, alkaline solutions are effective against soils that are either acidic or neutral in nature.

EXAMPLES:

- Floor Cleaning/Scrubbing/Stripping
- General Cleaning
- Heavy Duty Cleaning/Degreasing
- Carpet Cleaning



Examples of alkaline base products include:

All Purpose Cleaners

Degreaser/ Cleaners

Floor Finish Strippers

Heavy Duty Cleaners

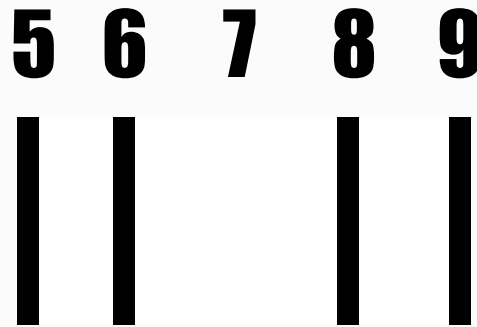
Carpet Extraction Cleaners

Disinfectant Cleaners



NEUTRAL BASE PRODUCTS

Neutral base products are designed to provide an adequate level of cleaning without causing damage to sensitive surfaces such as floor finishes or soft metals (such as aluminum). Many floor finishes actually fall into a neutral range (between 7.0 - 9.0)



Examples of Neutral products:

Fifth Generation Compatible Carpet Cleaners

Floor Finishes

Neutral Floor Cleaners

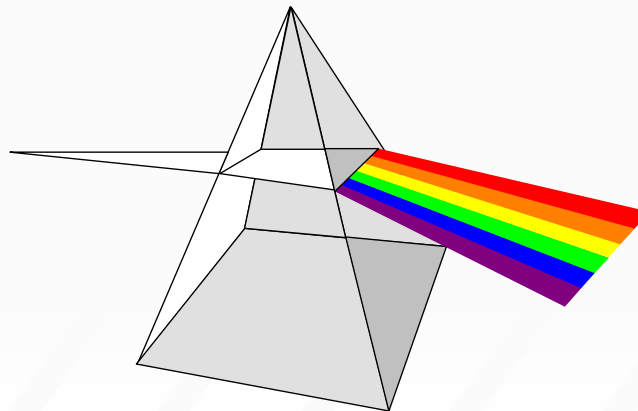
Hand Soaps

Neutral Floor Disinfectant Cleaners



EFFECTS OF pH IN CLEANING PRODUCTS

The pH affects different products in different ways. Products that are considered high in pH (Highly Alkaline) will typically be effective for heavy cleaning, degreasing or wax/floor finish stripping. They are also much more potentially corrosive to skin and sensitive surfaces than lower pH products. The same holds true for very low pH products (Highly Acidic). Probably the best advice in judging different products is to find a product that will perform the best job with as close to a neutral range pH as possible.



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Basic Cleaning Chemistry

Chemical Mixing Chart

Some of the common dilution ratios used in the sanitary maintenance industry are:

| <u># of Parts of Chemical</u> | <u># of Parts of Water</u> | = | <u># of Ounces of Chemical per Gallon of Water</u> |
|-----------------------------------|--------------------------------|---|--|
| 1 | 1 | | 128 |
| 1 | 2 | | 64 |
| 1 | 4 | | 32 |
| 1 | 8 | | 16 |
| 1 | 10 | | 13 |
| 1 | 16 | | 8 |
| 1 | 32 | | 4 |
| 1 | 40 | | 3 |
| 1 | 64 | | 2 |
| 1 | 128 | | 1 |
| 1 | 256 | | .5 |
| 1 | 512 | | .25 |

The Seven Cleaning Mechanisms

| Mechanism | Activity | Example |
|-----------------------|---|------------------------------------|
| Solvency | Substance that dissolves another substance, loosening the soil through penetration. | Glass Cleaners |
| Emulsification | Used to remove substances not normally water soluble. Principal agent is surfactant, with builder “tying-up” hard water minerals. | Floor Finish & Stripper |
| Saponification | Process of turning fat into a water soluble substance by breaking down fat molecules. | Hand Cleaners |
| Chelation | Ability of a cleaner to continue working in hard water. In detergents, they inactivate minerals such as calcium, magnesium and iron. | Restroom Products |
| Suspension | Ability of a cleaner to suspend soils in solution enabling soil to be removed from surface. Disperses solid particles into cleaner so it can continue to work. | Degreaser / Cleaners |
| Wetting | Defined as “getting the cleaner to the soil”. Wetting agents alter the surface tension of the cleaning solution; allow penetration of cleaner under and between soil particles. | General Purpose / Neutral Cleaners |
| Disinfection | Destroys pathogenic bacteria. | Disinfectant Cleaners |



Basic Cleaning Chemistry

Soils and their Cleaning Mechanisms

| Soil Type | Cleaner | |
|----------------------------|-------------------------|--|
| Animal (acid) | Alkaline | Fats, Blood, Oil & Grease |
| Plant (acid) | Alkaline | ketchup, Cooking Oils, Grass stains |
| Minerals (alkaline) | Acid | Iron, Rust, Hard Water |
| Man made ? | Alkaline or Acid | Makeup, Silicones, Medicines |

Soils have a Multitude of Combinations

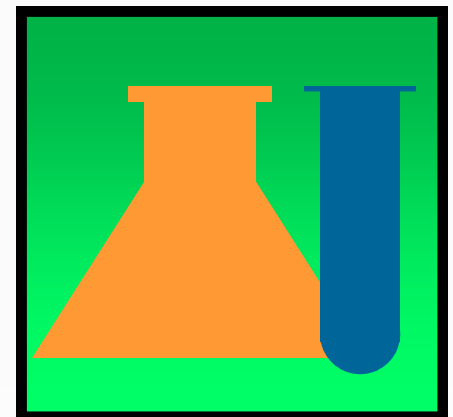
Soil Forms and Combinations

- Airborne Dust and Fumes - usually in microscopic particulates
- Bonded Dusts - dust that bonds to oils or moisture
- Organic Soil, Greases and Oils - usually from production processes
- Chemical Deposits - Deposits derived from hard water

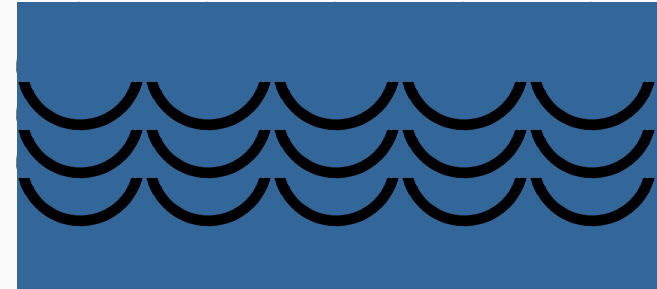
Derivation of Soil in Office Buildings

- 80% from Foot Traffic**
- 15% Airborne
- 5% Other

Highlights the need for proper traffic matting at all building entrances. Matting should allow an average size adult to take three full steps on each foot. Proper matting will significantly reduce overall cleaning costs.



The Role of Water in Cleaning



The Role of Water in Cleaning

- Use as a Pre-Rinse
- Carrying mechanism for soils
- Vital in the removal of detergent residue form surfaces

Water “hardness” and its effect

- Hard water is the description of the level of minerals contained (i.e. calcium)
- Water is classified as soft, moderately hard or very hard (expressed in parts per million)
- Modern chemical cleaners are built to work even in very hard water conditions



General Cleaning Products for Building Maintenance



- **Alkaline** - most widely used cleaner type, for many and varied cleaning applications
- **Acid Cleaners** - primarily used for restroom and exterior maintenance applications
- **Solvent** - when heavy degreasing and quick evaporation is required. Use under close supervision

Review Questions

- 1) The first modern detergents were created in what country during WW 1 (because of a shortage of fats and oils) ?
A - France
B - United States
C - Austria
D - Germany
- 2) T.A.C.T. stands for :
A - Time, emulsify, cleaner, heat
B - Time, energy, concentration, heat
C - Temperature, energy, cleaner, heat
D - Total, energy, cleaning, hands
- 3) The factors of T.A.C.T. are important because they all have a direct effect on the cleaning operation. True or False.
- 4) When a cleaning solution is left on a surface for a very short time, how is energy (physical action) affected ?
A - Need less B-Need More C - Not affected at all





Review Questions

- 5) A pH of 7 on the pH Scale is considered:
A - very harmful to floor finishes C - neutral / safe for floor finishes
B - a very powerful cleaner D - Slightly acidic
- 6) Most building soils are _____ in nature.
A - acid B - alkaline C - neutral
D - cannot be measured by pH
- 7) A pH of 9 is _____ times more powerful than a pH of 7.0:
A - 10 times B - 50 times C - 100 times D - no difference
- 8) The Anionic Surfactant has a negative charge. True or False
The Cationic Surfactant has a positive charge. True or False
The Anionic Surfactant has neither a negative or a positive charge. T or F
- 9) What are the Seven Mechanisms of Cleaning ?
1) _____ 2) _____ 3) _____
4) _____ 5) _____ 6) _____
7) _____
- 10) The dilution of 1:64 has how many ounces of chemical added?
A) 1 B) 2 C) 64 D) 16

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