

Advanced Carpet Cleaning Study Guide

Fiber types: Natural (protein - produced by sheep) - wool, silk (easily damaged by high alkalinity, aggressive agitation)
cotton, jute (cellulosic; highly absorbent, subject to shrinkage and cellulosic browning)

Synthetic - nylon (most popular, most resilient), polyester, olefin, acrylic

extrusion - pumping hot, liquid fiber through small holes in a metal plate to form filaments of fiber.

filament - single strand of fiber; **continuous filament** - long indefinite lengths; **staple** - short specific length

denier - the weight in grams of 9000 meters of filament (indicates thickness of a fiber)

distortion - pooling, watermarking, crimp-loss in fiber that changes carpet surface appearance.

resilience - the ability of carpet pile to spring back when crushed by traffic.

shedding - releasing of short staple fiber, primarily from cut-pile carpet styles

Nylon - most popular fiber used in today's carpet: generations:

1st - early nylons (showed soil badly)

4th - fluorochemical soil/stain repellent

2d - soil hiding (modified cross section to hide soil)

5th - stain resistant (dye blockers)

3d - antistatic (carbon-cored filaments added to yarn)

olefin - most heat sensitive, least absorbent, most stain resistant (no dye sites)

polyester - durable, stain resistant (dyed with dispersed dye system); made from recycled plastic bottles

acrylic - originally, made as a synthetic substitute for wool; durable colorfast

Burn Testing (duckbill shears, tweezers, butane lighter, non-flammable surface)

Fiber	Flame		Odor	Ash		
cotton	orange	even	paper	gray	wispy	crumbles
wool	orange	sputters out	hair	gray	irregular	crumbles
nylon	blue/orange	even	celery	brown	round	hard
polyester	orange	sputtering	sweet	black	round	hard
olefin	blue/orange	even	asphalt	brown	round	hard
acrylic	orange	sputtering	burned meat	black	irregular	hard

chemical tests - formic acid dissolves nylon; chlorine bleach (Clorox®) dissolves wool; olefin floats in water.

shading - diffusion/deflection of light due to abrasive soil or traffic dulling or bending plastic fibers.

wear - loss of fiber density in traffic areas compared to untrafficked areas along walls and under furniture

crimping - providing bulk or texture to fibers.

plying - twisting together two or more yarn "singles" to form two-ply yarn

heat setting - using heat and pressure to provide a new (twisted) memory to yarns. Suessen setting uses temperature up to 428°F; Superba, between 260-270°F; Autoclave, around 275°F.

dimensional stability - ability of a backing to recover after being stretched.

Carpet Construction:

Weaving - carpet made on a loom with warp, weft, pile yarns and adhesive backcoat

Tufting - pile yarns stitched into a **primary backing**, latexed to a **secondary backing**.

Bonding - pile yarns adhered to **adhesive** applied to a **primary backing** with a **vinyl secondary** for stability.

3 pile designs or styles - loop pile, cut pile, cut-and-loop pile

Methods of Dyeing:

1. **solution** - adding pigment to liquid polymer before extrusion.

2. **stock** - dyeing fibers before spinning into yarn.

3. **yarn** - dyeing yarns in skeins or socks.

4. **piece** - dyeing carpet in becks or on continuous dye lines.

5. **printing** - applying dye to "greige goods" (undyed carpet) in the form of a pattern.

dye site - irregular area on fiber surface on which dyes fix.

crocking - transfer of dye due to physical (rubbing) action.

bleeding - dye transfer in a liquid state.

optical brighteners - reveal blue/white end of light spectrum; may yellow in time.

Carpet Cushion (insulation, noise suppression; helps carpet resist matting and crushing):

1. **urethane** - prime, bonded 2. **sponge rubber** - flat, waffle 3. **felt** - natural (jute), synthetic

Carpet Soiling: anything foreign to the construction of the carpet (unwanted materials)

1. **3 classes:** insoluble, water soluble (foods), dry solvent soluble (oils and greases)

2. **particle soils are measured in microns** (1,000.000th of a meter)

3. **wicking** - upward migration of moisture and remaining soil particles to yarn tips during drying.

4. **most carpet soil is particulate and is easily and economically removed with dry vacuuming**

Chemistry of Cleaning:

soluble - capable of being dissolved (e.g., oil, grease, sugar, salt).

compound - combining substances so that a chemical reaction forms a new compound.

solvent - substance that dissolves another substance.

emulsion - mixture in which oil is uniformly dispersed in water (e.g., milk)

suspension - mixture in which components are uniformly dispersed, due to detergent activity.

atom - the basic unit of all matter

molecule - smallest unit into which a substance can be divided and still maintain its original characteristics (e.g., 1 molecule of water has 2 hydrogen atoms and 1 oxygen atom: H₂O).

saponification - mixing components in the proper portion, at the proper temperature for the proper time to form a soap or synthetic detergent (syndet).

hydrophobic - water (hydro) fearing (phobia). End of detergent molecule that's repelled by water.

hydrophilic - water (hydro) loving (from "philos" or love). End of detergent molecule that's attracted to water.

surface tension - tendency of molecules of a substance to bond, thus creating a material's surface.

surfactant - surface active agent.

anionic - negative charge (most detergents: preconditioners, shampoos, steam cleaning agents, etc.).

cationic - positive charge (most antistats, disinfectants, fabric softeners, soil retardants, etc.).

non-ionic - no charge.

pH value - the *acidity* or *alkalinity* of a solution. The pH scale is measured from **0-14**, with **7** (distilled water) being neutral. Below 7 is acid, above 7 is alkaline. Each whole number on the scale increases or decreases strength of a solution by a factor of **10**. Wool cleaner must be between 4.5-8. *Acid* - white vinegar (acetic), citric, most soils: *Alkaline* - ammonia, most precons, rinse detergents.

MSDS (Material Safety Data Sheet) - Required for each chemical on a work vehicle or job site.

pH and **concentration** are used to determine the strength of a solution

Principles of Cleaning:

1. **Dry vacuuming** - use an upright with high-efficiency collection bag. Empty when 2/3 full.

2. **Soil suspension fundamentals ("CHAT"):**

- chemical action - separates soil from fibers
- heat, or temperature - excites chemicals
- agitation - distributes chemicals evenly (hand brushing or mechanical brush action)
- time - for chemicals to work

3. **Soil extraction**

4. **Nap setting** - for best appearance.

5. **Drying** (prevents resoiling, odor, safety hazards) - Drying should occur within **6-8 hours**. Most **overwetting** is caused by technician error.

If one fundamental of cleaning is **decreased**, other must be **increased** to maintain the same level of cleaning effectiveness.

Methods of Cleaning:

1. **Absorbent (dry) compound** - detergent saturated carrier broadcast over carpet and worked in with brush action
 2. **Dry foam** - high foam detergent worked in with cylindrical brush action
 3. **Bonnet or absorbent pad**- detergent sprayed on carpet and pad and absorbed with bonnet buffing
 4. **Rotary Shampoo** - low-foam detergent worked into carpet pile with rotary brush action
 5. **"Steam" or hot water extraction** - hot water injected into pile to suspend soil; removed with wet vacuuming
- lift** - measurement of vacuum power, usually expressed in inches of water lift ("H₂O), or in inches of mercury lift ("Hg).
- airflow** - measurement of vacuum efficiency in moving extracted soil and solutions to a recovery tank; expressed in cubic feet per minute (cfm).
- wicking** - the upward migration of moisture and soil on fiber surfaces during drying.
- Never allow exhaust from internal combustion engines to enter structures; propane tanks must be mounted outside vehicles.
- waste water disposal** - in sanitary (treated) sewer systems only

Spotting:

- volatile** - evaporates quickly and completely. Always ventilate well when using dry solvent spotters.
- VDS** - volatile (evaporates completely) dry solvent: usually a chlorinated or citrus solvent used to dissolve light oils, grease, tar, or to suspend carbon, graphite or copier toner.
- NVDS** - non-volatile dry solvent (or **POG**: paint, oil, grease remover) used to remove dried oils and paints, and some pigment.
- flashpoint** - vapor ignition point of a dry solvent.
- tamping** - proper method for working spotting agents into carpet pile without distortion
- NDS** - neutral detergent spotter: used for general soiling and neutralizing areas before applying special agents.
- ADS** - alkaline (ammoniated) detergent spotter: used on food and some dye spots, and as a lubricant for particle soils. Also, neutralizes acid spotters, such as rust remover.
- AS** - acid spotter: used on tannin (a weak, vegetable dye found in coffee, tea, cola, etc.).
- hydrofluoric acid** - strong organic acid used on rust spots. Must be neutralized w/ammonia & rinsed after use.
- oxalic acid** - slower, but safer, rust remover.
- enzyme digester** - used to digest protein spots (blood, egg, milk).
- acetone** - flammable, dry solvent used on synthetic resins, such as nail polish, acrylic paint, airplane glue, etc. CAUTION! Acetone dissolves acetate fiber found in upholstery fabrics.
- amyl acetate** - milder version of acetone that dissolves the same synthetic resins, but won't harm acetate fiber. Amyl acetate (smells like bananas) is found in most NVDS or POG formulations.
- reducing agent** - removes oxygen from a dye structure to render it colorless.
- oxidizing bleach** - adds oxygen to a dye to render it colorless by oxidation (chemical "burning").
- sodium hydrosulfite** - reducing agent used for color removal.
- hydrogen peroxide** - mild oxidizing agent used in color removal.
- sodium hypochlorite** - chlorine bleach: strong oxidizing bleach used in color removal (not recommended for carpet applications).
- benzoyl peroxide** - acne medication (Oxi-10, Stridex); slowly removes color from fabric.
- reappearing spots** - caused by wicking of unremoved contaminant or spotter residue.

After-treatments (Additives):

- defoamer** - silicone-based corrective treatment that reduces foam from detergent residue left in carpet.
- silicone** - basic ingredient for defoamers, or for some water-based stain repellents (voids carpet warranties).
- fluorochemical fabric protector** - basis for soil/stain repellents, such as Scotchgard® or Teflon® MF, that repel dry soil, and water and oil-based spots and stains.
- stain-resist treatment** - acid dye blocker + fluorochemical (Zonyl 8180; Scotchgard Stainrelease).

Stain-resist Carpet:

components:

1. **acid dye blocker** applied to nylon fiber immediately after dyeing.
2. **fluorochemical soil/stain repellent** topical treatment applied during finishing.

warranty - covers the ability of carpet installed in an owner-occupied residence to resist staining by most common household foods and beverages.

pH of stain-resist cleaners - must be 10 or less.

polarity of cleaners - must be anionic (-) or non-ionic (0)! Since the stain-resist acid dye blockers are anionic (-), application of cationic (+) cleaners or additives neutralizes the stain-resist treatment & voids fiber producer warranties.

additives - most biocides, fungicides, bactericides are cationic and void stain resist warranties.

Problem Areas:

Yellowing - caused by BHT (anti-oxidizing agent) in plastics, adhesives, etc. Corrected with 10% citric acid treatment followed by an acid (pH 5) rinse.

Filter Soiling - Caused by polluted air passing through carpet yarns at walls, vents, doors. Corrected by aggressive application of Principles of Cleaning.

Fume Fading - Caused by atmospheric gases passing through yarns and attacking dyes over time. Corrected with reapplication of dye.

Streaking - Caused by blocked jet or vacuum; uneven application of the Principles of Cleaning. Corrected by recleaning, or light surface cleaning (bonnet, light shampoo).

Browning - Term applies to cellulosic fibers (cotton, jute) only. Caused by overwetting, alkalinity, prolonged drying. Corrected with application of formulated acid "sour" or 3% hydrogen peroxide.

Rippling - Caused by failure to power stretch, or by natural tendency of synthetic backing materials to relax over time. Corrected by minor stretching or double-stretching and trimming.

Numbers:

Temperature	68-86°F	optimum range for most microorganism growth
Relative Humidity	30-50% RH 70% RH	optimum humidity range for human health and comfort indoor humidity considered hazardous to human health
Dilution Ratios	1:1 1:9 1:10-1:11	dilution ratio for mixing 20 Volume hydrogen peroxide (6%) normal mixing ratio for Hydro Force sprayer dilution for ½% solution of household chlorine bleach (5.25-6%) as disinfectant
Time	10-15 min 2472 hrs	minimum "dwell time" proper soil suspension time required for microorganisms become active
Weight/ Measures	2 3.785 4 8 8.34 lbs 16 32 128	number of liquid cups in a pint; pints in a quart number of liters in one gallon number of quarts in one gallon number of ounces in a cup; pints in one US gallon weight of one U.S. gallon of water number of dry ounces in one pound; liquid ounces in a pint number of liquid ounces in a quart number of liquid ounces in one US gallon
Percentages	½% 3% 5.25-6% 6% 79%	use dilution for household chlorine bleach used as a disinfectant use dilution for hydrogen peroxide used as a disinfectant strength of 10 Volume hydrogen peroxide percent of chlorine in household bleach (Clorox®, Purex®, Javex®) percent of peroxide in 20 Volume particle/fiber soil content of average residential carpet

Notebook (provided at course) study emphasis pages: 10, 11, 12, 13, 16, 20, 21, 22, 28, 31, 33, 34, 35, 40, 41, 43, 44, 45, 46, 54, 55 Questions? Call the instructor or school with whom you registered.