Collections Care Manual

Muscle Shoals National Heritage Area

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HANDLING MUSEUM OBJECTS

"PREVENTATIVE CONSERVATION STARTS WITH CAREFUL HANDLING. PROPER HANDLING IS LARGELY A MATTER OF COMMON SENSE AND IS NECESSARY FOR THE CARE AND PROTECTION OF OBJECTS."

NPS *MUSEUM HANDBOOK*

GENERAL RULES[1]

- Only handle a museum object when necessary
- Consider safety first before moving an object
- Make sure your staff is trained on how to properly handle museum objects
- Never smoke, eat, or drink when handling objects
- Avoid wearing anything that may inadvertently damage the object such as rings, other jewelry, belt buckles, or nametags
- Know the condition of the object before moving it
- Stop and think before handling an object – consider where the weak points are and whether you should be wearing gloves or have assistance
- If you do not need gloves, make sure your hands are clean
- Plan your move, make sure your route is clear for moving an object
- Prepare a space where the object is being moved before moving it
- Use both hands to support an object
- Move only one object at a time
- If any damages occur during handling, collect all broken pieces and place them in a labeled bag with your name and date
- Report and record any damages

Areas of Vulnerability[2]

Museum objects should always be reviewed before being handled. Some items may have weak spots from years of wear, or from being previously repaired. Below are areas and objects to watch for:

- Handles
- Protrusions
- Areas of previous repair
- Soft/powdery surfaces
- Large, floppy items
- Brittle paper
- Heavy items
- Ornate or gilded frames
- Loose components of objects (drawers, lids, doors, etc.
- Surfaces that are sensitive to tarnishing or abrasions
- Touch-sensitive surfaces (photographs)
- Heavy items that are attached to lightweight items (beads on a fine silk piece)

[1] Museums & Galleries of NSW, "Handling Museum Objects," https://mgnsw.org.au/sector/resources/online-resources/collection-care/handle-museum-objects/ (accessed March 7, 2018).
National Park Service, "Chapter 6: Handling, Packing, and Shipping," *Museum Handbook*, Part 1, 1999.
[2] Museums & Galleries of NSW, "Handling Museum Objects."

Why are careful handling practices important?[3]

Improper handling is the most common form of damage for museum objects that museum staff have control over. Proper handling reduces the probability of damage to an object when it is being moved. Once an object has been broken or damaged it can be repaired to a certain extent, but most the original historical integrity of the piece is lost. A loss like this can be avoided if museum staff are trained in proper handling procedures and implement them daily.

Implementing a handling procedure orientation for all staff members, volunteers, and even board members will help alert them of the "dangers of thoughtless handling." It will also reinforce the importance of artifact care which should reduce, if not eliminate, the likelihood of accidents happening.

Standardized handling practices for a museum should be outlines in the museum's collections policy. If you do not have a policy in place, *see Appendix #1* for information on how and why you should develop a policy.

Why should I wear gloves?

Our hands have contaminants such as dirt, salt, acids, and oils that can be transferred to objects. While it may be okay to handle some objects with glove-free hands, they should always be freshly cleaned. Even clean hands can transfer contaminants to museum objects. Clean, white cotton gloves are recommended for handling ceramics, glass, fragile or damaged paper, and some natural history specimens. If you are worried that the cotton in the glove may catch on the fibers of the object, or you are concerned about losing your grip, wear tight-fitting latex or nitrile gloves.

Why do museum objects each have their own care and handling methods?[4]

Museum objects are made of many different materials. Some objects are even a combination of materials (i.e. a wooden door with brass hardware). Different artifact materials require specific methods of care and handling that is considerate of the material. While all object should be handled delicately and with care, a porcelain china set would not be handled the same way as an antique quilt. Before handling an object, museum staff need to evaluate its current condition and be familiar with its strengths and weaknesses. If the object has been repaired or has, for example, a loose component (especially on those composite objects made of two or more materials), it should be recorded on the object's accession card under "condition and treatment report."

Those objects that are metal, paper, textiles, unglazed pottery, marble or other porous materials should be handled with cotton gloves. Objects that are glazed or made of glass can be handled without cotton gloves to prevent slippage. Instead, those objects can be handled with clean, dry hands or vinyl gloves. Absolutely no bracelets or rings should be worn with or without gloves.

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[3]Ontario Ministry of Culture, "Handling Museum Objects," *Museum Notes*, Heritage & Libraries Branch, 2005, https://www.gov.mb.ca/chc/hrb/pdf/handling_museum_objects.pdf (accessed March 20, 2018), 1.
[4] Ontario Ministry of Culture.

OBJECT HANDLING KEY

Artifact Type	Handling Recommendation
Textiles[5]	Wear gloves. Do not allow the object to drag. Garments on hangers should be carried by the hanger. Support the object when moving, any lack of support can cause stretching. For access to more detailed information on handling textiles, *see Appendix #8.*.
Metal (iron, copper, tin, lead, gold, silver, bronze, aluminum, zinc pewter)[6]	Wear gloves. Support the object with two hands if it is large or has a loose component.
Wood[7]	Wear gloves. Lift the object in its strongest area (i.e. chairs by the seat with a hand on the back of the chair for support) use assistance if the object is large. Remove any unstable parts of the object before handling.
Glass/Ceramics[8]	Wear gloves or a glove with grip when handling unglazed ceramics (they are still porous). Wash hands before handling glass and glazed ceramics without gloves to prevent dropping the object. Do not handle the object by the spout, lip, handle or other separate parts (remove any lids). Carry the object by its body, supporting it with two hands.
Paper[9]	Wear gloves, oils from ungloved hands can easily transpire onto paper objects.

[5] Rebecca A. Buck and Jean Allman Gilmore, ed., *Museum Registration Methods 5th Edition*, (Washington, D.C.: The AAM Press, 2010), 213.
[6] "Preservation of Artifacts," http://www.tam.missouri.edu/MHCTC/docs/preservation_artifacts.pdf (accessed March 20, 2018).
[7] "Preservation of Artifacts."
[8] National Park Service, "Appendix P: Curatorial Care of Ceramic, Glass, and Stone Objects," NPS *Museum Handbook*, Part I (2000), https://www.nps.gov/museum/publications/MHI/AppendP.pdf (accessed March 20, 2018).
[9] Ontario Ministry of Culture, 3.

	Do not fold or roll the paper. Do not stack any larger objects on top of paper. Beware that old paper can easily deteriorate if not handled with care. Books – remove a book from the shelf by reaching over the top and gently pulling it out, or push the books on either side away from the book you desire until you can grasp it on both sides. Do not drag the book off the shelf, lift it.
Plastics/Rubber	Wear gloves. Be alert that "each plastic/rubber has its own chemistry and reacts differently" when it comes into contact with different cleaning solutions or other objects.
Paintings, Unframed[10]	Never touch the front surface of a painting. Never stack multiple unframed paintings on top of one another. When carrying an unframed painting by its edges, wear thin gloves with light grip. If moving the painting a short distance, slip a supporting board underneath and carry it horizontally.
Paintings, Framed[11]	Never touch the front surface of a painting. Remember that all objects are subject to expansion and contraction. Framed paintings are no exception. They are made of canvas, wood and paint bound together, each expanding and contracting at their own rate. As this occurs over time, paint will begin to flake off and supports may weaken and hardware loosen. Look for broken or loose pieces of the frame or guild. Never lift the frame by the top, it will likely separate from the body. Wear cotton gloves on both hands. Use both hands to lift and carry the framed painting – solicit additional help if needed. For moving larger paintings, use a padded truck or cart.

[10] Rebecca A. Buck and Jean Allman Gilmore, ed., *Museum Registration Methods 5th Edition*, (Washington, D.C.: The AAM Press, 2010), 213.
[11] Rebecca A. Buck and Jean Allman Gilmore, ed., 212-213.

	When leaning painting against the wall, place them on rubber mats or something that will prevent them from sliding. Keep the painting oriented in the direction it was hung.
Furniture[12]	Lift and carry furniture from its strongest points (i.e. not the arms, legs, or back). Do not drag, push, or pull furniture. This will strain joints and eventually cause them to snap. Move large pieces of furniture with a cart if necessary. If a cart is not needed, make sure that there are two people helping move the object, one on each side. If the path for the object is obstructed, have another person watch for doorways, stairs, etc., and hold doors open. Furniture that is in multiple pieces, such as a dresser, should be taken apart and moved separately to reduce the overall weight. Be mindful of any jewelry, belts, buckles, zippers, or buttons on your clothing – remove them if able.
Natural History Specimens[13]	Be aware that arsenic was a preservative in the past – especially in taxidermy mounts. Have them tested for arsenic residue before handling them. Handle these items with gloved hands and with extreme care. Some specimens may have developed a powder or the dyes are easily rubbed off. Bone, ivory, and antler are highly susceptible to chipping or stains from fingerprints. Small items should be transported inside a padded box.
Sculpture[14]	Inspect the object before handling it. "Look for loose components, cracks, breaks, or areas of old repair." Keep sculptures in the same position they were stored or displayed in. This is their most stable position, the one that best supports its weight. If the sculpture has to be laid down, make sure the surface it lays on is padded to support any weak areas. If the object is too large, transport it on a cart and make sure the path is clear and that the object is well-supported.

[12] Rebecca A. Buck and Jean Allman Gilmore, ed., 215-216.
[13] Rebecca A. Buck and Jean Allman Gilmore, ed., 216.
[14] Rebecca A. Buck and Jean Allman Gilmore, ed., 216-217.

MARKING OBJECTS[15]

All museum objects need to be marked with an identification number and letters. Whether the object is a part of the museum's permanent collections or a temporary loan, the museum needs to assign it a specific identification number so that the staff can have control over finding and identifying what is in their current inventory. Marking a museum object is the best way to connect the object with its documentation (identifying what collection it is from and whether it is on loan) and other information.

The marking should be discreet but visible, reversible, and safe for the object. Before marking the number on the object, test a small the application process on the object first to see if it will adhere properly. Some pens will not write on all surfaces and some inks will change and turn color, fading almost immediately – particularly on plastics.

Where should objects be marked?

- Make sure that you are uniformly marking objects that are of the same type or material in your collection.
- Objects should be marked in a location that is accessible but not generally visible to visitors when it is on display.
- Only mark on stable surfaces or in areas that are less likely to be destroyed by abrasion.
- Avoid marking an object in the area where it sits (e.g., the base) or where it may be routinely touched.
- Check to make sure you are not applying the identification number on any weak spots or over a flaking surface.

Marking Materials

Barrier Coats

A light strip of lacquer is placed on the object where the identification number will go. After it dries, the identification number is applied over the base coat, then a finishing barrier coat is applied after the identification number has dried.

Tips

- In humid conditions, allow for a longer period of drying time between each layer.
- If the object is dark in color, mix the lacquer with a white pigment over the base coat before applying the identification number.
- The second barrier coat (finishing coat) is thinner than the first coat.
- Do not use clear nail polish, PVA resin, typewriter correction fluid, silicone products, or acrylic emulsions as a base coat.

[15] Marianna James Munyer, "How to…Mark Objects in Museum Collections Part One: Barrier Coats, Pens, Inks, Paints," Illinois Association of Museums #16, July, 1997.

Recommended Barrier Coats

- Acryloid B67™ - do not use on wax or waxed surfaces
- Soluvar™ - do not use on wax or waxed surfaces
- Liquid Label™ - a while label to be applied on top of the clear base coat
- Acryloid B72™ - mix with a 25% solution of acetone (beware it may damage painted or lacquered surfaces)

Disposable Marking Pens

The following marking pens write well on objects other than paper but not plastics. Do not use white commercial pends, red ink, chalk, or ball-point pens.

- All-Stabilo Pen 166P™ (permanent, fine)
- Pilot SCA-UF™ (ultrafine point, permanent, no xylene)
- IDentipen 441™ by Sakura™
- Sanford Sharpie™

For making white markings

- Liquid Label™
- Golden™ or Liquitex™ fluid acrylic paint in Carbon Black or Titanium White – apply with a rounded nib pen or fine brush

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Marking Applicators

Fine technical drafting pens

- Rotring™
- KohI-Nor Rapidograph™

Traditional marking devices

- Crow quill pens
- Fine paint brushes

Refillable pens

- TRIA™

Tags

- Acid-free card stock
    - Use with a cotton string for ties
    - Rounded corners are preferred since they are less likely to pierce a delicate surface

    - Can be laminated for outdoor use
    - Not waterproof or oil resistant
    - Do not use with cyanotypes, color photographs or proteina-ceous materials. It can speed up the degradation process of those materials
- Reemay
    - Acid-resistant
    - Insect resistant
    - Polyester
    - Recommended for use as a drop-tag for textiles
- Tyvek
    - Polypropylene
    - Comes in still and soft varieties
        - Soft varieties can be used with textiles and baskets
    - Water, oil, and chemical resistant
    - Insect resistant
    - Recommended for outdoor use
- Resistall paper
    - Contains melamine
    - Recommended for labels placed inside a fluid-filled container (alcohol or formaldehyde)
- Metal
    - Recommended use on large industrial artifacts and machinery
    - Not recommended for most materials because it will scratch objects and tarnish over time
- Teflon tape
    - Non-adhesive
    - Water, oil, and chemical resistant
    - Insect resistant
    - Recommended for tagging plastics
- Mylar
    - Clear, inert, and has sharp edges
    - Water and oil resistant
    - Insect resistant
- Plastic corrugated board
    - Water and oil resistant
    - Insect resistant
    - Recommended for outdoor use or for large machinery
- Formica
    - Water, oil, and chemical resistant
    - Insect resistant
    - Recommended for outdoor use

Marking Methods for Specific Objects[16]

Recommended marking procedures for items commonly found at Belle Mont. For more specific material marking procedures, please see the *Museum Registration Methods 5th Edition* textbook.

Make sure you are consistent in your marking locations on each object.

Basketry and Mats	Some basket fibers may be resistant to base coats and adhesives. Mark at the center bottom of the basket or inside the rim.
Books	Mark with a pencil on the reverse of the title page and inside the front cover on the lower right side. If the inner cover is decorated in any way, mark the first blank page. Mark all loose or weakened pages that accompany the book.
Buttons	Mark on the back, flatter, side. Store small buttons in a labeled container or string them together and attach a tag.
Ceramics	Mark with ink or paint over a base coat in an inconspicuous place that will not be worn by handling. Ceramics that are unglazed and more porous may require multiple base coat applications. Use a thick varnish to prevent extensive penetration into the porous material. Do not mark over cracked or peeling surfaces. Decorated pottery shards should be marked on the side without decoration.
Clocks	Mark on the back of the case at the lower edger or corner. Mark inside the hinged door if the clock has one.
Coins and Medals	Mark coins on the "flip" side they are stored in. Also mark the coin box or envelope that it is stored in. If you must mark the coin directly, B-72 barrier coat and a fine point archival marker are recommended. Never make permanent marks.
Costumes and Costume Accessories	Sew labels to textiles.

[16] Rebecca Buck and Jean Allman Gilmore, eds., *Museum Registration Methods 5th Edition*, (The AAM Press, 2010), 249-262.

	Some museums will have a standard location for their labels to be sewn on garments. Do not sew over any maker's labels. For dresses, coats, shirts, and other upper garments: sew the label on the back neckband or on the left underarm seam or inside cuff. For vests and other sleeveless garments: sew the label on the left armhole on the seam side. For skirts, trousers, and other garments with waistbands: sew the label at the center back of the waistband. For hats: sew the label inside the band at the back. For stockings and gloves: sew the label inside near the top edge. For purses and other accessories: sew the label on the inside near the opening. For footwear: mark on the bottom of the sole in the rise before the heel or at the back of the shoe in the heel area for those shoes without heels.
Dolls	Sew the label on the back of the head at the nape of the neck, or on the foot.
Drawings	Mark with pencil on the reverse side of the work in the lower corner.
Furniture	Mark over a base coat with ink or paint using the method that is appropriate for that material. Attach a tag to large items in storage. Marks all removable parts. For commodes and chests: mark on the back at the bottom left or right corner. For chairs and sofas: mark at the back of one leg at the height of the seat near the inside for less visibility. For completely upholstered pieces: sew a label near the left or right back leg. For tables: mark on the underside near one of the legs.

	For beds: mark on the back of the rail at the head of the bead near one or both legs. For lamps: mark on the lower right-hand side at the back or base. For mirrors: mark on the reverse at diagonal corners of the frame.
Glass	Mark with ink or paint over a base coat. Avoid marking over any fractures, etches, or painted designs. Number as small as possible. Use white lettering on clear glass to minimize its visibility when it's on display.
Lace	Sew a label near the end of the piece with a small loop of thread, using only one or two stitches.
Leather	Do not mark leather objects. They can be permanently stained by inks and paints. Attach a label or acid-free tag to the object through an existing hole in the leather or around assembly stitches.
Manuscripts and Documents	Mark in pencil on the reverse or blank side of the document near the upper or lower corner. Mark envelopes on the reverse side in the lower corner. If you are unable to mark either side of the manuscript or document, mark an acid-free storage sleeve or box with the number.
Metal	Mark with ink or paint over a solvent-based acrylic base coat. Choose an inconspicuous location. Avoid marking on areas that are corroded or painted. Avoid using water-based marking materials and materials containing ammonia. Seal with a solvent-based varnish on any unfinished metals. If the object is too small, attach a tag to it.
Paintings	Mark on the reverse of the frame, protective backing, or support. Marking can be done with pencil or ink, although ink is easier to read. Never apply the number to the face of the painting or on its reverse canvas.

Photographs	Mark lightly in pencil on the reverse in a low corner. If a pencil does not work, try a Stabilo All pencil or Berol China Marker. If the photograph is hinged in a mount, place the number on the unhinged end. If the photograph is framed, also mark the frame as for "paintings."
Plastics, Vinyl, and Rubber	Since plastics can be easily damaged by solvents and any type of moisture, it is best to try and mark them with acrylic artist's paints or tie a tag to them, if able. Mark on a non-plastic component if possible. Try marking directly to hard plastics with a Berol China Marker, Stabilo All pencil, or acrylic pen.
Rugs	Sew a label (as seen in "textiles") on the reverse of the rug at diagonal corners. If the rug has a tie, attach a tag to it as well.
Tableware	Mark under a recessed foot or on one side of the base. Also mark on the inside of the lids and on any removable parts.
Textiles	Sew a label on the reverse side of textiles in one corner – typically along a hem or selvage. Large textiles should have a label sewn into diagonal corners. Attach labeled tags to fragile pieces with one loop of thread. If the textile is deteriorated, do not sew a label directly to it. For pillow cases: sew inside the left corner near the hem. For decorative pillows: sew on the reverse at the lower left or right corner. For bed coverings or quilts: sew on the reverse in diagonal corners For draperies and curtains: sew on the reverse in the lower left or right corner
Wood	Mark with a base coat first, then apply the number in ink or paint, then seal with a thickened varnish. Wood can be very porous and may require more than one case coat application. Your base coat will likely leave a stain. Choose its location carefully.

DISPLAY GUIDELINES[17]

By following proper display guidelines that are specific to each object material, you can prolong the integrity of those objects for the future. Key points to keep and mind for objects that are going to be displayed are:

- Those objects that are on display should be chemically and structurally stable. If they pose any hazard to the environment and the visitor, they should not be displayed.
- Always consult a conservator if you have any questions on how an object should properly be displayed.
- Be sure to follow light level exposure guidelines for those objects that are paper-based or are textiles. 50 Lux maximum for no more than 90 days. Finished wood, paintings on canvas, leather, and other composite objects can withstand up to 200 Lux for no more than one year. Any inorganic materials (stone, metal, glass, and some ceramics) do not have exposure limits if they are not painted.
- Keep in mind that your organic objects are most at risk to ultraviolet and infrared radiation, even if the windows have UV film.
- Displays should be placed out of direct sunlight and away from any leaking surfaces including air leaks from windows, drafts, and heating/cooling equipment.
- Avoid placing the display against any exterior walls and out of high-use areas where high vibrations could be felt.
- Do not use wool felt inside display cases; it contains sulfur and can tarnish metals. Nylon and any PVC products should also be avoided.
- Do use polyester or cotton to mound coverings inside a display case.
- If a historic garment is displayed directly on top of another historic artifact (e.g. a dress on top of a bedspread), a protective material such as Mylar or acid-free tissue, should be placed between the two objects.

[17] Minnesota Historical Society Historic Housekeeping Handbook, June 2000, www.mnhs.org/preserve/conservation/reports/manual-0102.pdf (accessed April 3, 2018).

STORAGE GUIDELINES[18]

- No food or drink in the storage area
- Keep the area clean
- Do not store object near exposed pipes or other sources of water or heat
- Have a fire extinguisher nearby or in the storage area
- Keep the storage area locked when not in use and only allow authorized staff with access
- Regularly clean those objects in storage that are not covered or boxed
- Larger objects should be stored closer to the door, if able, to prevent less maneuvering or handling within the storage space
- All object should be inspected every three months

Collection Items[19]

Those objects that are not currently on display in the home should be housed in a specific storage area – not a basement or attic where the temperature and humidity can fluctuate, and where pests and water could also pose a problem. However, if you do not have any other storage options, a basement or attic could suffice as long as regular inspection of those areas takes place and the temperature and humidity can be controlled.

The first step to having a storage area is determining how much space is needed and the storage equipment requirements for specific collection objects. Small three-dimensional objects can be stored in a standard museum storage cabinet with drawers, or a wardrobe. Medium-to large-sized three-dimensional objects may also be stored in a cabinet or wardrobe, but be sure to allow objects enough room between one another and the sides of the storage container to prevent them from scraping. Those large, but stable, three-dimensional objects can be stored on steel shelving units. Make sure that the unit is stabilized against a wall or firm support. Do not place heavy items on top or place items too deep on the shelf. You do not want to have to handle multiple objects each time.[20]

For more information on storing collection items, *see Appendix #10 and 15*.

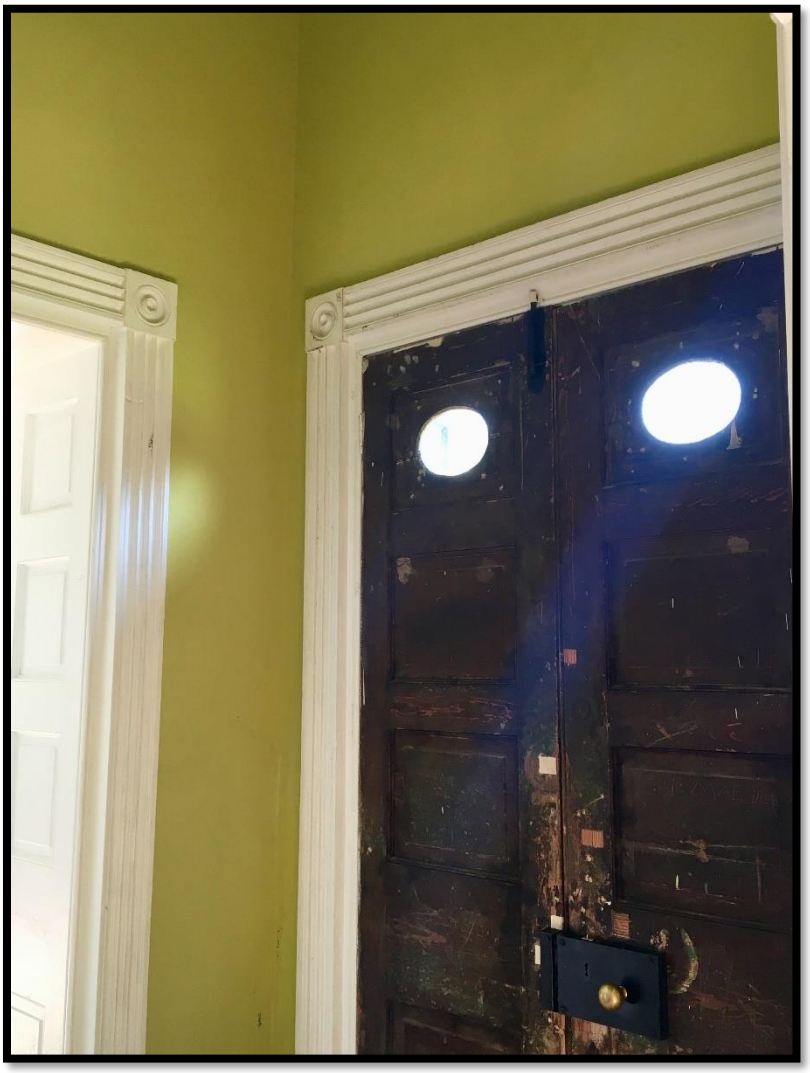
Non-Collection Items[21]

Objects that are necessary to running the house museum but are not a part of the collection should be stored separately from collection items and out of sight of visitors. Non-collection items include things such as cleaning supplies, office equipment and supplies, tools, and any

[18] Minnesota Historical Society Historic Housekeeping Handbook, June 2000, www.mnhs.org/preserve/conservation/reports/manual-0102.pdf (accessed April 3, 2018).
[19] Minnesota Historical Society Historic Housekeeping Handbook, June 2000, www.mnhs.org/preserve/conservation/reports/manual-0102.pdf (accessed April 3, 2018).
[20] Donald R. Cumberland Jr., "Determining Museum Storage Equipment Needs," *Conserve O Gram* 4/10, June 1997.
[21] Minnesota Historical Society Historic Housekeeping Handbook, June 2000, www.mnhs.org/preserve/conservation/reports/manual-0102.pdf (accessed April 3, 2018).

other miscellaneous items that do not serve any function to the presentation of the home for its period of interpretation. A specific area should be designated for the storage of those items.

AGENTS OF DETERIORATION



"EVERYTHING FALLS APART EVENTUALLY. IN THE FIELD OF CONSERVATION, WE TRY TO PREVENT THIS EVENTUAL DETERIORATION."

SCIENCE MUSEUM OF MINNESOTA

There are nine agents of deterioration that threaten a museum's collection: direct physical forces, thieves, vandals, and displacers, fire, water, pests, contaminants, radiation, incorrect temperature, and incorrect relative humidity. Some objects are more prone to a particular agent of deterioration than others. For a complete list of materials and the agents of deterioration that befall them, please visit the Canadian Conservation Institute's page on "Agents of Deterioration" *https://www.canada.ca/en/conservation-institute/services/agents-deterioration.html*

1. DIRECT PHYSICAL FORCES[22]

Forms that a direct physical force can impact an object:

- Impact
- Shock
- Vibration
- Pressure
- Abrasion

An object will typically show sudden damage from the result of a direct physical force. This can occur when it was being handled, moved, or when something collapsed (e.g. shelves, supports, or the result of an earthquake). The most common form of damages from a direct physical force are due to improper handling procedures. Although the severity of the damage may vary, a human-caused direct physical force can often be avoided with proper training and executing situational awareness.

2. THIEVES, VANDALS, AND DISPLACERS[23]

Having good security is an important and necessary part of any museum's risk management program. While risks of collection objects being stolen or broken due to thieves and vandals are traditionally covered by security services of large museums, smaller museums can also implement their own security measures.

- Thieves – are attracted to museum items because of their value
- Vandals – attack the most noticeable items and can inflict damage on the building as well
- Displacers – people (typically staff within a museum) who have misplaced an item in the collection. This is typically inadvertent but if the item is never recovered, the misplacement is considered theft.

[22] Charlie Costain, "Framework for Preservation of Museum Collections," *Canadian Conservation Institute*, September, 1994.
[23] Charlie Costain, "Framework for Preservation of Museum Collections," *Canadian Conservation Institute*, September, 1994.

3. FIRE[24]

Fire poses a threat to all items in a museum collection, including the museum itself. Organic artifacts are particularly vulnerable. Any damage sustained to collection objects due to fire is generally irreversible. Museums should have a fire suppression or detection system installed to reduce the impact or spread of fire.

4. WATER[25]

Water is a common threat to museums because of leaking roofs, water pipes, floods, or fire suppression. Organic materials, metals, and composite materials (those that are layered or joined together) are most susceptible to water damage.

Control Strategies

- Avoid
    - This begins with the location of the building. If the building is new, do not build on a site that is close to a body of water, or on a flood plain.
    - If the building already exists and is threatened frequently by rising waters, it can be raised or relocated. Both are extensive and a costly effort to save the structure and the collection.
    - Avoid displaying items near water sources such as the basement, attic, or under pipes, air conditioners, or other water source. If you have to store items in the basement, store them at least 10 cm off the floor. Make sure your pipes are well-insulated against freezing in winter and seal all opening around pipes to prevent any leaks.
    - Many water problems in smaller house museums are due to poor maintenance, or lack thereof. To avoid this, a routine maintenance program should be carried out to prevent or help mitigate the effects of water. A checklist should be developed that includes a visual internal and external inspection of:
        - Roof or chimney leaks
        - Faulty or loose roof shingles and flashings
        - Leaking windows or doors
        - Blocked eaves troughs
        - Cracked foundations
        - Vegetation that is growing too close to the building
        - Splits or cracks in structural columns and supports
    - In the museum, use water-resistant storage containers and cover displays with a case cover whenever possible to prevent any dripping or spraying water from falling on objects.

[24] Charlie Costain, "Framework for Preservation of Museum Collections," *Canadian Conservation Institute*, September, 1994.
[25] Charlie Costain, "Framework for Preservation of Museum Collections," *Canadian Conservation Institute*, September, 1994.

- Block
    - If water cannot be avoided, have a disaster preparedness plan in place to help make swift decisions on how to handle the situation.
        - Be prepared to tape or board up windows or doors.
        - Move collection items to higher levels in the building or to a temporary location.
        - Have equipment such as pumps, mops and squeegees, dehumidifiers, and a wet-dry vacuum ready to use.
        - If you do not have any sandbags on hand, know where you could get some.
- Detect
    - If your collection or site has been affected by water, first determine if the structure is safe to enter, then inspect the collection to determine the severity of the damage.
        - Identify the visible presence of water (leak or flood)
        - Look for water damage to the building and objects to determine the origin of the problem
            - Efflorescence (stone, concrete, or brickwork)
            - Plant growth on the building
            - Fungal or mold growth
            - Rot odor
            - Peeling paint
            - Excessively cool walls or floors
            - Drips or stains on the walls, floors, or ceilings
            - "Tide lines"
            - External corrosion on pipe work or other metals
            - Movement of floorboards

5. PESTS[26]

Pests can include insects, vermin, or mold. Organic materials are most at risk either because the pests see them as a food source or because they represent a barrier that they pest wants to cross (e.g. wood). Damage due to pest infestations can be extensive. Museums should have an integrated pest management manual in place to help create a plan of attack to combat these everyday pests.

Types of Pests

- Fabric pests
    - Carpet beetles
        - Black carpet beetle

[26] Charlie Costain, "Framework for Preservation of Museum Collections," *Canadian Conservation Institute*, September, 1994.

        - Varied carpet beetle
        - Common carpet beetle
        - Furniture carpet beetle
    - Clothes moths
        - Webbing clothes moth
        - Case making clothes moth
- Wood pests
    - Powderpost beetles
    - Drywood termites
- Stored product pests
    - Cigarette beetle
    - Drugstore beetle
- Moisture pests
    - Mold
    - Psocids (aka booklice)
- General pests
    - Cockroaches
    - Rodents
    - Silverfish
    - Ants

To learn about additional pests, *see Appendix #5.*

Identifying Pest Activity[27]

- Discovering the actual insect or pest, alive or dead
- Cast skins or other body parts
- Chewing marks
- Exit holes
- Hair, fur, or feathers
- Webbing
- Frass (debris or excrement left behind by insects, a soft powdery material)
- Fecal pellets or dried fecal stains

Monitoring Pests[28]

Early detection of pests can help reduce if not prevent the onset of damage to your collection. While a regular visual inspection of those areas that are most vulnerable to pest infestations is helpful, often pests enter from areas that are more difficult to monitor and require additional methods to help regulate and control pests.

[27] Denise Klein, "Identifying Museum Insect Pest Damage," *Conserve O Gram* 3/11, August 2008.
[28] R.E. Child, "Monitoring Insect Pests With Sticky Traps," *Conserve O Gram* 3/7, August 1998.

Sticky traps are the most commonly used insect trap. There are types available, but the best sticky trap is one that is used consistently.

- Set sticky traps on ground level against a wall and record where the trap was set in the building along with the date it was set.
- Identify all doors, windows, and heat and water sources nearby in your sticky trap record.
- Inspect the trap daily to see if any pests have been collected.
- Once insects are caught, record the species, their stage of development (larvae or adult), how many different species, how many, and what direction they entered the trap from.
    - If you can determine which direction the pest entered the trap from, you will begin to have a better idea where the pests are coming from or where they are going.

Identifying the species will help determine whether they are a common pest or if they pose a real hazard. The number of species caught over time will indicate if the infestation is well-established or just an isolated outbreak. Being able to identify which stage of development the pest is at will tell you if the infestation is ongoing (there is larvae present) or new (adult pests). If you set multiple traps within a specific area, you can determine where the pests are being drawn to based off which traps collected the most pests.

An Object is Infested, What Next?

Once you have determined that an object has been infested by pests, isolate it immediately to prevent the spread of the infestation to other objects and clean the infested area. Those objects that are small enough can be sealed in a Ziploc bag for further monitoring. Before purging the pest from the object, you need to determine what type of pest it is and understand its life cycle and behavior. This will give you an idea of where it came from, what it is doing there, and if there may be more. The type of pest will determine the most appropriate treatment method for the infested object.[29]

Due to the health and environmental risks associated with pesticides, there are alternatives to treating an infestation. The freezing process is one of the most effective pest control methods for protecting collection objects. When an infested object is exposed to freezing temperatures, the object does not freeze and no ice forms. Only the living insects that have a body of water are frozen. While this process can be beneficial to eradicating pests it should not be used on a routine or preventive basis; only when pest activity has been detected.[30] For more on the freezing process, *see Appendix #6.*

[29] D.B. Pinniger, "Controlling Insect Pests: Alternatives to Pesticides," *Conserve O Gram* 3/8, August 1998.
[30] Tony Raphael, "An Insect Pest Control Procedure: The Freezing Process," *Conserve O Gram* 3/6, July 1994.

6. CONTAMINANTS[31]

Chemical agents found in the museum environment. These chemicals are typically found in the form of a gas, liquid, or a solid and can be emitted from objects that are housed in the museum such as wood or plastic. Gas is generally given off by wood or coatings and liquids that could contaminate other objects are from plasticizers. Solid contaminants are salt or dust. Dust can be abrasive to objects that it settles on, which is why regular cleaning should be performed. Any of these contaminant types can disfigure or destroy an object over a prolonged period of time.

7. RADIATION[32]

Radiation included visible and ultraviolet light. Ultraviolet light can cause organic objects to disintegrate or discolor the outer layers. Visible light can cause the outer layers of artifacts to fade (i.e. color photographs). Any damage or discoloration done by light damage cannot be repaired or reversed.

Recommended Light Levels[33]

- 50 lux maximum
    - Dyed organic materials
    - Textiles
    - Photographs
    - Tapestries
    - Prints or drawings
    - Manuscripts
    - Leather
    - Wallpapers
    - Fur or feathers
    - Biological specimens
- 200 lux maximum
    - Undyed organic materials
    - Oil and tempera paintings
    - Finished wood surfaces
- 300 lux maximum
    - Metals, stone, ceramics, and some glass

[31] Charlie Costain, "Framework for Preservation of Museum Collections," *Canadian Conservation Institute*, September, 1994.
[32] Charlie Costain, "Framework for Preservation of Museum Collections," *Canadian Conservation Institute*, September, 1994.
[33] National Park Service, "Chapter 4: Museum Collections Environment," *Museum Handbook*, Part I (1999), 4.35-4.36.

Devices to Monitor Light[34]

- Visible Light Meter – measures the visible light on the electromagnetic spectrum
- Ultraviolet Meter – will give UV readings in microwatts per lumen

Tips for Reducing Light Damage[35]

- Keep curtains drawn or blinds down
- Install UV filtering over windows and fluorescent tubes
    - For more information of UV-filtering window films, *see the Appendix #3.*
- Replace any CFL light bulbs with LED bulbs
- Turn off lights when the room is not in use
- Rotate out light-sensitive objects that are on display

8. INCORRECT TEMPERATURES[36]

It should first be noted, that different materials will react differently to fluctuations in temperature. A low temperature is overall better than a high temperature. But some painted objects may become more brittle and fragile at low temperatures. When there is a temperature fluctuation, the collection will not be stabilized and some objects may expand and contract and may eventually break. When the temperature is too high, biological growth can begin to develop on some collections. For more information on how to improve your exhibit environment, *see Appendix #4*.

How to Control Incorrect Temperatures

- Do not place organic or fragile objects in direct sunlight
- Avoid installing a mechanical system that is not reliable or cannot be easily maintained
- Avoid heating collections in winter and take advantage of the cold weather to help mitigate pest activity and chemical decay
- Block sunlight by keeping blinds or shutters closed
- Have an air space of 10 cm or more between objects and the walls, floors, and ceiling
- Insulate artwork that is in transit
- Monitor your collection for signs of chemical damage from incorrect temperatures
    - Too hot – brown brittle paper, decaying photographs
    - Too cold – cracked paintings and furniture

[34] National Park Service, "Chapter 4: Museum Collections Environment," *Museum Handbook*, Part I (1999), 4.37.
[35] National Park Service, "Chapter 4: Museum Collections Environment," *Museum Handbook*, Part I (1999), 4.37-4.38.
[36] Stefan Michalski, "Agent of Deterioration: Incorrect Temperature," *Canadian Conservation Institute*, https://www.canada.ca/en/conservation-institute/services/agents-deterioration/temperature.html (accessed April 4, 2018).

9. INCORRECT RELATIVE HUMIDITY[37]

Relative humidity (RH) is a measure of the quality of air that ranges between damp and dry. What we perceive as relative humidity is the dampness or dryness felt by our bodies. Although we can feel the extremes between a low and high relative humidity, it is better to rely on measurement instruments (*sling psychrometer or aspirating psychrometer*) to tell us what the RH is in a museum.

Stages of Relative Humidity

- Damp (over 75%)
    - Mold is present
        - Can discolor or disintegrate skin, leather, textiles, paper, baskets, and occasionally wood, paint, or glass
    - Rapid corrosion
    - Mechanical damage
- Relative humidity is above or below a critical value for objects
    - When glass, for example, is below it's critical RH level of 55%, it can begin to crizzle. *(See Appendix #7 for more information on crizzling)*
    - Some minerals such as, calcium chloride and magnesium chloride, have specific critical RH levels at which they can crumble or weep. Always be aware of what you have in your collection and what is a stable RH for those objects.
- Relative humidity is above 0% (when water vapor is present)
    - Applies to archival materials such as acidic paper, magnetic tape, acetate, and nitrate films. These materials can become weak, yellow, and brittle over just a few decades due to acid hydrolysis. Acid hydrolysis is the chemical reaction to the presence of water vapor.
- Relative humidity fluctuations
    - Poses the greatest concern to museums. A change in RH can cause materials to expand and contract as the RH goes up and down.

[37] Stefan Michalski, "Agent of Deterioration: Incorrect Temperature," *Canadian Conservation Institute*, https://www.canada.ca/en/conservation-institute/services/agents-deterioration/humidity.html (accessed April 4, 2018).

OBJECT CARE

"COLLECTION CARE IS SIMPLY BEING CAREFUL TO AVOID NEEDLESS DAMAGE AND LOSS TO A COLLECTION. MORE TECHNICALLY STATED, COLLECTION CARE ACHIEVES THE SYSTEMATIC MITIGATION OF ALL RISKS TO ALL STRATEGICALLY MANAGED VALUES OF A COLLECTION"

AMERICAN INSTITUTE FOR CONSERVATION OF HISTORIC AND ARTISTIC WORKS

BOOKS AND PAPER[38]

Agents of Deterioration

- Incorrect Temperatures and Relative Humidity
  - Low RH levels can cause embrittlement of paper materials
  - High RH levels can cause swelling of paper materials, leading to planar distortion
  - RH levels above 60% lead to mold growth
  - Temperature fluctuations can lead to the expanding and contracting of paper
  - Papers that are bound in a different material that does not expand or contract at the same rate, constitutes deformation and tears

- Radiation
  - Too much exposure to light can cause fading, discoloration, and embrittlement from the heat.
  - Ultra Violet is the most damaging portion of natural and artificial light. UV filters are available for windows and light bulbs to reduce the effects of UV rays.
  - 50 Lux is the recommended light level.
- Pests
  - Common pest threats to paper and books:
    - *Silverfish* – feed on mold and starchy materials
    - *Firebrat* – feed on mold and starchy materials; prefer warm, moist, and dark environments
    - *Book Louse* – feed on mold spores; found in heated buildings or in an RH above 60%
- Direct Physical Forces
  - Careless handling is the most prevalent cause of damage to paper-based materials. Mishandling can lead to tears, wear, creases and staining.

Cleaning

- Use caution when cleaning paper and books.
- Make sure your hands are clean and you are wearing clean cotton gloves.
- Before handling books, inspect them for any loose materials or binding.
- Use two hands to support paper and books.

[38] Mary Fahey, "Documents and Works of Art on Paper," *The Henry Ford*, https://www.thehenryford.org/docs/default-source/default-document-library/the-henry-ford-documents-amp-works-of-art-on-paper-conservation.pdf/?sfvrsn=2%22 (accessed April 5, 2018).

- Cleaning with water solvents should only be carried out by a professional. Instead use a soft bristled brush or low-suction vacuum to remove and dirt or build-up.

Care

- When handling books and paper always wear clean cotton gloves to prevent the transfer of salts and oils.
- Make sure that your workspace is clean and there is no food or drink present.
- When moving a paper object, always support it from below with a stiff piece of paper or mat board.
- Use only pencils when working with books and paper. Pens and markers can stain the material and their marks are not reversible.

Storage

- Do store and display in a cool area and keep materials away from heat sources such as furnace vents, fireplaces, lights, and direct sunlight.
- All storage boxes, folders, and tissue paper should be acid-free, lignin-free and have a neutral pH.
- Paper or books that are severely degraded should be stored with buffered boxes or folders containing an alkaline reserve.
    - For more information on buffered and unbuffered storage materials, *see Appendix #16*.
- If you are storing multiple pieces of paper together, depending on how many there are, store them loosely in an acid-free (Mylar) folder or envelope. If you must, you can use a museum-grade paperclip. Never use metallic clips, they can corrode and leave stains.
    - For more information on clips and their removal, *see Appendix #14*.
- Avoid storing materials in damp basements.

Display

- Display photocopies of paper documents when possible.
- If you have a book open on display, maintain a regular schedule of page-turning to ensure that no page is exposed to light for too long.
- Use a book cradle to support open books on display.
- Do not display papers or books longer than 6 months. Try to circulate your collection to avoid displaying the same radiation prone materials annually.

CERAMICS AND GLASS

Ceramics[39]

There are four different types of ceramics, ranging from porous to non-porous: adobe/mudbrick, earthenware, stoneware, and porcelain. Adobe and mudbrick are unfired clay mixtures commonly used in building or sculpture. Earthenware is a low-fired clay that does not vitrify and is very porous and granular. Stoneware is formed at a slightly higher heat than earthenware – it will partially vitrify and is still porous, but less porous and denser than earthenware. Porcelain forms at the highest temperature, above 1300°C; it is completely vitrified and non-porous.

Some ceramics will have a surface treatment applied, such as a glaze, either for decoration or to make them less porous. There is slip treatment (a thin layer of colored clay applied before the first firing), underglaze (applied prior to adding fine detail after the first firing), and over glaze (applied to fired or unfired clay).

Glass[40]

Glass is made up of silica (sand or crushed flint) and alkaline oxide (flux). Flux can be "lead, calcium, potassium, and sodium oxides." Oxides that are added for colorant include: "iron, copper, cobalt, manganese, chromium, and nickel." The combination of flux and oxides are added to create glass, will determine whether or not the final product is transparent, translucent, or opaque. Glass is shaped by an artist at hot temperatures. Some of the shaping processes include: mouth blowing, glass pressing, core dipping, pâte de verre (glass paste), lost wax casting, and millefiore. After the glass object has been produced, there are cold-working techniques such as cutting, engraving, and acid etching that add decoration to the object.

Agents of Deterioration

[39] National Park Service, *Museum Handbook*, "Appendix P: Curatorial Care of Ceramic, Glass, and Stone Objects", Part 1, https://www.nps.gov/museum/publications/MHI/mushbkI.html (accessed October 25, 2017), 6, 7.
[40] National Park Service, *Museum Handbook*, "Appendix P: Curatorial Care of Ceramic, Glass, and Stone Objects", Part 1, https://www.nps.gov/museum/publications/MHI/mushbkI.html (accessed October 25, 2017), 6, 7.

Ceramics

- Incorrect Temperature or Relative Humidity[41]
    - A fluctuation in relative humidity can trigger soluble salts in ceramics to crystallize and porous surfaces to expand and contract leading to fractures.
- Direct Physical Forces[42]
    - Ceramics can easily break due to mishandling or another form of a direct, or even indirect, physical force.
    - Make sure that staff are trained in proper artifact care and handling techniques to prevent any accidents.
    - The best form of preventative care is to limit handling ceramics as much as possible.
- Contaminants[43]
    - Dust is the most common contaminant to harm ceramics. It can scratch and degrade surfaces, requiring ceramics to be constantly monitored and cleaned.
    - To remove dust, gently use a Tyvek cloth to wipe away any settled materials. For those ceramics that are stable or high-fired, you can use a slightly damp cloth with alcohol, water, and detergent to clean away any stubborn contaminants.

Glass[44]

- Water
    - When water droplets form on the surface of glass, this is known as "weeping glass." This water can leach out unstable components from the glass and form an alkaline solution.
    - Crizzling will occur when those water droplets remain on the surface for an extended period of time, long enough to develop a network of hairline cracks.
- Radiation
    - If glass is left in direct sunlight, iridescence (a rainbow-effect) can develop.
    - Glass can also turn purple or brown from too much sun exposure. This is commonly seen in archaeological glass.
- Direct Physical Forces
    - Glass can easily break due to mishandling or another form of a direct, or even indirect, physical force.
    - Make sure that staff are trained in proper artifact care and handling techniques to prevent any accidents.

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[41] National Park Service, "Appendix P: Curatorial Care of Ceramic, Glass, and Stone Objects," *Museum Handbook,* Part I, 2000, P:11.
[42] Rebecca A. Buck and Jean Allma Gilmore, eds., *Museum Registration Methods 5th Edition,* (Washington, DC: The AAM Press, 2010), 215.
[43] Greg Byrne, "Removing Dust From Ceramic and Glass Objects", Conserve O Gram 8, no. 1 (July 1993): 1-3, https://www.nps.gov/museum/publications/conserveogram/08-01.pdf (accessed October 25, 2017).
[44] National Park Service, "Appendix P: Curatorial Care of Ceramic, Glass, and Stone Objects," *Museum Handbook,* Part I, 2000, P:11.

- The best form of preventative care is to limit handling glass objects as much as possible.

For more information on agents that attack ceramics and glass, *see Appendix #7*.

Cleaning

Ceramics

Do not wet clean porous ceramics, clean them with a brush instead.

Before beginning to clean, inspect the object to make sure that there are no loose gilded flakes or paint that could possibly be removed during cleaning. The cleaning solution should always be diluted and applied with a clean soft damp, not wet, cloth. Cleaning solutions could be 1% mild detergent mixed in water, or ethanol and water (1:1). Before applying the cleaning solution to the surface, test a small inconspicuous area of the object to make sure that any surface designs will not be damaged. If a detergent cleaning solution was used, follow-up with distilled water on a cloth or cotton ball to remove any residual detergent. Allow the object to air dry.[45]

Glass[46]

Most glass objects can be cleaned the same as ceramics, but should include even portions of distilled water, isopropyl alcohol and a few drops of ammonia as a cleaning option. This mixture can be sprayed on glass panes and wiped clean with a cloth. If glass is going to be cleaned with water, it should only be cleaned once a year and on an as-needed basis. Orvus, a near-neutral pH paste, can be used to clean glass if it is diluted in warm water.

To dry the object, let it rest on a flat surface and gently pat dry with a soft cloth. Windows that are covered with UV film, can be dusted gently with a brush and if needed, wiped clean with a damp cloth. Mirrors can be cleaned the same way, but make sure that the fixture is secured to the wall or stabilized by another person. Any glass light fixtures should be removed from the ceiling before they are cleaned and a conservator should be consulted. If glass is clouded, it cannot be reversed by intensive rubbing. Clouded glass is a chemical leaching action, not a deposit. It cannot be removed. Glass that is "weeping" should be professionally cleaned by a conservator.

Care[47]

Proper handling is a part of preventative care. The best form of preventative care for glass and ceramic objects is to limit handling them as much as possible. But, if you do have to handle them, carefully examine them first for any loose pieces, cracks, lifted glaze, or vulnerable pieces. Glass and ceramics can be handled with ungloved hands as long as they are clean and dry. But, if

[45] Clara Deck, "The Care and Preservation of Glass & Ceramics", The Henry Ford (2016): 1-7, https://www.thehenryford.org/docs/default-source/default-document-library/the-henry-ford-glass-amp-ceramics-conservation.pdf/?sfvrsn=2 (accessed October 25, 2017).
[46] Minnesota Historical Society, "Historic Housekeeping Handbook", http://www.mnhs.org/preserve/conservation/reports/manual-0102.pdf (accessed October 20, 2017), 14.
[47] National Park Service, *Museum Handbook*, "Appendix P: Curatorial Care of Ceramic, Glass, and Stone Objects", Part 1, https://www.nps.gov/museum/publications/MHI/mushbkI.html (accessed October 25, 2017), 24, 25.

there is a ceramic that is especially porous or unglazed, hands should be covered in cotton gloves. All rings should also be removed prior to handling the object. Also note that glass and ceramics are considered composite objects – they can be made of more than one material. Glass and beads are often sewn into jewelry, clothing or dolls. Care should be taken to analyze the object for its different materials that require different forms of care, and then determine the best method of preventative care.

- Thoroughly examine the object first.
- Never handle more than one object at a time.
- Always life the object with two hands and by the object's strongest points – not the handle, spout, or lip.
- Be careful not to rub surface that have been gilded or have iridescent glass.
- Never stack glass or ceramic objects without a protective layer between them. The unglazed bases of ceramics could scrape the glaze of the object below.

Each time a glass or ceramic object is handled, there is a new opportunity for decorative elements to be knocked off or old repairs to break. If an object breaks, or is broken, take a photograph in situ and keep all the pieces. Do no try to fit the pieces back together. Reach out to a trained conservator to see if the object can be repaired. Keep basic housekeeping for glass and ceramic objects at a minimum. A good preventative approach to conserving glass and ceramic objects is to store or display them in dust-proof cases. For more information on how to care for ceramics and glass, *see Appendix #7*.

Storage and Display

Good storage will minimize the need for constant monitoring and the chance for anything to break, thus possibly extending the shelf life of the object. Objects should be stored in areas where they are away from the direct flow of traffic, reducing vibrations, and shelves should be lined with closed-cell polyethylene foam to help prevent objects from moving. Cabinets with clear glass doors are highly recommended because they allow museum staff to view the objects without actually handling them. An alternative is to store objects on a stable shelving unit that is only one object deep which would cut down on moving objects to retrieve others. If it is an open unit, make sure that it has a good dust cover. Both shelves and cabinets should be bolted to the walls and ceiling to increase their stabilization. If an object has multiple pieces or has been broken they should all be kept together, but apart, in storage; no one piece should be touching another. If an object has an irregular shape or is damaged, it should be stabilized in a single position that is reinforced with foam blocks.[48]

- Do not store or display glass or ceramics in direct light. Light will raise the temperature and relative humidity around the object, heating it. This fluctuation in relative humidity

[48] National Park Service, *Museum Handbook*, "Appendix P: Curatorial Care of Ceramic, Glass, and Stone Objects", Part 1, https://www.nps.gov/museum/publications/MHI/mushbkI.html (accessed October 25, 2017), P:5, P:14, P:15.

can cause soluble salts in ceramics to crystalize and porous surfaces to expand and contract leading to fractures.

- Line storage shelves with closed-cell polyethylene foam (Volara®). Attach the foam with double-stick tape so it will not budge.
- Do not store your glass or ceramic objects more than one object deep on a shelf. This limits the need to move one object to retrieve another.
- Heavy items should be stored on the bottom shelves.
- Do not stack any glass or ceramics, including plate, cups, and bowls.
- Store irregularly shaped or unstable glass and ceramics in a stable position using padding or foam blocks.
- If you have a set of items, store them together. And if you have any broken pieces, store them with the original.
- Use dust covers over shelves in the storage area to prevent contaminants from settling.

Environmental Recommendations[49]

	Temperature and Relative Humidity	Relative Humidity
Weeping Glass	65-70ºF	40%
Crizzling Glass	65-70ºF	55%
Archaeological Ceramics	65-70ºF	45%

[49] Clara Deck, "Glass & Ceramics," *The Henry Ford*, https://www.thehenryford.org/docs/default-source/default-document-library/the-henry-ford-glass-amp-ceramics-conservation.pdf/?sfvrsn=2 (accessed April 5, 2018).

METALS

Before treating any metal, be sure you have properly identified the type of metal. Proper identification of metals is important not only for the housekeeping of the object and storage and exhibit techniques, but also to ensure that you are delivering accurate interpretive information. If you do not know the basic properties of the metal, or you don't have the tools and supplies needed to accurately identify it, describe the metal in generic terms. For example, if you are trying to determine if the metal is pewter, silver, or nickel, instead identify it as white metal to avoid misidentifying it entirely.[50]

Metal	**Color**	**Other Identifying Characteristics**	**Primary Alloys and Uses**
Iron and Iron Alloys	Grey/silver, blue-black and red-brown color	Some but not all iron alloys are magnetic	**Cast Iron** (iron & carbon, 2% to 4%). Kettles, door hardware, fire backs, stoves **Wrought Iron** (pure iron & carbon, not more than .035%). Railings, nails, wagon hardware. **Steel** (iron & carbon, 0.15% to 2 %). Knives, tools, structural materials
Copper and Copper Alloys	Yellow to rich browns. Surface may be patinated and vary in color from red, brown, black and blue to shades of green	-----	**Brass** (copper & zinc). Lighting devices, jewelry, scientific instruments, marine fixtures, cookware **Bronze** (copper & tin): Bells, cannons, bearings. **Nickel Silver:** (copper & nickel & zinc), household decorative objects
Lead	Pure lead and lead alloys where lead predominates, dull metallic blue in color.	Very heavy & very malleable.	Pipes, pump wells in ships, toys, roofs, bullets, and solder.
Silver and Silver Alloys	White metallic appearance	Sterling silver is usually hallmarked	Numerous silver-copper alloys such as Sterling, coin silver, jewelry, and tableware
Nickel	Gray to white appearance	Metal is slightly magnetic.	**Nickel** is often used in its pure form as a plate for tableware, kitchenware, and decorative ornaments
Tin and Tin alloys	Dull gray	-----	**Pewter** (tin & antimony & copper). Kitchenware and plating for tin cans and toys

[50] National Park Service, "Appendix O: Curatorial Care of Metal Objects," *Museum Handbook*, Part 1, 2002, O:2-O:5.

Agents of Deterioration[51]

Corrosion is the chemical reaction between the metal and its environment that causes the deterioration of the material and its properties. It is the most common problem for metal-based objects and can occur during fabrication or develop in the environment they are being exhibited or stored in. The presence of corrosion does not necessarily mean that there is an active case of corrosion. While corrosion can tarnish the metal and cause patination over time, it can also be deliberately created in the fabrication process for aesthetic effect.

You can identify active corrosion by looking for:

- Color changes in the metal (wet or dry in appearance)
- Powdery or flaky formations on the surface or around the base of the object
- Loose formations that are meant to be securely attached to the object
- Continual change or growth

Corrosion is an indication that your house museum may have an *incorrect relative humidity, temperature extremes, airborne pollutants,* or the metal has been *mishandled.*

Metal Corrosion Identification Chart

Metal	Active Corrosion	Stable Surfaces	Causes of Corrosion
Iron & Steel	Orange to reddish-brown. Wet or glossy appearance. A surface that is scaling, flaking or pitting.	Compact blue-black and red brown color.	High relative humidity, surface moisture.
Lead	Loose white powder in tiny spots or overall.	Smooth gray surface.	Weak organic acid vapors, from sources such as wood, cardboard, and vinegar.
Copper and Copper Alloys	Corrosion forms in small spots overall. Powdery green, blue, and white corrosion products that are generally over the entire surface.	Wide variety of colors: solid blue, green, red, brown, or black. Surfaces are smooth and tightly adherent.	High relative humidity, surface moisture, air pollution, salts from inappropriate cleaning and handling.

[51] National Park Service, "Appendix O: Curatorial Care of Metal Objects," *Museum Handbook*, Part 1, 2002, O:5-O:6.

Silver and Silver Alloys	Alloys Slight gray dullness through blue/purple that deepens to brown/black as corrosion becomes thicker.	Smooth white metallic. A blue/purple surface can be stable if it occurs overall and the object is removed from the source of corrosion.	High humidity, sulfur compounds, etching from fingerprints, organic vapors.
Nickel	Nickel corrosion is reddish brown and is similar in appearance to rust. Green copper corrosion products indicate preferential corrosion from a copper alloy.	Smooth gray appearance.	High humidity and sulfur compounds.
Tin and Tin Alloys	White gray, dark gray to black. Nodules of white to gray corrosion that form under the surface layer.	Smooth gray surfaces.	High relative humidity, atmospheric pollutants, low temperatures.

Cleaning[52]

When you clean metals, you will oxidize the surface and it will be chemically stable again. This is only a safe cleaning practice if the metal was not created with an intentional patina or if it has a painted surface. A patina is a thin chemical layer that can be applied to the surface as a part of the finishing process or appear naturally over time. Objects could also be gilded with a thin layer of gold which can easily be destroyed by polishing. When examining the object, if you notice there is any type of organic coating over the surface, such as paint, keep in mind that the inadvertent removal of this coating would permanently diminish the value of the object.

Care[53]

Thoroughly examine the object to make sure it has retained its structural integrity before beginning any handling or cleaning procedures. Examine the object carefully, look for any cracks, weak areas, old repairs, or loose or missing parts. If you notice a change in the integrity of the object, make a note of it on the object's identification card, and proceed with caution.

[52] Clara Deck, "The Care and Preservation of Historical Silver," Benson Ford Research Center, www.thehenryford.org/research/caring/silver.aspx (accessed April 5, 2018).
[53] National Park Service, "Appendix O: Curatorial Care of Metal Objects," *Museum Handbook*, Part 1, 2002, O:6-O:7.

If the object does not have any organic or inorganic coatings, the following are recommended techniques for caring for metal objects.

- Always be gentle, even with metals. You do not want to cause any unnecessary deterioration.
- Do not use commercial polishes. They may contain corrosive chemicals such as ammonia which can damage the surface.
- Handle and clean metals in a clean work space.
- Wear protective gloves such as nitrile gloves (Safeskins® powder-free 6 ml) or clean cotton gloves to avoid contaminating the object and your hands. Do not choose gloves that contain chlorine or polyvinyl chloride; synthetic gloves are also not recommended.
- Use thing sheets of polyethylene to protect and cover any parts of the object that are nonmetallic.
- If you are transporting a heavy metal, whether it is to a new location or to be cleaned, transport it on a cart or dolly.
- If you need to gently clean the surface, use a jewelry cloth to wipe away fingerprints on uncoated gold, silver, copper alloys, and highly polished steels. Any soft cloth can be used to buff an object after handling.
- Please see the *Appendix #11* for more information of the care of copper and silver alloys.

Storage and Display[54]

- Try to store all metal objects indoors, away from rain water and temperature extremes
- Do not store metals on the floor (especially basement and attic floors) or near any exterior walls.
- Keep metals away from paper, textiles, and wood objects.
- Be aware that frequent cleaning of exhibit areas may add moisture and harmful vapors to the environment.
- Store metals on steel shelving and line the shelf with an inert, nonabsorbent material such as expanded polyethylene and loosely drape clear polyethylene over the shelving unit to protect the metal from water leaks and dust.

[54] National Park Service, "Appendix O: Curatorial Care of Metal Objects," *Museum Handbook*, Part 1, 2002, O:7-O:8.

OIL PAINTINGS

Storing and displaying paintings in an inappropriate environment is the primary cause of damage to oil paintings. When examining the condition of paintings look for the following clues for signs of active deterioration.[55]

- Cracks in the varnish or paint
- Mold
- Evidence of pest infestation
- Rusty or loose hooks and handing wire
- Warping in the frame or stretcher
- Slackness in the canvas

Agents of Deterioration[56]

- Radiation
    - Light levels for paintings should not exceed 200 Lux.
    - Excessive light exposure can cause paintings to fade and/or darken.
    - Too much light will raise the temperature surrounding the painting.
- Incorrect Temperature and Relative Humidity
    - If the temperature fluctuates, paintings can expand and contract in their wood frames. Paint can crack and flake as a result of this.
    - Paintings should be "keyed out" when the humidity is high. "Keying out" is when the painting's stretcher or strainer's expandable corner joints are adjusted to insure the painting remains fixed in the frame.
    - Winter: 65-70ºF, RH 40-45%
    - Summer: 70-75ºF, RH 45-55%
- Pests
    - Carpet beetles – found in the back of paintings between the canvas and stretcher.
    - Powder post beetles – bore holes into the wooden frame and leave frass (looks like saw dust) behind.
        - If you notice signs of an infestation on one of your paintings, isolate the paintings in a plastic container until it can be examined by a conservator.
- Direct Physical Forces
    - The greatest amount of damage that paintings sustain is due to mishandling.
    - Do not handle large paintings alone, have someone there to spot you.

Cleaning

Light cleaning with a soft bristled brush or filtered vacuum are recommended to be done on-site. If your painting needs to be thoroughly cleaned, contact a trained conservator.

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[55] National Park Service, "Appendix L: Curatorial Care of Easel Paintings," *Museum Handbook*, Part I, (2000), L:9

[56] Mary Fahey, "Oil Paintings," *The Henry Ford*, https://www.thehenryford.org/docs/default-source/default-document-library/the-henry-ford-oil-paintings-conservation.pdf/?sfvrsn=2 (accessed April 5, 2018).

Care

- Handling paintings with clean hands and always wear clean cotton gloves.
- Never carry a large painting by yourself.
- Do not hold a painting by the top of the frame. Grasp it on either side with both hands.
- Be careful that the wire does no puncture the back of the painting when moving it.
- Never touch the surface or push on the canvas from the reverse.

Storage and Display[57]

- Store paintings in a dimly lit area where no direct sunlight hits them.
- Hang them from storage screens, place them on storage shelves (not stacked), or stack them vertically against an interior wall or side of a cabinet.
- Do not store paintings in attics or basements, against exterior walls, below a heat or water source, or near old insulation or wiring.
- Hang paintings away from doors, furniture, or other objects that could bump into the painting.
- Painting should be hung away from heat sources.
- Do not display painting in direct sunlight and make sure that light sources being emitted on the painting are no greater than 200 Lux.

[57] National Park Service, "Appendix L: Curatorial Care of Easel Paintings," L:11-L:13.

PHOTOGRAPHS

Photographs are one of the most common collection materials to own. They are also among the most unstable and difficult collection materials to preserve because of their composition. Photographs are composed of two layers. The upper layer is the emulsion layer (metallic particles and dyes) and the lower "support" layer (paper, glass, metal, or plastic.[58]

Older black and white prints have a silver embedded emulsion layer with a gelatin (c. 1870-present) binding material. Gelatin was, and continues to be, the most common binder, but other binding materials include albumen (c. 1850-1900, a globular protein from the white of hens' eggs) and collodian (c. 1851-1920, cellulose nitrate). Color photographs began being produced in 1935 and involve a variety of color process on different materials. [59]

Most nineteenth-century black and white prints are finely divided metallic silver, also known as "printed-out" or "photolytic" silver. These silver particles are rounded and scatter light. As a result, they produce the red or brown image tones that are commonly seen in good condition nineteenth-century prints. The final image material for photographs printed in the twentieth-century is filamentary silver. Filamentary silver contains larger particles that are less vulnerable to image deterioration because they absorb light rather than scatter it. Therefore, unlike the brown tone that nineteenth-century photographs had, twentieth-century images are characterized by a neutral black color.[60]

Agents of Deterioration

- Incorrect Temperature and Relative Humidity[61]
    - High RH – more moisture (fading, discoloration, silver mirroring)
    - High RH and high temperatures – mold growth
    - Low RH – desiccation, embrittlement, curling or flaking of glass emulsions
    - RH and temperatures fluctuate – photograph will crack or warp
- Radiation[62]
    - Light can cause permanent embrittlement, yellowing, and fading.
    - Direct sunlight is more damaging and fast-acting than indoor lighting
    - Color photographs are more sensitive to light damage than black and white prints
    - Filter light by using UV filters over the windows or framing with UV filtering glass or Plexiglas

[58] Mary Fahey, "Photographic Prints," *The Henry Ford*, https://www.thehenryford.org/docs/default-source/default-document-library/the-henry-ford-photographic-prints-conservation.pdf/?sfvrsn=2 (accessed April 5, 2018).
[59] Mary Fahey, "Photographic Prints."
[60] National Park Service, "Appendix R: Curatorial Care of Photographic Collections," *Museum Handbook*, Part I (1996), R:2.
[61] NEDCC Staff, "5.3 Care of Photographs," *Northeast Document Conservation Center*, https://www.nedcc.org/free-resources/preservation-leaflets/5.-photographs/5.3-care-of-photographs (accessed April 5, 2018).
[62] Mary Fahey, "Photographic Prints."

- Contaminants[63]
    - Degradation through metallic corrosion is heighted by contact with pollutants such as sulfur, ozone, or peroxides.
    - Due to the large amount of sulfur they contain, do not store photographs near rubber or leather

Cleaning

"Surface dirt should be removed using a soft brush. More extensive cleaning and repair should be left to a professional conservator since photographs are easily damaged by moisture and solvents."[64]

Emergency Salvage of Wet Photographs[65]

- Act fast to conserve your photographs. The longer they are left untreated, damage will become maximized.
    - Mold begins within 48 hours, 60% RH and 70F
        - Can cause permanent staining
- If photos cannot be air dried, they should be frozen
    - Material priority:
        - 1. Prints (excluding nitrate and safety films)
        - 2. Photographs that are made of unstable materials
- Air drying
    - Gently separate photographs from their enclosures
    - Drain excess water
    - Lay flat on absorbent blotters or paper towels
    - Keep air moving at all times, with a fan on low
- Freezing
    - Good for when photos are stuck together
    - Wrap photos in waxed paper prior to freeze
- Drying frozen photos
    - Thaw, then air dry
    - Vacuum thermal drying not recommended following freezing

[63] Mary Fahey, "Photographic Prints."
[64] Mary Fahey, "Photographic Prints."
[65] Gary Albright, "3.7 Emergency Salvage of Wet Photographs," *Northeast Document Conservation Center*, https://www.nedcc.org/free-resources/preservation-leaflets/3.-emergency-management/3.7-emergency-salvage-of-wet-photographs (accessed April 5, 2018).

Care[66]

For specific photograph care, including daguerreotypes, ambrotypes, and tintypes, please refer to *#9 in the Appendix*, or visit nps.gov, "Appendix R: Curatorial Care of Photographic Collections." *https://www.nps.gov/museum/publications/MHI/Appendix%20R.pdf*

All photographs should be handled with cotton gloves to prevent the transfer of oil or salt from your hands to the material. Gently handle photographs. If the photographs are in a deteriorated state, you can place a ridged support under it when moving or lifting it.

When not on display, photographs should be stored in dark storage. Those photographs that are on display should not be in direct sunlight or have spotlights directed on them. Light should be between 50-100 Lux, room temperature at 68ºF, and a relative humidity of 20-40%.

Storage and Display[67]

- Use copies to display whenever possible – this will elongate the life of the original.
- Keep all light levels low.
- Hang or display photographs where they will not be exposed to direct or indirect sunlight, or to unfiltered fluorescent lights.
    - UV-absorbing sheets can be used over windows or in frames
    - Consider purchasing low UV-emitting indoor bulbs.
- Store with neutral pH envelopes or sleeves in acid-free folders or boxes.
- No more than one page in a sleeve or other enclosure.
- Store according to size, format, and type.
- Store in same-sized folders.
- Label with pencil all materials on reverse side.

[66] NEDCC Staff, "5.3 Care of Photographs."
[67] NEDCC Staff, "5.3 Care of Photographs."

TEXTILES[68]

Museum textiles consist of objects that are composed of natural fibers such as wool, linen, or silk. The descriptions here are generalized. For more material specific information, see *Appendix #8*.

Agents of Deterioration

- Radiation
    - Too much exposure to natural and artificial light over a long period of time can reduce the longevity of textiles, causing them to deteriorate or fade
    - The recommended visible light levels for textiles is 50 Lux
- Incorrect Temperature and Relative Humidity
    - Low humidity levels can cause embrittlement
    - High humidity levels promote mold growth
    - Fluctuation in temperatures can cause the fibers in textiles to expand and contract, damaging the objects structural integrity
    - Winter: 70ºF, RH 30-35%
    - Summer: 75ºF, RH 50-55%
- Pests
    - Clothing moths – feed on the protein in textiles, especially wool and feathers
    - Carpet beetles – feed on the protein in textiles and leave frass (dust-like particles) behind
    - Firebrats and silverfish – feed on starchy materials such as glue and fabric; both prefer moist dark environments
- Inherent Instability
    - Antique silk textiles that were produced in the early nineteenth and twentieth-century are often chemically unstable due to the addition of metallic salts. This process was called "weighting." It added weight and body to the fabric. Those silks that have been weighted contain iron and tin, both of which will accelerate the degradation of the material, brittling and fraying it faster.
        - Avoid placing physical stress on those silks and store them lying flat.
- Direct Physical Forces
    - Mishandling is a common agent of deterioration for all textiles. Always handle textiles with caution and educate your staff on proper handling techniques

Cleaning

- Any washing or drying of a textile should be handled by a conservator.
- Commercial dry cleaning is not recommended due to the harsh chemicals that can damage fragile materials

[68] Mary Fahey, "Antique Textiles & Costumes," The Henry Ford, https://www.thehenryford.org/docs/default-source/default-document-library/the-henry-ford-antique-textiles-amp-costumes-conservation.pdf/?sfvrsn=2 (accessed April 5, 2018).

- Vacuuming is the only recommended cleaning procedure for a non-specialist.
    - Before vacuuming, gently brush the dirt with a soft bristled brush from the surface of the textile
    - Vacuum the textile using a low suction vacuum with a clean brush nozzle attachment. Make sure that your vacuum has a nylon screen attached so that it can catch any loose fragments that become detached during cleaning.

Care

- Textiles should be lying flat when they are being examined, cleaned, or prepared for storage or display
- Do not eat, drink, or smoke in the vicinity or textiles. Textiles that are exposed to food, water, or air pollutants can lead to irreversible staining.
- Always handle textiles with clean hands while wearing clean cotton gloves.
- Remove any jewelry, rings, belts, or buckles that may snag or tear textiles while they are being handled.
- When marking textiles, prepare the tags away from the material to avoid transferring any ink to the textile.
- Do not place other objects on top of textiles.
- Avoid folding textiles whenever possible.
- Never try to wear historic textiles.

Storage

- Flat storage
    - The most recommended storage method, especially for fragile items.
    - Helps minimize fiber damage.
    - Storing textiles flat in drawers, tray, shelves, or boxes.
    - Do not store textiles in direct contact with wood, uncoated metal, and wood-based cardboard boxes.
    - Do store textiles on enamel metal shelving units or in acid-free and lignin-free boxes.
    - Do not stack and try not to fold your textiles. If you must fold them, place a piece of acid-free tissue paper between the folded layers.
- Rolled storage
    - Recommended storage method for rugs, quilts, and large flat textiles.
    - Layer the textile with a piece of acid-free tissue before rolling it and placing it in a storage tube.
    - If you do not have a storage tube, place the rolled textile inside a piece of washed muslin.
- Hanging storage
    - Not recommended for fragile or heavy textiles.
    - Use padded plastic hangers for historic costumes.

- Avoid using metal and wood hangers.
- Cover all hanging stored textiles with pre-washed muslin or Tyvek dust cover.

Display

- Rotate your textiles that are out on display to reduce their overall exposure to radiation and other airborne contaminants.
- Clothing textiles are typically framed, hung, or placed on a mannequin.
- Do not display textiles in direct sunlight.
- Large textiles such as quilts or rugs can be hung using a Velcro support system. Only hang sturdy textiles.
- Place a piece of washed, unbleached muslin on the back of the textile if it will be touching any other surface.

WOODEN OBJECTS[69]

Agents of Deterioration

- Radiation
  - Exposure to high light levels can cause wood finishes, stains, and some paints to darken and fade.
  - Excessive light can accelerate the aging process of finishes, causing them to crack, become brittle, or develop an "alligatored" appearance.
- Incorrect Temperature and Relative Humidity
  - Since wood is porous, it is susceptible to differing relative humidity levels and fluctuations in temperature.
  - Too high RH causes wood to swell.
  - Too low RH causes wood to shrink which leads to structural damage such as cracks, lifting veneer, gaps in joints, and embrittlement of adhesives.
  - Winter: 70ºF, RH 35-45%
  - Summer: 70-75ºF, RH 55-65%
- Fire
  - Fire is the most damaging agent of deterioration for wood since it is highly flammable.
- Pests
  - Carpet beetles – feed on protein in the furniture and are commonly found in adhesives, joints, and drawers.
  - Powder post beetles – bore small holes into wooden objects. You should routinely check the underside of legs and drawers for evidence of these beetles.
- Direct Physical Forces
  - The primary cause of damage to furniture is due to mishandling. Staff should be trained in proper handling techniques before handling, moving, cleaning, storing, or displaying wooden furniture.
- Contaminants
  - Dust is prone to settle on wooden furniture at some point in time. It contains hard and sharp particles that can cause abrasion and chemical damage to the surface of objects they settle on.[70]

[69] Clara Deck, "Furniture & Wooden Objects," The Henry Ford, https://www.thehenryford.org/docs/default-source/default-document-library/the-henry-ford-furniture-amp-wooden-objects-conservation.pdf/?sfvrsn=2 (accessed April 5, 2018).
[70] Alan Levitan, "Dusting Wood Objects," Conserve O Gram 7/5, (July 1993), https://www.nps.gov/museum/publications/conserveogram/07-05.pdf (accessed April 5, 2018).

Cleaning

- Whether the furniture is finished, porous, or unfinished, any extensive cleaning should be done by a trained conservator.
- Dust can be removed with a soft bristled brush or a vacuum cleaner nozzle.
- Wet cleaning can be done if the finish is in good condition.
    - Use a concentration of 1% detergent (Orvus) and water. Apply the mixture using a cotton ball or soft cloth to the surface of the object.
    - After cleaning the area, rinse the residual detergent with distilled water using a clean cotton ball or soft cloth.
    - Let the surface dry approximately 15 minutes before waxing or lightly buffing the surface with a clean soft shoe polishing brush.
        - Wax should only be applied once a year. For more information on waxing furniture and other wooden objects, see *Appendix #12 and 13.*

Use	Do not use
Vacuum with clean brush attachment—use micro tool adapter kits for nooks and crannies.	**Feather Duster** – they scatter the dust into the air and broken feathers can scratch the surface of furniture.
Untreated Synthetic Micro-Fiber Dust Cloths	**Commercially Treated Dust Cloths**—they may also contain silicones or other damaging additives.
Compressed air with a vacuum—use compressed air only when pressure can be regulated.	**Commercial Formulations**—such as aerosol or liquid furniture polishes, that frequently contain silicones (*see Conserve 0 Gram 7/6*), lemon, or linseed oil.

Care

- Do not wear gloves when handling furniture that has a fragile veneer and may snag on cotton gloves.
- Do wear gloves when handling finished objects or unfinished objects that are made from light colored wood.
- Examine the object for any loose or broken pieces before handling and moving
- Secure any doors, drawers, drop lids, or leaves before moving a piece.
- Use a dolly to move large pieces of furniture.
- Wooden furniture should be grasped at its most sturdy area.
- Do not grasp a chair by the back or arms. Instead grasp it by the seat.
- Do not attempt to move large objects by yourself.
- Do not draw the object across the floor, this will put stress on the legs or feet or a chair or table.

Storage and Display

- Store wooden furniture in a place where it can be easily accessible.
- Never store wooden furniture directly on concrete, stone, or brick floors
- Do not stack furniture
- Do not use historic period furniture for storage of other materials
- Avoid placing wooden furniture near furnace vents, warm lights, and direct sunlight

APPENDIX

SUPPLEMENTAL RESOURCES

1. “CURRENT THOUGHTS ON COLLECTIONS POLICY”

DANIEL R. PORTER III.

http://resource.aaslh.org/view/current-thoughts-on-collections-policy/

2. “CHOOSING A MUSEUM VACUUM CLEANER”

JESSICA S. JOHNSON AND STEVEN P. FLORAY, *CONSERVE O GRAM 1/6*

https://www.nps.gov/museum/publications/conserveogram/cons_toc.html

3. “CHOOSING UV-FILTERING WINDOW FILMS”

MELANIE PEREIRA AND SARA J. WOLF, *CONSERVE O GRAM 3/10*

https://www.nps.gov/museum/publications/conserveogram/cons_toc.html

4. “LOW-COST/NO-COST IMPROVEMENT IN CLIMATE CONTROL”

NORTHWEST DOCUMENT CONSERVATION CENTER

https://nedcc.org/free-resources/preservation-leaflets/2.-the-environment/2.6-low-costno-cost-improvements-in-climate-control

5. “INTEGRATED PEST MANAGEMENT MANUAL: MUSEUM PESTS”

CAROL DISALVO, NATIONAL PARK SERVICE

https://www.nature.nps.gov/biology/ipm/manual/museum.cfm

6. “AN INSECT PEST CONTROL PROCEDURE: THE FREEZING PROCESS”

TOBY RAPHAEL, *CONSERVE O GRAM 3/6*

https://www.nps.gov/museum/publications/conserveogram/cons_toc.html

7. “CARE OF CERAMICS AND GLASS”

CHARLOTTE NEWTON AND JUDY LOGAN, CANADIAN CONSERVATION INSTITUTUE

https://www.canada.ca/en/conservation-institute/services/conservation-preservation-publications/canadian-conservation-institute-notes/care-ceramics-glass.html

8. “CARE AND CONSERVATION OF COSTUME AND TESTILES”

THE INSTITUTE OF CONSERVATION

www.conservationregister.com/Downloads/Costume.pdf

9. “CARING FOR PHOTOGRAPHS: GENERAL GUIDELINES”

DIANE VOGT-O’CONNER, *CONSERVE O GRAM 14/4*

https://www.nps.gov/museum/publications/conserveogram/cons_toc.html

10. “DUST COVERS FOR OPEN STEEL SHELVING”

DONALD R. CUMBERLAND JR., *CONSERVE O GRAM 4/2*

https://www.nps.gov/museum/publications/conserveogram/cons_toc.html

11. “CARING FOR SILVER AND COPPER ALLOYS”

DEBORAH LONG, *CONSERVE O GRAM 10/2*

https://www.nps.gov/museum/publications/conserveogram/cons_toc.html

12. “CLEANING WOOD FURNITURE”

RON SHEETZ, *CONSERVE O GRAM 7/1*

https://www.nps.gov/museum/publications/conserveogram/cons_toc.html

13. “WAXING FURNITURE AND WOODEN OBJECTS”

RON SHEETZ, *CONSERVE O GRAM 7/2*

https://www.nps.gov/museum/publications/conserveogram/cons_toc.html

14. “REMOVAL OF DAMAGING FASTENERS FROM HISTORIC DOCUMENTS”

NORTHEAST DOCUMENT CONSERVATION CENTER

https://www.nedcc.org/free-resources/preservation-leaflets/7.-conservation-procedures/7.8-removal-of-damaging-fasteners-from-historic-documents

15. “MUSEUM STORAGE CABINETS”

DONALD R. CUMBERLAND JR., *CONSERVE O GRAM 4/1*

https://www.nps.gov/museum/publications/conserveogram/cons_toc.html

16. “BUFFERED AND UNBUFFERED STORAGE MATERIALS”

VIRGINIA KILBY, *CONSERVE O GRAM 4/9*

https://www.nps.gov/museum/publications/conserveogram/cons_toc.html

17. “STORING ARCHIVAL PAPER-BASED MATERIALS”

DIANE VOGT-O’CONNER AND DIANNE VAN DER REYDEN, *CONSERVE O GRAM 19/15*

https://www.nps.gov/museum/publications/conserveogram/cons_toc.html

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