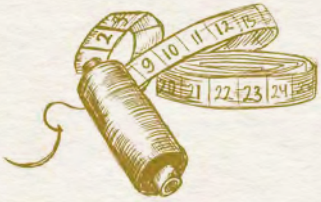
HERITAGE
CONSERVATION
CENTRE

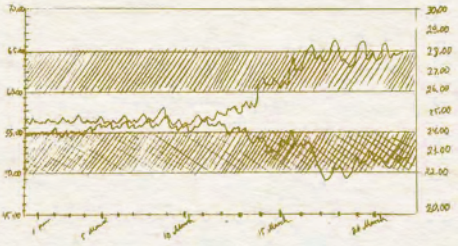


Chapter I
Managing Your Collections

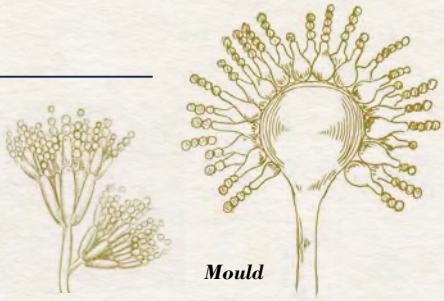
Accessioning

A Basic Guide to

Caring for Your Collections



Temperature & Relative Humidity



Mould

Chapter II
Understanding the Agents of Deterioration

Pests

Cigarette Beetle
Lasioderma serricorne

Asian Subterranean Termite
Coptotermes gestroi

Silverfish
Lepisma saccharina

Common Clothes Moth
Tineola bisselliella

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A Basic Guide to

Caring for Your Collections

HERITAGE
CONSERVATION
CENTRE

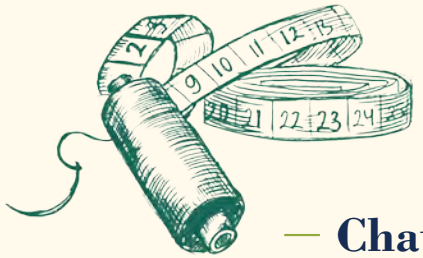
Introduction

Regular and consistent care of your collection goes a long a way in preventing damage from occurring and allows your precious treasures and heirlooms to be preserved for future generations to enjoy.

Opened in 2000, the Heritage Conservation Centre (HCC) is a purpose-built facility located on Jurong Port Road that serves as the repository of the National Collection. It houses over 250,000 artefacts and artworks in climate-controlled stores and conservation laboratories, where a dedicated team of cataloguers, collections managers, conservators, estate and support staff, photographers, and scientists strive to manage and care for them to the highest professional standards.

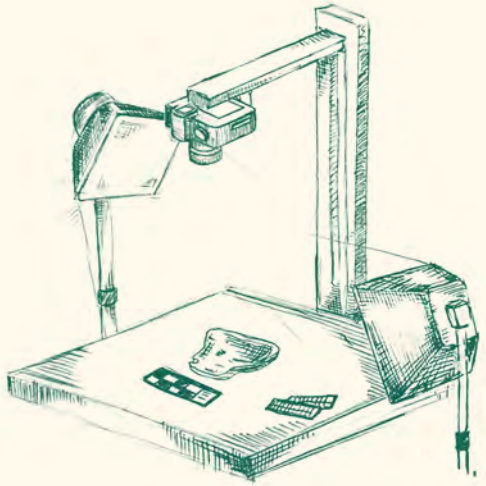
As part of our efforts to reach out to the wider community and promote heritage conservation, we created this booklet to share the basics of collections care. The booklet is divided into five different chapters covering a wide range of topics that will serve as a useful starting point whether you are an individual collector looking after your treasures and family heirlooms, or you are looking after important heritage materials belonging to your organisation. You will find useful information and practical tips for managing your collection. Collections care need not be complicated or costly, and there are always things you can do to improve the lifespan of your precious objects.

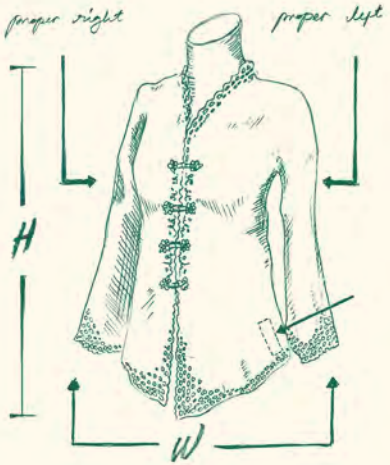
Contents



— Chapter I —

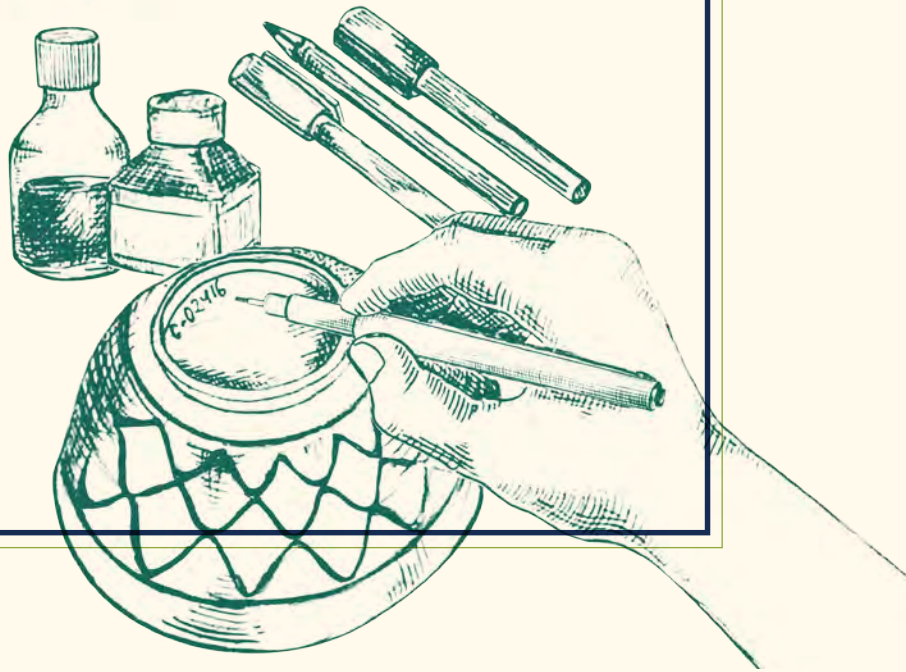
Managing Your Collection





Whether you're an individual collector or an institution custodian, you'll want to take care of your objects to preserve them in the best condition possible. Managing your collection entails many activities — from finding and acquiring objects that meet your collecting goals to documenting and storing them safely for future research or display.

This chapter introduces the key aspects of managing and looking after a collection.



Acquisition

What to acquire for your collection could be the decision of just one person if you are an individual collector. For museums, curators are the specialists who seek out and recommend potential acquisitions. They are guided by the collecting policy and mission of their museums, and the final decision on what to acquire is often vested with acquisition committees comprising members with the appropriate knowledge and expertise. Ensuring proper legal transfer of ownership when acquiring objects is one of the first and most important steps in managing your collection.

ACQUISITION is the process of adding new objects to your collection. Purchases and donations are the most common ways of adding to a collection. There are also other acquisition methods such as transfer, exchange, or collections that arise from research activities (e.g. natural history specimens and materials from archaeological digs).

Tips to Ensure Proper Legal Transfer of Ownership

Make sure the correct type of documentation is used based on the acquisition method (e.g. a deed of gift for a donation, or a sales and purchase agreement for a purchase).

Make sure acquisition documents are complete and in order (i.e. no missing information and endorsed by the correct approving authorities).

Keep the records safe — both physically and digitally.

Seek advice from a legal professional when needed.

Did you know?

Certain types of objects such as firearms and objects made from ivory are governed by special regulations such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Make sure you seek approval from the relevant authorities and secure the necessary permits when acquiring them!

Receiving and Inspection

Appoint a reputable courier or art logistics company to handle the delivery of your acquired objects and ensure that they are adequately insured against loss and damages during transportation. The receiving and inspection process is important because this is the time your acquired objects are handed over to you officially.

Do not rush the ***RECEIVING AND INSPECTION*** process. Make sure you allocate sufficient time to conduct the check carefully and take the chance to document the condition of the objects at the point of receiving.

A Note of Caution

When receiving objects originating from a different climate, bear in mind that they — like humans — will need time to acclimatise to the new environment. Let your crates from overseas acclimatise for at least 24 hours at your premise before opening them.

Did you know?

Anoxic treatment is a safe method to remove pests from infected objects using inert gases. A bubble is set up to enclose the objects and the oxygen level brought down to a level where pests are unable to survive.

Tips to Ensure Proper Receiving of Acquired Objects

Inspect for damages that might have happened during transportation, especially if the packing was done poorly (e.g. low-quality packing material or insufficient buffering).

Inspect for mould or pest infestation. Immediately bag and isolate any objects found or suspected to be infected and send them for pest treatment.

Check the inventory of the objects you are supposed to receive, especially when there are multiple parts or components (e.g. a modern installation artwork or bulk collection).

Immediately follow up on any damages or discrepancies found and alert your insurer and shipper (if they are not present during the inspection).

Take pictures from many angles and record the condition of the object at the time of receiving. This serves as a reference point for any condition change observed later.

Issue an official receipt to complete the receiving process.

Accessioning

After you have gotten your acquisition document in order and completed the receiving and inspection, the next step is to accession the object.

The first step in accessioning involves registering the acquisition into an accession register that contains the handwritten record of objects acquired. Record down pertinent information such as acquisition date, acquisition method, source, a brief description of the object and most importantly, assign a unique identification number for the object. This identification number links the object to all records and information kept.

ACCESSIONING is the formal addition of an object to your collection, a process in which a permanent record is created and a unique identification number assigned.

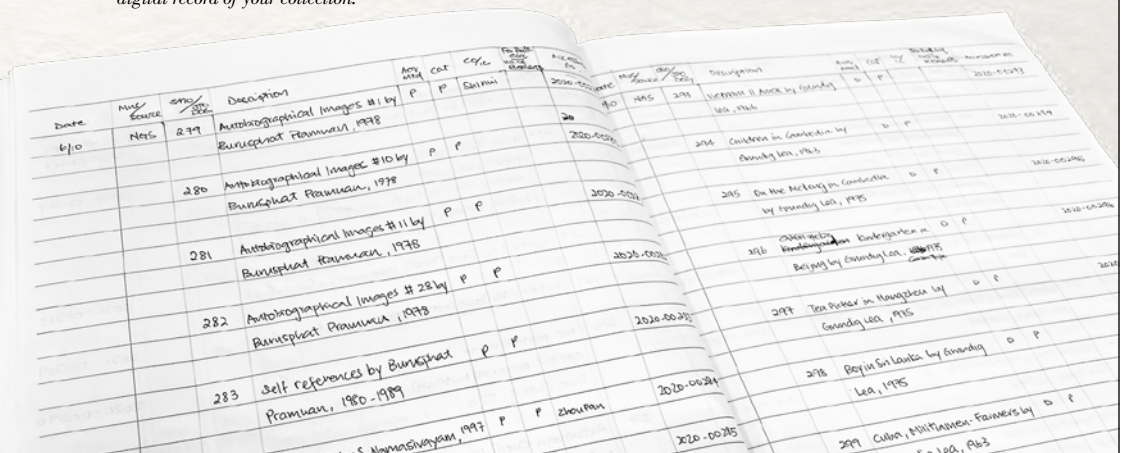
What is an accession register?

The accession register is a continuous record of all the objects in your collection. It can be in physical written form and/or digital record. Think about the time before computers and databases were invented. For institutions with a long history, the old accession register books could be hundreds of years old and they serve as an important reference and backup to digital records today!

Did you know?

You can assign identification numbers in different formats as long as the numbers are unique. The format used by the National Heritage Board (NHB) is YYYY-NNNNN-PPP, where YYYY denotes the year of acquisition, NNNNN is a sequential running number, and PPP is the part number (used only when needed). An example of an identification number would be 2020-00003-001 — the first part of the third object registered in year 2020.

▼ *An accession register can be a hand-written record and/or digital record of your collection.*



Accessioning involves three main processes: Physical marking, visual documentation, and database management.

Physical Marking

This is necessary to prevent the dissociation of the physical object from its record. Imagine if you have multiple objects that are similar-looking (e.g., ceramic wares) and none of them are marked with their identification numbers — you will not be able to identify and link the objects to your records!

When writing the identification number, choose a discrete part of the object (e.g. the bottom of a ceramic bowl) that will not be visible when it is on display and does not obscure any maker's mark or design elements. Be consistent with the approach used for similar types of objects and make sure to write legibly!

Consult a conservator or experienced person if you are unsure how to do physical marking on your objects. You need to use the right tools and be trained for it. If you are unable to do physical marking, you can write the identification number onto a jewellery tag and place it (or tie it) together with your object.

Methods and Tools for Marking Different Types of Objects

Metal, ceramic, wood, and other 3D objects

Method: Apply a layer of paraloid B72 or B67 onto the object and wait for it to dry.

Write the identification number onto the dried layer, using a black pigma micron pen (white if contrast is needed) and wait for the ink to dry.

Seal the written number by applying another layer of paraloid B72 or B67.

Tools and Materials:

- Paraloid B72
- Black or white pigma micron pen

Textile and garment

Method: Write the identification number onto a piece of cotton tape and sew it to the garment or textile.

Tools and Materials:

- Cotton tape, black pen, scissors, needles, and polyester/cotton thread (standard white)

Paper and paintings

Method: For paper, write the identification number onto the paper directly using soft 2B pencil. For framed artworks, write the accession number onto the back of the frame on the mounting board using a black pen.

Tools and Materials:

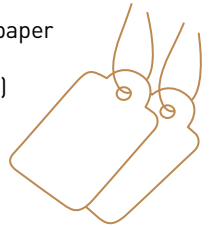
- Soft 2B pencil, eraser
- Black or white pen (only for mounting boards or non-historical frames)

Very small and intricate objects

Method: Write the identification number onto a jewellery tag and tie it to the small object.

Tools and Materials:

- Jewellery tag (paper tag with looped thread for tying)



The methods recommended above are all safe and reversible (i.e. possible to undo). Do not risk permanent damage to your objects by using unsuitable methods, tools or materials to mark your objects.

Visual documentation is the photography of the object for research, publication, and identification purposes.

Visual Documentation

The availability of smartphones these days allows us to take high-resolution images easily. These images can be good enough for general identification or documentation purposes. But there is more to shooting artefacts and artwork which makes it different from other kinds of photography. The photographer has to capture all the details of the object in the image (e.g. the intricate patterns, textures, weaves, and motifs on different kinds of materials) accurately so that it can be used for identification, research, and publication.

Tips to Photograph Your Objects

Use spot metering and a light meter to achieve precisely even exposure.

Use focus stacking to achieve the sweet spot where all depths of fields are sharp.

Use a book cradle to flatten the curvature and protect the book's spine when using a copy stand to photograph archival materials.

Include scale rulers and colour checkers in the image to ensure colour accuracy.

Do not photoshop or edit the image.

What Kind of Archival Format Should You Use?

- TIFF (Tagged Image File Format): With a 'lossless compression', this allows high-quality images to be saved and is often used as the master or archival copy.
- JPEG (Joint Photographic Experts Group): With a 'lossy compression', bits of data may be lost when transferred across machines. However, it does save in good quality with a relatively small file size.

Pictures in RAW formats such as TIFF have excellent resolutions, but they come with huge file sizes and require a large amount of system storage space. Depending on your needs and resources, JPEG images may suffice. More importantly, your image should be clear enough to show the object's details in print and on screen. Bear in mind that digital records need to have backup and require migrations to keep up with rapidly changing software and hardware.

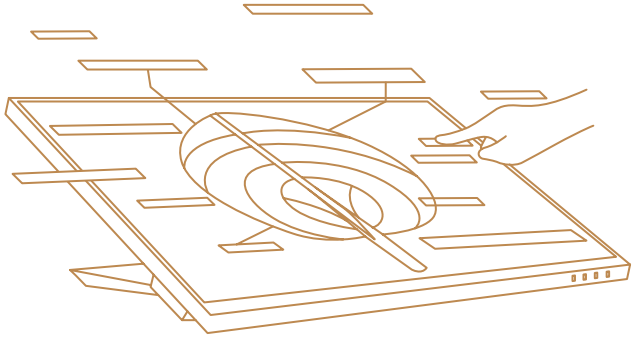
Fun Fact

Here at HCC, we have the practice of taking photographs in native camera RAW format before it is processed to TIFF and JPEG formats for archival and publication. For most objects, a 36-megapixel DSLR is used, while for objects that require a high level of colour accuracy or have fine and intricate details, we use a 80-megapixel Medium Format Camera (MFC) instead.

Database Management

When it comes to the value of your collection, it really matters that the records of your objects are accurate and complete. An object without a history is practically without value, and poor record-keeping can also lead to misplaced or lost objects.

Managing your collections database involves constantly maintaining and updating the data of your objects, such as new information generated from research, changes in the condition of the object over time and records of the movement of the object.



Tips to Manage Your Collection Database

Record and update pertinent data immediately at the point of acquisition. This is the best time to gather any missing data and obtain additional information that helps you preserve your object for the long term.

Think about your needs and objectives to decide how much data to record. As a baseline, record all the information relating to the acquisition and all the data you need to identify and locate your objects (e.g. accession number, object name, image, and location).

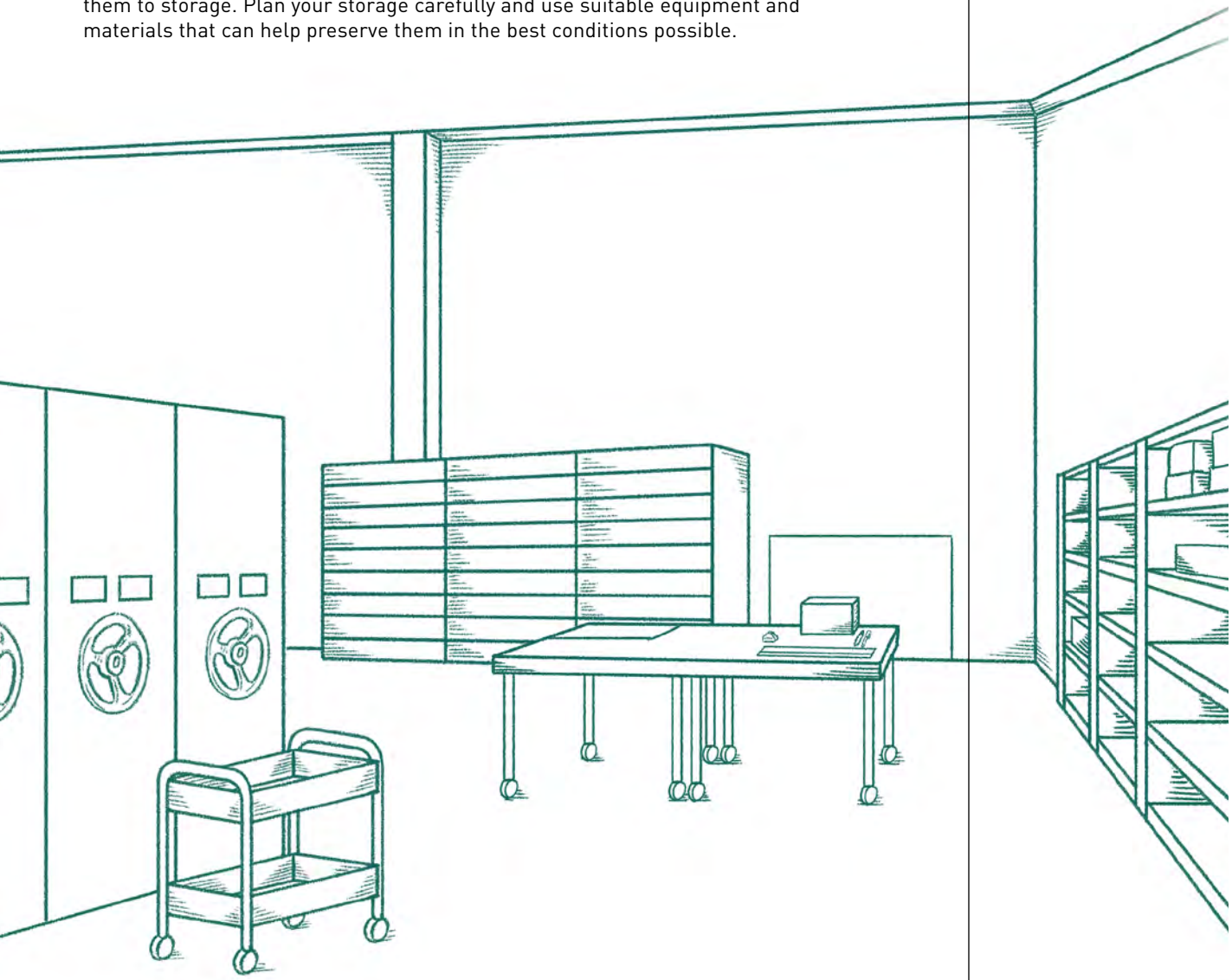
How Can You Organise Your Database?

There are two options. You can choose a full-fledged collections management system with templates and workflows based on international best practices, or simply use a spreadsheet that can also do the job if you only have a small personal collection.

Select a system that fits your budget and needs, and more importantly, make sure you have a robust backup system to protect your data! At the end of the day, what you want to achieve is knowing what you have and where they are, so choose the database system that will help you to do that efficiently.

Storage

After the accessioning for your newly acquired object is done, you'll need to move them to storage. Plan your storage carefully and use suitable equipment and materials that can help preserve them in the best conditions possible.



Storage Planning and Building Management

For most museums, what you see on display is normally just a small fraction of their collections. Given that objects will spend most of their time in storage, it make sense to plan your storage carefully to create the best conditions for their preservation.

Think of the risk to your collection in relation to how well they are protected by the surrounding layers of enclosure. Starting at the most macro level, assess how your collections are susceptible to potential hazards.

Site

Is the storage site free from factors that may affect your collections such as pests or pollution?

Is the area prone to flooding?

Building

Is there sufficient building insulation to keep out the sunlight, moisture, and pollutants?

Is access controlled and monitored to provide adequate security?

Room

Are the rooms adjacent to your storage free from pests, dust, and pollutants that may find their way into the storage?

Are your storage rooms adequately sealed to minimize fluctuating environmental conditions?

Building Management

Did you know that the immediate exterior of your room or building plays a part in maintaining a stable environment for your storage space? Good building insulation and a good control system can help in maintaining an environment with stable relative humidity and temperature. Avoid planning your storage spaces directly under the roof or in the basement as the temperature and relative humidity there fluctuate more. Basements are also more prone to water leaks and risk of floods.

Now that you have your storage space planned, let's look at some of the solutions inside the storage rooms.

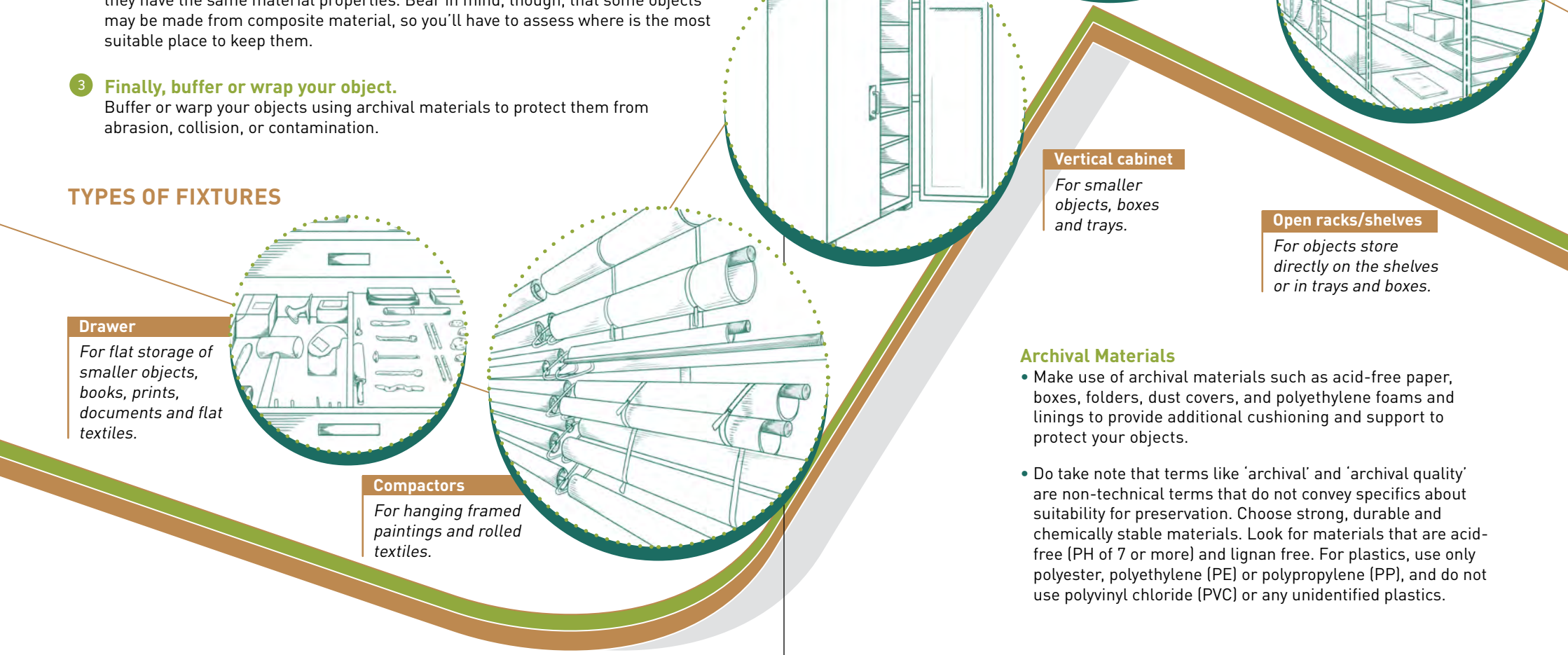
1. **Start from the fixtures.**
   Plan your room in such a way that the fixtures (and fittings) cater to your collection type, and allow for easy retrieval. Label each shelf, rack, compartment, and slider for identification, e.g. Rack05 Shelf 01 Tray 02

2. **Move on to the enclosure level.**
   Be sure to label each tray, box, folder, zip-lock bag, etc used to store your objects. It is important to ensure that labels do not easily separate from the enclosures to prevent dissociation. Just imagine the time you'll waste to locate misplaced objects!

   In general, objects of the same material type or size should be stored together as they have the same material properties. Bear in mind, though, that some objects may be made from composite material, so you'll have to assess where is the most suitable place to keep them.

3. **Finally, buffer or wrap your object.**
   Buffer or warp your objects using archival materials to protect them from abrasion, collision, or contamination.

TYPES OF FIXTURES



Drawer
For flat storage of smaller objects, books, prints, documents and flat textiles.

Compactors
For hanging framed paintings and rolled textiles.

Vertical cabinet
For smaller objects, boxes and trays.

Dry cabinet
For objects highly sensitive to change in temperature and RH.

Open racks/shelves
For objects store directly on the shelves or in trays and boxes.

Archival Materials

- Make use of archival materials such as acid-free paper, boxes, folders, dust covers, and polyethylene foams and linings to provide additional cushioning and support to protect your objects.

- Do take note that terms like 'archival' and 'archival quality' are non-technical terms that do not convey specifics about suitability for preservation. Choose strong, durable and chemically stable materials. Look for materials that are acid-free (PH of 7 or more) and lignan free. For plastics, use only polyester, polyethylene (PE) or polypropylene (PP), and do not use polyvinyl chloride (PVC) or any unidentified plastics.

Stocktaking

Managing a collection includes accounting for the collection and ensuring that it is safe and intact. This means conducting regular stocktake to confirm that your objects are at their recorded locations and that no loss has occurred.

If you have a large collection which makes conducting stocktake a challenge, it is worthwhile to explore and invest in software and technologies, such as barcode and radio frequency identification (RFID) tagging. These can help you conduct stocktake more efficiently.

Tips for Stocktaking

Have a written policy to guide you on the frequency and reporting requirements.

Stocktake can be done on certain categories of objects (e.g. high-value objects) or a percentage of your collection. (e.g. random 1% of all of your objects) depending on your requirement.

Conduct the stocktake together with an independent witness, or engage an audit firm to conduct the stocktake.

Risk Management and Disaster Planning

Unfortunately, disasters and emergencies can happen when you least expect it. Always conduct risk assessments and have a disaster plan ready so that your team can respond swiftly during an emergency to prevent drastic or total damage to your collections.

Tips to Develop an Emergency Response Plan

Your plan should outline how you respond to and manage the aftermath of unexpected emergencies. This involves:

Training your staff on the emergency response plan, through annual drills, live exercises (simulating disaster scenarios) and tabletop exercises to familiarise them with the procedures.

Putting in place business continuity and long-term recovery plans.

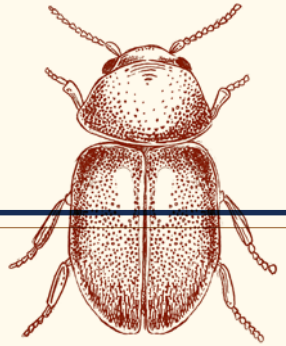
You will also need to maintain disaster kits near the storage rooms and display spaces with supplies that can help you to respond quickly in unexpected situations.

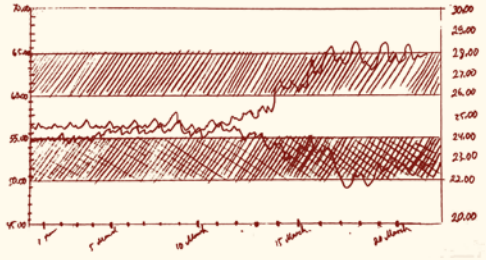
Such kits include personal protective equipments (PPE) and supplies such as absorbent cloth, torchlight, brushes, label cards, zip-lock bags, vacuum cleaners, portable dehumidifiers, mops, buckets, and air-circulation fans, among others.

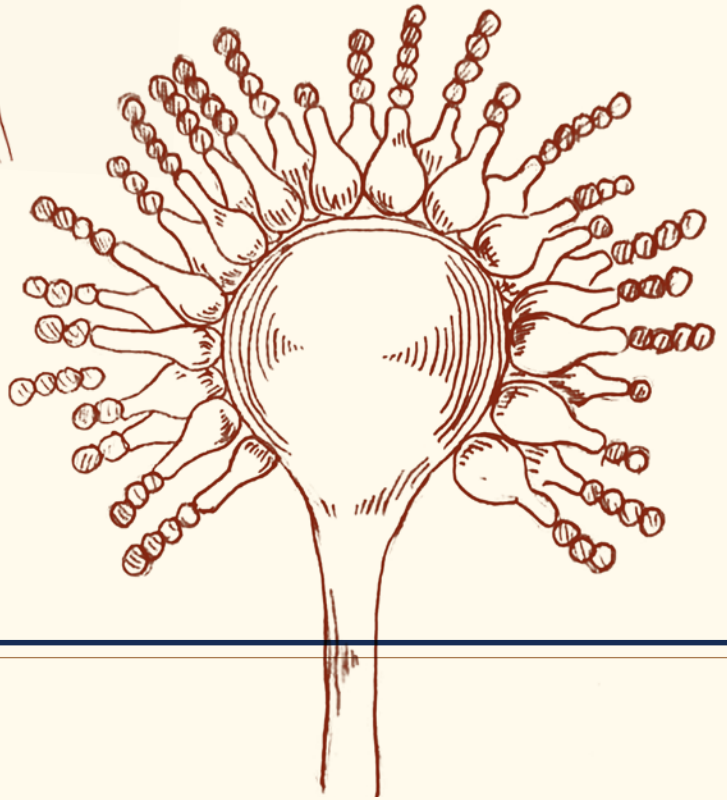
— Chapter II —

Understanding the Agents of Deterioration

Unbearably high or low temperature and humidity, harmful ultraviolet (UV) light, mould outbreaks and pest infestations, fires and floods – all these events can affect humans negatively depending on their severity. But did you know they are equally harmful to your collections? In caring for heritage materials, there are "agents of deterioration" you need to understand and watch out for in order to create the ideal environment for preserving your precious objects.



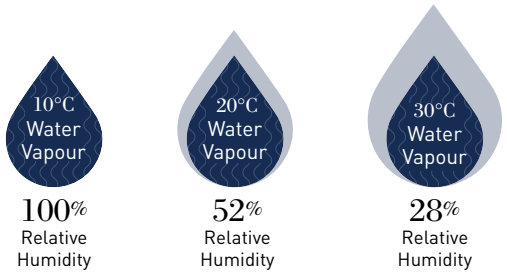




What is Relative Humidity?

Relative humidity (RH) is the amount of water vapour in the air compared to how much it could hold at that temperature. It is represented as a percentage. For example, an RH of 50% means that the air has half of the water vapour it can hold.

Temperature *and* Relative Humidity



▲ *Notice that temperature and RH have an inverse relationship — as temperature increases, RH decreases, and vice versa.*

Effects of Incorrect Temperature and Relative Humidity

Think about what happens to your body when humidity levels rise — you perspire, your hair frizzes and your allergies might even worsen. Objects around us are affected physically too, except we often don't see the effects until it's too late — corrosion of metals, bleeding of dyes or paints, and damage by mould and insects that thrive in warm and damp environments.

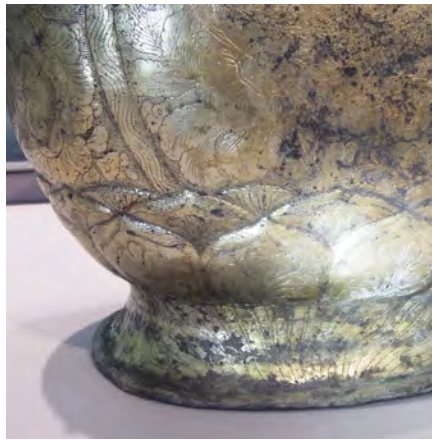
On the other hand, too little moisture in the air is also undesirable. For example, moisture-sensitive material like wood can crack, delaminate, or split, while paper can become brittle.

An important part of creating the ideal environment for preservation is maintaining stable temperature and RH. This is because sudden or large fluctuations in temperature and RH will cause materials to expand and contract constantly and rapidly. The amount of strain this causes, especially in objects with composite materials that expand and contract at different rates, often results in structural damage.

Blanching of painting due to high RH.

Delamination of wood due to low RH.

Mould growth due to high RH.



Corrosion of metals due to high RH

Did you know?

Damage caused by incorrect temperature and RH can go undetected for a long time or can occur suddenly without any warning!

Temperature
22 ± 1°C

Relative Humidity
55 ± 5%

Recommended Temperature and Relative Humidity

These recommended set points are suited for a wide range of materials in both storage and display environments. Even if you don't have the means to maintain them within range all the time, aim to create a stable environment as close as possible to these recommended set points using methods you can sustain — the key is to avoid extremes and major or sudden fluctuations.

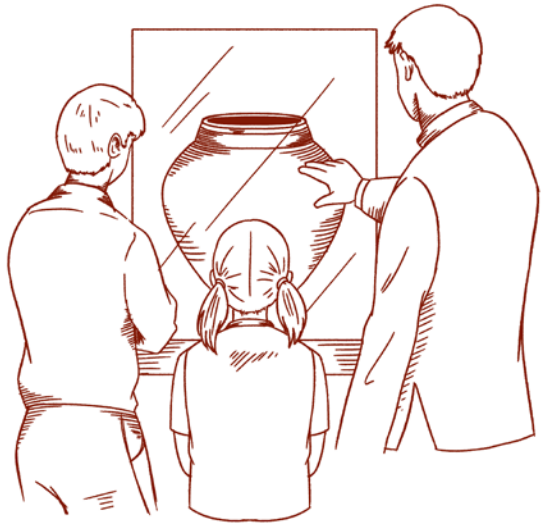
Controlling Temperature and Relative Humidity

Climate control can be achieved through using a well-designed heating, ventilation, and air-conditioning system (HVAC). You could also utilise portable equipment like humidifiers, dehumidifiers, and heaters. These, though, require some caution and expertise to operate effectively.

Apart from mechanical control through HVAC and specialised equipment, which may not be accessible due to high cost, you can use the following strategies to maintain a stable environment for preservation.

Ensure that your building and spaces are well maintained and gaps are sealed. Carry out regular housekeeping, inspections and maintenance and watch out for tell-tale signs of building deterioration.

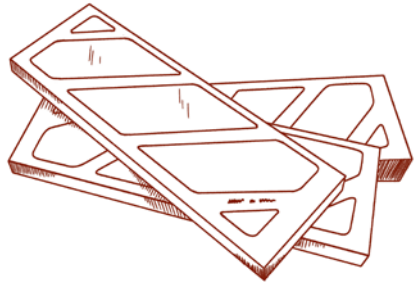
Limit the number of times and the duration that doors to your storage rooms are opened. Every opening brings disruption to the internal climate and affects temperature and RH.



Control the number of visitors to your storage or display spaces. Humans emit heat and moisture which increase temperature and RH in the area.

Implement localised control. To buffer against environmental changes and keep moisture out, you can make use of display cases, dry cabinets and desiccants.

Use well-sealed display cases or dry cabinets



Use pre-conditioned silica gel packs that absorb and release moisture

Monitoring Temperature and Relative Humidity

Monitoring devices are needed to check if your storage or display spaces are maintaining the conditions you want. It's not a must to get the latest or most expensive equipment, so choose something which meets your budget and requirements. Devices that record environmental trends are highly recommended, because they allow you to keep detailed records and compare past trends to identify anomalies.

Spot measuring tools
Provides an instant reading of the current environment

Hygrometers

Psychrometer

Continuous recording tools
Record environmental trends over a period of time

Thermohygrograph (THG)

Electronic Data Logger

Have you seen any of the above in use at the museums?

They are normally hidden from view or placed in a discreet spot away from the exhibits!

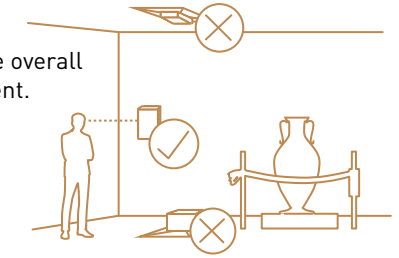
Where to Place Your Monitoring Devices?

Once you've gotten your monitoring tools, you'll need to choose good locations for them. Proper placement is important so you get readings which reflect the environment your object is in, and keep in mind you'll need data at different spots to evaluate the overall environmental condition!

Here are some

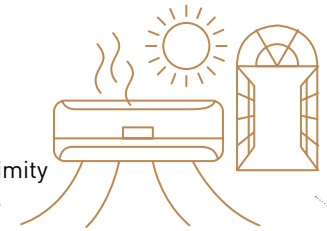
Guidelines

Reflect the overall environment.



Monitor conditions around an object.

Avoid any factors which would affect the readings such as direct sunlight, windows, and proximity to air-conditioning.



Ensure your device is properly secured and not easily accessible to visitors to prevent tampering.

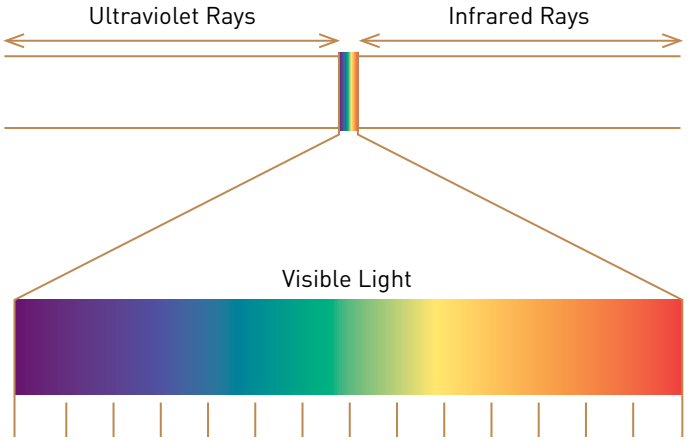
Keep your device clean and dust-free to protect the sensors and send them for regular calibration.

Light

What is Light?

Look around you. We are surrounded by light. But how much do you really know about light and what it can do to your objects?

Light is a form of electromagnetic energy that can travel through materials or vacuum, over a spectrum of wavelengths. UV rays, visible light, and infrared (IR) rays are most common in museum settings and they transmit energy that can cause photochemical deterioration to our objects.

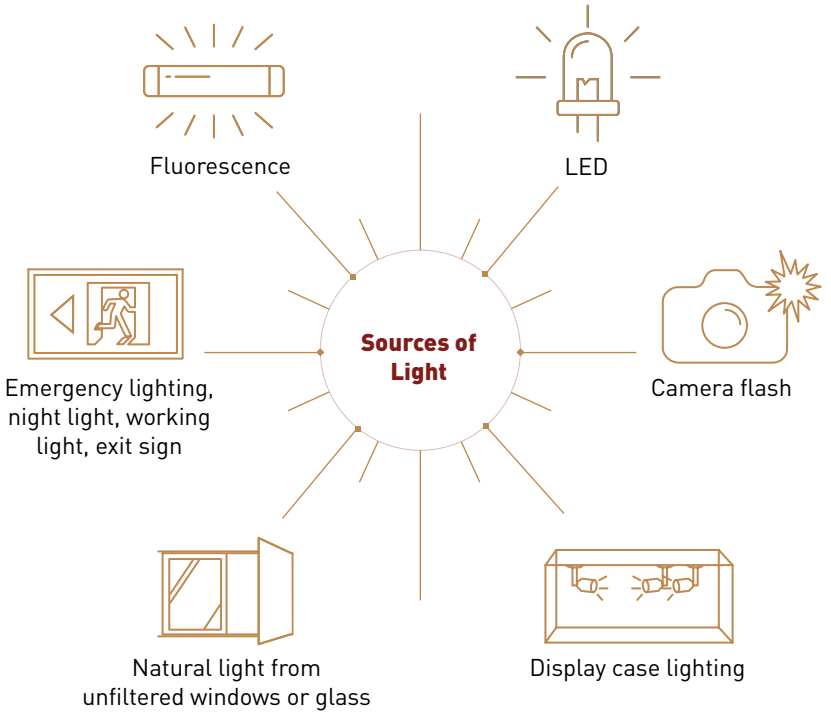


Light damage is determined by how much light is exposed to an object per unit area. This is measured in 'lux' (1 lux = 1 lumen per square metre).

A brief exposure to very intense light can be just as damaging as low exposure over a long period of time. Watch out also for 'innocent' lights such as exit signs and floor lightings that may inadvertently fade your objects.

Why is camera flash prohibited in museums and galleries?

Unlike human skin which could fade from a tan, all forms of light damage to your objects are cumulative, permanent, and irreversible. That's why as a precaution, camera flash is often prohibited in museums for light-sensitive objects!



All types of lighting emit varying amounts of UV radiation that can damage our objects. Just as you would protect your skin with sunblock or by staying out of the sun, keep your objects safe by using the appropriate lighting and blocking out any source of harmful UV rays.

Recommended lighting

LED Low Blue Spectrum with Colour Temperature

2,700K – 3,000K
Causes less damage

Colour Rendering Index (CRI) of

80 – 95
Provides better colour accuracy

Effects of Light on Our Collections

Certain materials such as paper, photo, ink, fur, leather, textile, and watercolour are particularly susceptible to light damage. Brief exposure to very intense light can be just as damaging as low exposure over a long period of time. The rate of light damage is proportionate to both the illumination level and length of exposure time.

▲ *Effect of light fading shown on right side of photograph.*

▲ *Discoloured and embrittled newspaper caused by light damage.*

▲ *Fading of textile caused by light damage.*

▲ *Light damage on lacquer.*

Measuring Light

For measuring the level of lighting, you can use a visible light meter and UV meter to determine the lux and UV levels to determine if they are appropriate for your object.

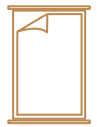
Some materials such as paper, photographs and textiles are very sensitive to light, while others such as metal, ceramic, stone, and glass can withstand exposure to higher levels of light.

Consult a conservator to develop an appropriate lighting plan when displaying your objects.

▲ *Visible Light Meter*

Tips to Prevent Light Damage

Use LED light with a low blue peak in the spectrum



Use UV filtering films on windows and lighting

Use physical barriers such as curtains, blinds, and filters

Follow recommended light levels

Store objects away from light when not on display

Rotate and manage the display period for light-sensitive objects

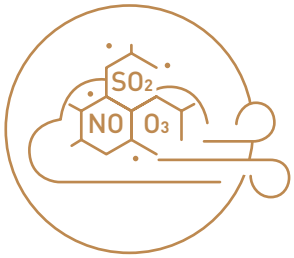
Pollutants

What are Pollutants?

Have you noticed dust that collects in hidden areas during your occasional spring clean? Well, those are visible because of the accumulation. Most pollutants contaminate our objects in gaseous or aerosol states which are not visible to the naked eye. In fact, they may also be inherent within the objects because of the composite materials used by the artist or manufacturer.

Learn about how the different types of pollutants react with your objects, and how you can block them out!

Gaseous Pollutants



Did you know that common reactive chemicals in the air such as sulphur dioxide (SO_2), nitrogen oxide (NO), and ozone (O_3) are found almost everywhere — both indoors and outdoors?

When sulphur and nitrogen compounds combine with moisture, it produces sulfuric or nitric acid that causes acidic reactions. Ozone can also oxidise materials leading to their physical and chemical deterioration.

Aerosol or Airborne Particulate Pollutants

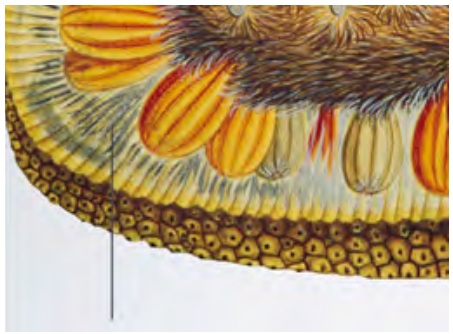
Liquid or solid particles transported in the air

You might be surprised that there are many solid particles suspended in the air! They commonly include dirt, dust, pollen, and even skin cells.

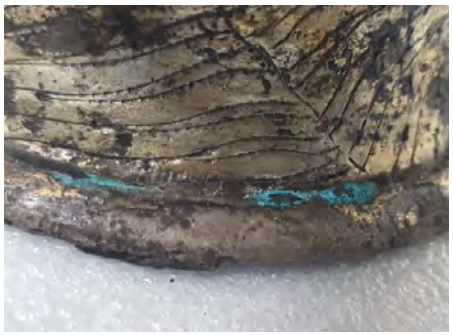
These particulate matter attract pests and moisture, and can react with gaseous pollutants to damage our objects.

Sources of Pollutants

Effects of Pollutants on Our Collections



▲ *Darkening of pigment colour due to pollutants*



▲ *Corrosion of silver due to acidic environment*

▲ *Deterioration caused by pollutants in the environment or inherent within material.*

▲ *Damage caused by contact with acidic mount boards and tapes.*

Monitoring and Measuring Pollutants

To minimise damage from pollutants, they should be closely monitored. You can do an Indoor Air Quality (IAQ) test periodically to measure the level of pollutants in the air. Other methods of testing for pollutants include conducting an Oddy test, using passive sampling devices to measure specific pollutants or using an Acid-Detection (A-D) strip to detect level of acetic acid. Alternatively, you can also take the following steps to monitor air pollution levels:

1. Inspect and monitor your storage areas to study how fast dust accumulates in places like the floor, open shelves, and the top of cabinets.
2. Inspect and monitor the condition of metal objects to check for signs of active corrosion.
3. Keep track of human traffic and monitor how much dust and dirt is brought in by staff and visitors (e.g. through a sticky doormat).

Tips to Prevent Damage by Pollutants

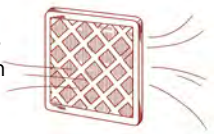
Perform regular housekeeping to keep the floors, tops of cabinets and work surfaces, and neglected corners clean to minimise dust accumulation.

Use doormats to trap dust and limit human traffic to your storage spaces.

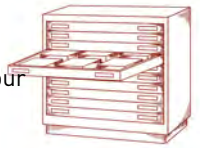
Seal the gaps and windows in your rooms to keep pollutants out.

Use a high-efficiency particulate air filter (HEPA) vacuum that traps particulates.

Use pollutant filtering in your HVAC system or portable air filters with activated carbon filters to remove particulates from the air.



Use multi-layer storage (cabinets, drawers, boxes, folders) to keep your objects away from pollutants.



Use archival quality storage to reduce acidic emissions from regular cardboard boxes.

Use good quality display cases or microclimate framing.

Air Filters

The diameter of particulate pollutants is measured in microns. Consult a specialist for advice on what kinds of air filters to install to keep particulate pollutants out of your building effectively. There are also chemical filters available that can keep out specific pollutants from your building!

What are Museum Pests?

Museum pests are organisms that attack and damage our collections. They can be divided into different groups based on the types of food sources they seek out.

Watch out for common ones such as the clothes moth, cigarette beetle, silverfish, and termite! You can identify them by their characteristics shown in the table beside.

Museum Pests

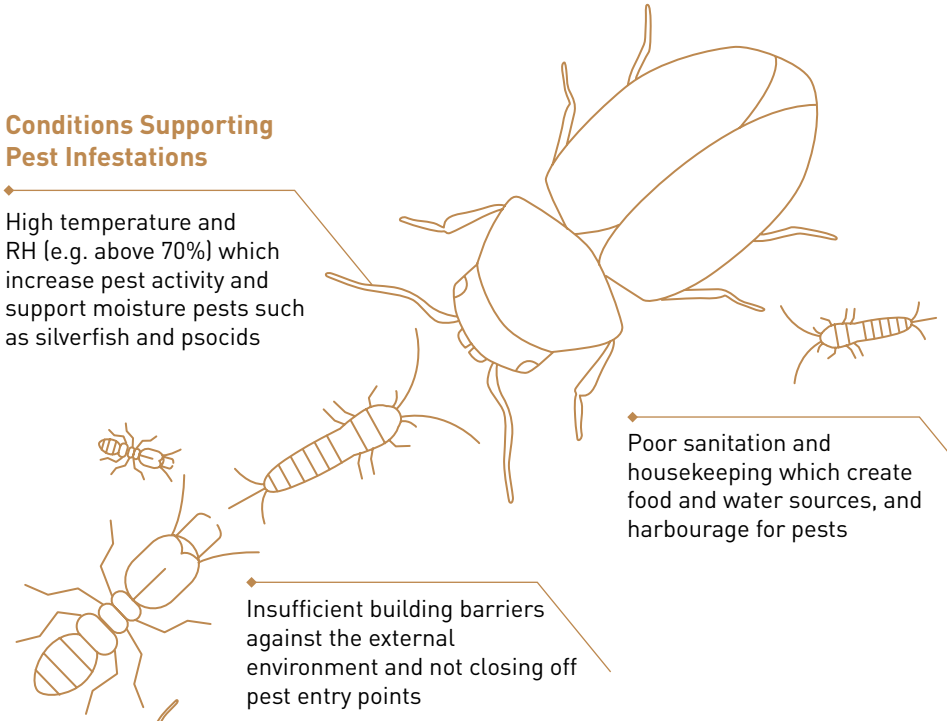
Types of Pest	Pests	Food Sources
Fabric Pests *Protein eaters*	Clothes Moth	Soiled woollens, fur, feather, felt, and silks
	Carpet Beetle	Wool, skins, fur, feathers, hair, silk, and taxidermy
Stored Product Pests *Infest objects made from seeds, nuts, grains, and other foods*	Cigarette Beetle	Tobacco, spices, seeds, nuts, and dried food and vegetables
Moisture Pests *Thrive in damp conditions*	Silverfish, Firebrat	Fabric, paper and sizing, and glue and paste in book bindings
	Psocids / Booklice	Fungi, dead insects, and glue and paste in book bindings; often indicate presence of mould
Wood Pests *Digest cellulose and excavate for suitable habitats*	Termite	Wood; potentially very destructive

Did you know?

Other kinds of pests such as ants, spiders, and scorpions may enter our buildings, but they are not considered museum pests as they don't eat or damage our objects. However, if you do spot these '**perimeter invaders**', it suggests a lack of housekeeping or proper sanitation. This may eventually lead to serious problems, so exercise caution when you start to spot them!

Conditions Supporting Pest Infestations

High temperature and RH (e.g. above 70%) which increase pest activity and support moisture pests such as silverfish and psocids



Poor sanitation and housekeeping which create food and water sources, and harbourage for pests

Insufficient building barriers against the external environment and not closing off pest entry points

Effects of Pest Attacks on Our Collections

Pest attacks can be very damaging to the structural stability and aesthetics of our objects. Their droppings (called 'frass'), larvae, and casings may leave stains on our objects even after cleaning, and their feeding can leave holes in our objects.

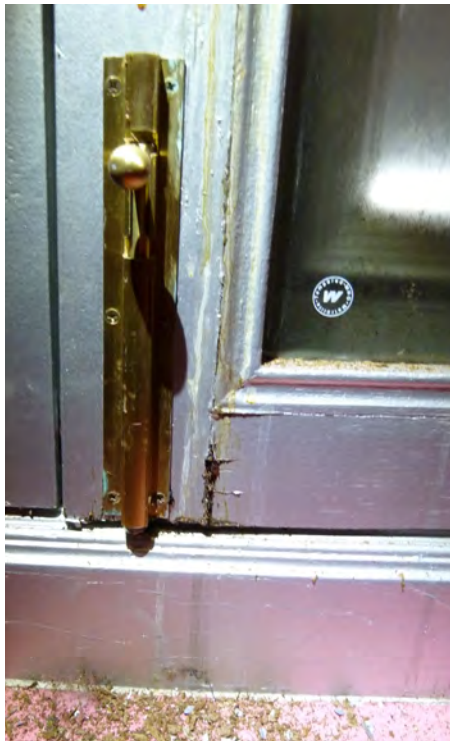
▲ *Holes and losses from insect damage.*

▲ *Severe damage on wood caused by termites.*

Tips to Prevent Pest Attacks

Here are some recommendations to keep pests at bay:

- Inspect your objects carefully when you first receive them or when they return from display or loan.
- Restrict food, drinks, and live plants from where collections are kept or displayed.
- Conduct regular checks on your building and implement a system to monitor pest activity.



▲ *Signs of termites activity and damage*

▲ *Signs of pest activity*

Integrated Pest Management

Integrated Pest Management (IPM) is a method developed to reduce pest activity by using a combination of strategies — environmental control, monitoring, and good housekeeping. By actively monitoring and identifying pests, you can create effective and sustainable strategies to guard against them. You can implement your own pest monitoring system using sticky traps or engage a specialist to monitor pest activity for you.

Tips to Manage Pest Infestations

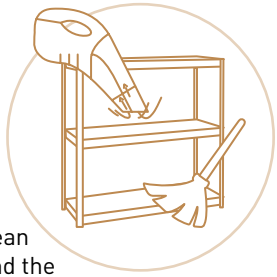
Don't panic when you find live pests or signs of pests! Follow the steps below to protect your collections from further infestation and damage:

Tip 01

Document the pests or signs of pest activity (i.e. record what, where, and when, and take photos) and carefully inspect the infested object or space to check if there is a live infestation.

Tip 02

Seal the infested or potentially infested object in a plastic bag and isolate it from the rest of the collections.



Tip 03

Thoroughly clean the area around the infested object (e.g. the shelf, cabinet, desk) using a HEPA vacuum and disinfectant. Be sure to retain the pest or its traces if you need help for identification!

Tip 04

Identify the pests to determine if they will cause damage to your objects. Consult an expert if necessary.

Tip 05

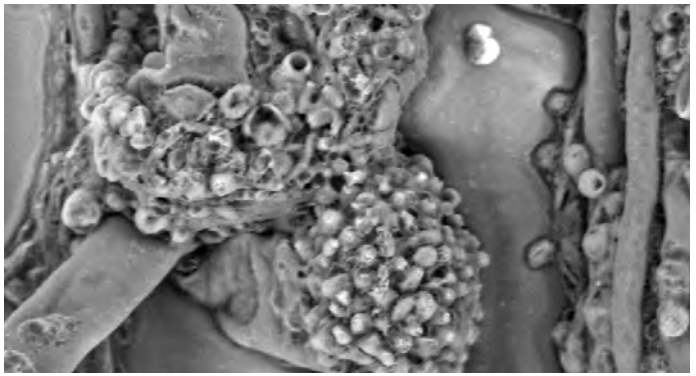
For termites, call a pest exterminator.

What is Mould?

Mould is a general term to describe a type of fungi which grows on food and similar substrates. Mould can spread very quickly across objects and rooms and cause great harm to your objects and health. Make sure you keep your objects in a stable environment to prevent a mould outbreak from happening.

A mould outbreak is one of the most difficult situations to handle — it takes great amount of resources to contain and remediate an outbreak.

Mould



Causes of Mould Growth

Mould spores are everywhere around us. With a strong survival instinct, these spores can stay dormant and endure harsh environments for a long time, germinating when conditions become favourable. The growth of mould thrives:

- At RH level above 60%, with a level of 70% greatly increasing its chances of survival and reproduction.
- In warm, dark, moist conditions where air circulation is limited.
- In the presence of dust and other food sources.

Did you know?

Mould does not discriminate! They will grow on both organic and inorganic materials and surfaces as long as conditions are favourable.

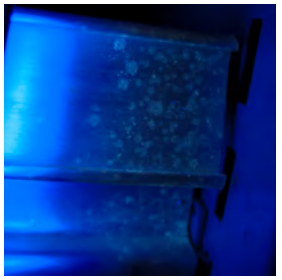
Fun Fact

Despite its harmful properties, mould plays a crucial role in our ecosystem to break down and decompose organic materials like dead trees. Some of the cheese we eat are ripened and flavoured by the penicillium mould, which is also used for the production of antibiotics.

How Can You Spot Mould?

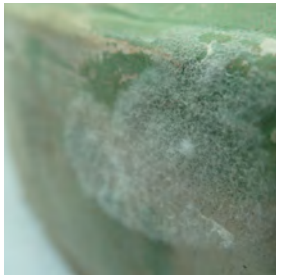
Mould growing on air vents

Mould growing on storage shelves visible under UV light



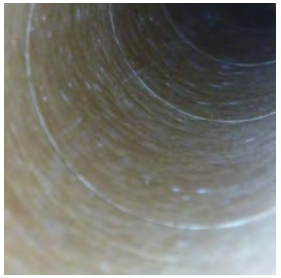
Mould growing on surface of painting.

Mould can take on many different appearances depending on the substrate material, mould species, and whether they are active or dormant. Most of us can also smell mould – you know how something is not right when there is a "damp and mouldy smell".



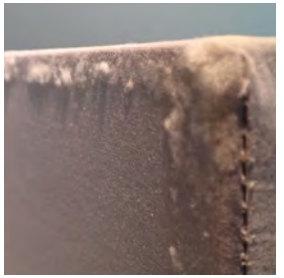
Mould growth on our objects can be visible and obvious. In some cases though, we may need to use a UV light to detect them on the surface of our objects. Using an IAQ test can also help you find out the concentration of mould spores in the air.

Mould growing on ceramic bowl



Mould growing on inside of rollers used to store textiles

Mould growing on plint in display case



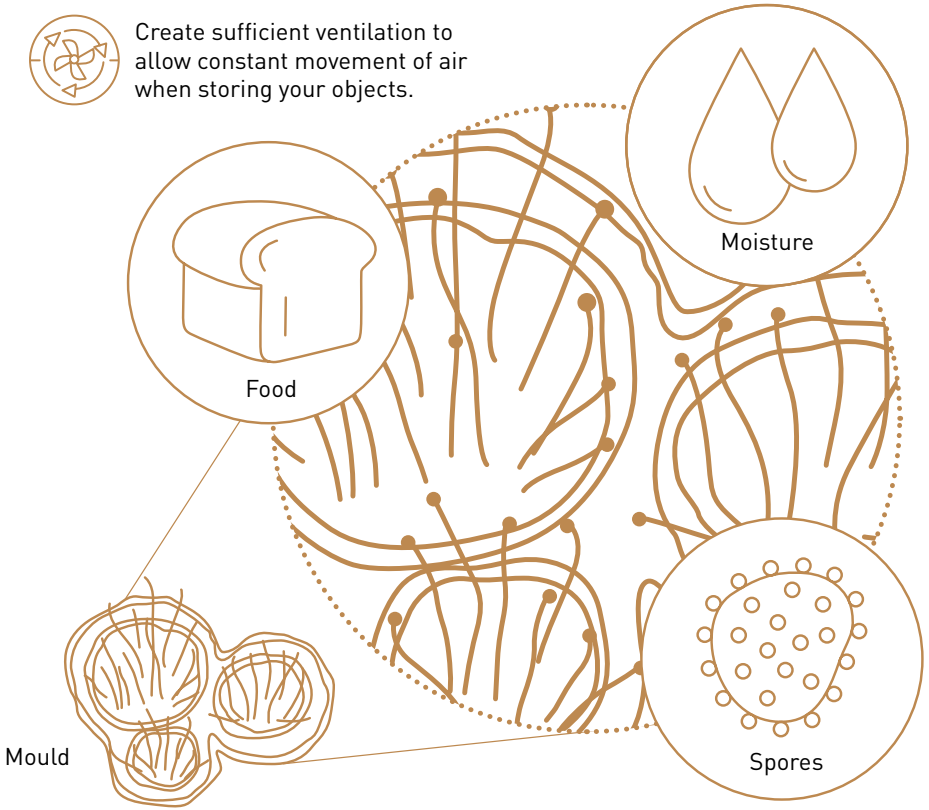
Tips to Prevent Mould Growth

As shown in the diagram, moisture, food, and spores are key ingridients for mould growth. Follow the steps below to prevent the growth of mould:

Carry out regular housekeeping to remove a potential food source for mould.

Keep RH level below 70%, or ideally below 60%.

Create sufficient ventilation to allow constant movement of air when storing your objects.



Did you know?

Floods, water leaks, and air-conditioning malfunction are common causes of spikes in RH that can lead to mould growth.

Remember to carry out regular inspection and maintenance to detect and rectify potential issues early!

Responding to Mould Outbreaks

As important as it is to eradicate mould, be aware that mould can be serious health hazards! People with health issues or serious allergies should not be dealing with mould as it can cause headache, rash, sore throat, cough, and red and watery eyes. In more serious cases, it may trigger an asthma attack or cause a serious infection. Unless you have been trained in the recovery process, it is better to seek the advice and help of specialists to deal with a mould outbreak.

What is the appropriate response to a mould outbreak? Check out the process below!

1. Mould growth spotted and confirmed
2. Survey surrounding spaces and objects to determine extent of infestation
3. Develop remediation plan and secure resources
4. Carry out remediation using aseptic technique
5. Continue to monitor after remediation

Tips to Manage Mould Outbreaks:

- Affected objects should be bagged and isolated until they are ready to be cleaned.
- As a precaution, do not reuse any storage or packing material for objects affected by mould even if they appear clean.
- Do not use fans as they will spread mould spores around. Likewise, do not place any affected objects under the air-conditioning vent.
- Mould can be removed by vacuuming, but make sure the vaccum you use has a HEPA filter, otherwise, an ordinary vacuum will spread spores when in use.

It is important to protect yourself!

If you are involved in the mould cleaning process, you will be breathing in mould spores. It is hence of utmost importance that you wear PPE such as particulate filter masks, disposable gloves, lab coats, and protective eyewear.

Theft, Vandalism, *and* Accidental Damage

Why Does Security Matter?

We've all come across movies showing large-scale orchestrated art heists, but in reality, collections are more often stolen opportunistically or damaged accidentally.

Security matters because our objects are always at risk of theft, vandalism, and accidental damage. Damage caused by vandalism or accidents can be permanent and irreversible.

The loss of an object is arguably the ultimate failure in collections care. Imagine the serious reputational damage and even legal consequences of the loss of an object!

▲ *Vandalism: Pencil marks made on a sculpture by schoolchildren*

▲ *Accidental damage: Stapling with the intent to secure textiles inappropriately done*

Extent of Security Needed

The amount of security needed depends on your situation. It can vary from adopting a simple controlled access policy using locks and keys to hiring armed guards and installing sophisticated anti-theft systems.

How do you know which measure suits your security situation? You can hire an independent expert to conduct a risk assessment to help you identify vulnerabilities and recommend appropriate security measures. As a rule of thumb, objects that are more valuable and vulnerable will require more advanced security measures than others.

Strategies to Prevent Theft, Vandalism, and Accidental Damage

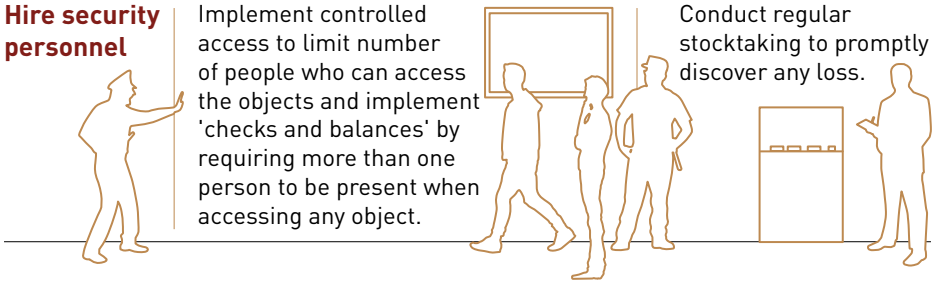
With the importance of security in mind, you should protect your objects by employing the following measures:

1 Tighten Security and Conduct Inspections

Hire security personnel

Implement controlled access to limit number of people who can access the objects and implement 'checks and balances' by requiring more than one person to be present when accessing any object.

Conduct regular stocktaking to promptly discover any loss.

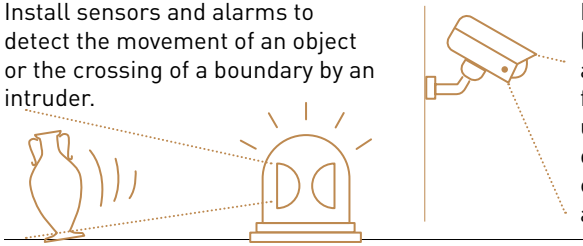


2 Install Alarms and Monitoring Devices

▶ For an additional layer of security and deterrence,

Install sensors and alarms to detect the movement of an object or the crossing of a boundary by an intruder.

Install closed-circuit television (CCTV) to deter theft or malicious actions on your objects. The footage recorded can also be used for investigation or as evidence, but note that a CCTV cannot stop a crime in progress and has privacy considerations.



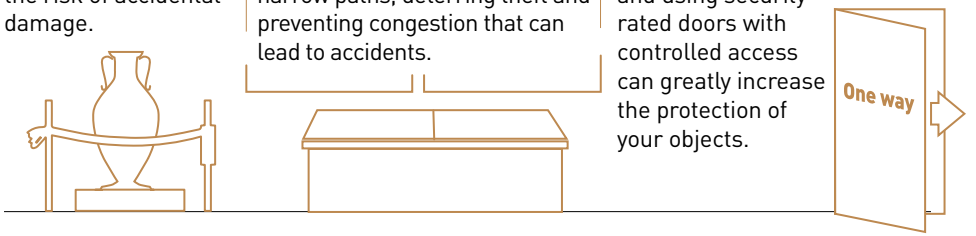
3 Modify Exhibition and Spatial Design

▶ If your objects are on display, consider using the following:

Physical barriers and markings that act as psychological barriers help reduce the risk of accidental damage.

Well-designed display cases and exhibition space that incorporate clear lines of sight. These prevent obscure corners and narrow paths, deterring theft and preventing congestion that can lead to accidents.

Architectural modifications to your exhibition space, such as eliminating windows, limiting entrances and exits, and using security-rated doors with controlled access can greatly increase the protection of your objects.



Preparing for Unforeseen Circumstances

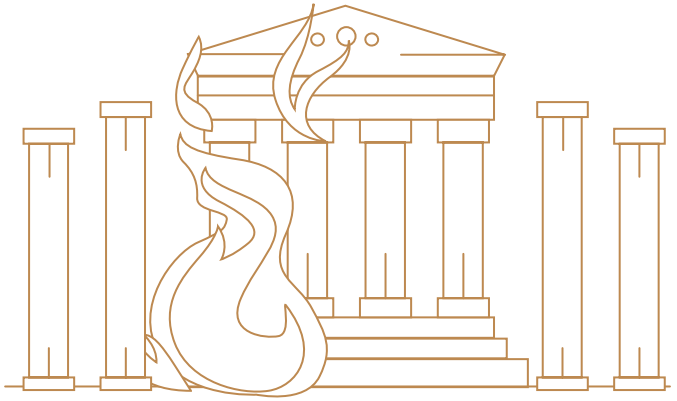
Accidents and disasters can happen anything, so we need to be prepared for any emergencies. These include fire and water emergencies that can have disastrous and irreversible impact on our collection.

Having a disaster response plan and rehearsing the drill are key to minimising damage in the event of a fire or water incident.

Fire *and* Water

Effects of Fire Damage

A fire can lead to rapid catastrophic loss of an entire collections. We can see this from the many high profiles examples in recent years such as the Brazil National Museum fire in 2018 and the Notre Dame Cathedral fire in France in 2019 where millions of precious objects were lost to fire caused by negligence or faulty equipment.



Source of Fire Damage

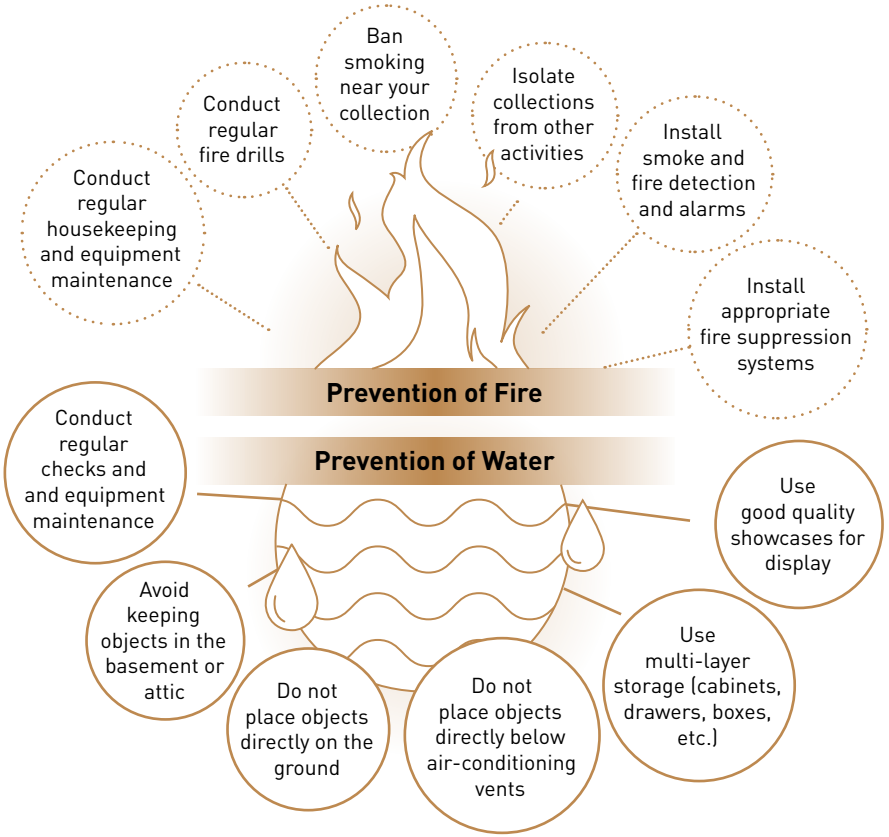
Common causes of fire include electrical short circuit, overheating, and faulty equipment that are not properly installed or maintained. Fires can also be caused by smoking and the presence of flammable substances.

Source of Water Damage

Don't underestimate damage caused by water leaks — they cause damage to your objects more frequently than you would expect! The sources of water leaks could be from the roof, window, air-conditioning or the plumbing system. They could be triggered by heavy rain or be due to old and deteriorating equipment.

Take note that heavy rain can also cause flash floods that lead to extensive damage if your building is not constructed on higher ground. The water sprinkler system could also be a source of water damage, either triggered by a fire outbreak or a malfunction.

Strategies to Prevent Fire and Water Damage

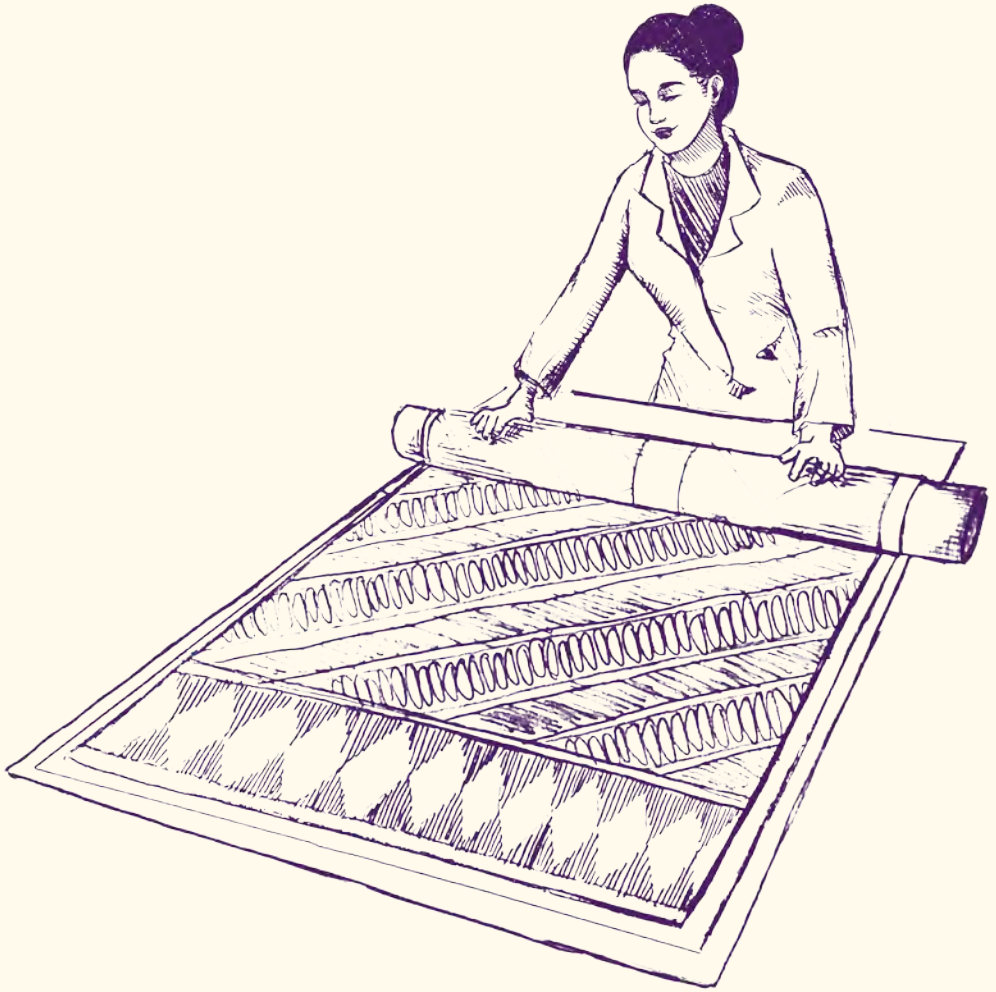


— Chapter III —

Handling Your Collections

The most common cause of damage to objects is poor handling. When precious objects come into our hands, they may have already gone through a lot of physical stress — due to repeated use, past damages and repairs, and exposure to the effects of the environment over time. Their fragile condition is not always obvious to the untrained eye.

That is why proper methods and techniques of handling are important. We must always assume that our objects are more fragile than they look. Never take any risks and make sure to follow the guidelines in this chapter to handle your objects with care!



Gloves

Wearing gloves is a must when handling heritage materials. Gloves protect objects from contaminants such as dirt, salts, acids, and oils on our hands. They also protect us from harmful substances that may be on objects such as pesticide, lead, or arsenic-based paints that are toxic to our body. So, never neglect to wear gloves — the damages caused by handling objects with our bare hands may not be apparent immediately but will definitely show up in the future.

What options do you have for gloves?

Nitrile Gloves

- Suitable for handling a wide range of materials
- Ideal for handling heavily soiled, flaking, or slippery objects

Use with care!

- Make sure it is unpowdered, both on the inside and outside
- Look out for the 'accelerator-free' term, i.e. no sulphur

- Suitable for some materials if nitrile gloves are not available
- Can be washed and reused

Use with care!

- Avoid using with slippery or heavy objects due to low-friction grip
- Avoid using with flaking or fibrous objects that may get caught or dislodged
- Not suitable for people with sweaty palms

Cotton Gloves

- Suitable for handling objects with hazardous chemicals if nitrile gloves are not available

Use with care!

Chemically unstable — can degrade and discolour after a while and leave residue on objects

Vinyl Gloves

Latex Gloves

- Only suitable when performing specialised conservation treatments — do not use for handling objects!

Use with care!

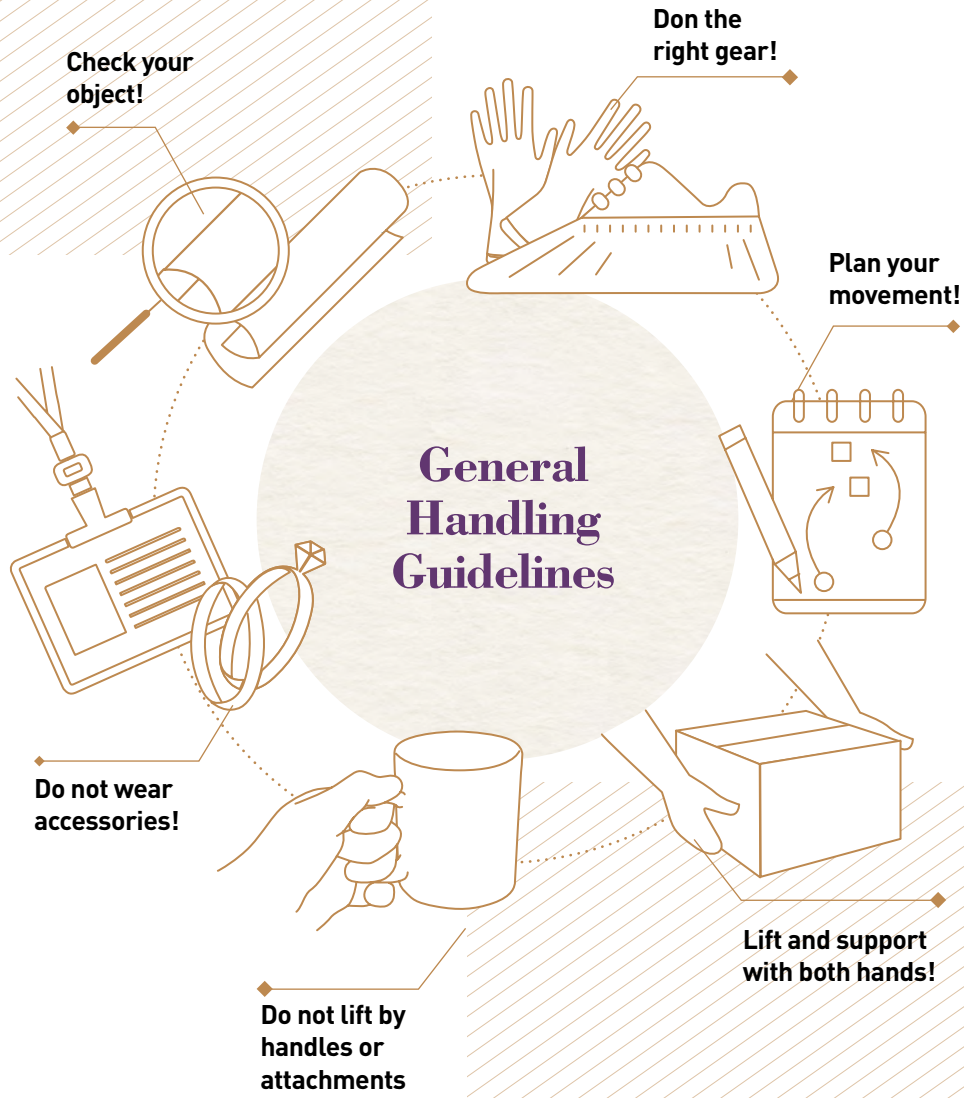
- Sulphur content in latex can cause damage to metal objects or photographs
- Risk of allergic reactions — latex allergy and sensitivity can also build up over time even for those who do not have allergies

- In the event that you really need to handle your objects urgently and do not have any gloves, make sure that your hands are clean and dry before handling your objects. Wash and dry your hands again whenever they get dirty from handling your objects.

Going Glove-free: Clean and Dry Hands

Did you know?

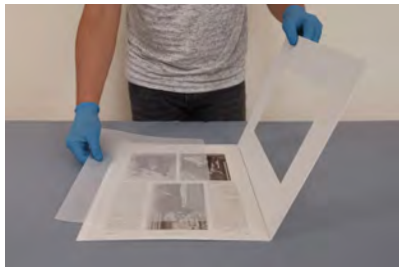
Museum objects should always be handled with gloved hands, but there are some situations where bare hands are needed such as when performing conservation treatment work that require high tactile sensitivity. For general handling though, gloves are a must to protect yourself and your objects. Make sure you choose the appropriate gloves for the object you are handling, as using the wrong type of gloves may cause more harm than good!



Handling your precious object safely requires patience and following the right techniques and methods. Don't worry if you think you don't have the nimble hands nor the experience. Handling skills can be picked up over time. Here are some basic guidelines to start you off in handling different types of objects.

Handling 2D and 3D Objects

Papers



▲ *Paper inside in a hinged frame*

▲ *Paper inside a Mylar sleeve*

- Place acid-free tissue between paper artefact and window when not on display.
- Store paper artefact flat (never vertically) with window side up.
- Store paper artefact inside Mylar sleeve for easier and safer handling.
- Make use of rigid support board when moving paper artefact.

▲ *Paper without any enclosure or support*

- Do not handle or lift paper artefact without support as they may tear from the edges.

DO AND DON'T CHECKLIST

Books

▲ *Using a book cradle and paper fingers*

- Place book on a cradle, pillow or foam to support to support the book spine.
- Use archival snake weights to hold down curling pages.
- Turn the pages gently with a paper finger.

▲ *Opening a book without supporting the spine*

- Do not open book wide on flat surface as the spine will be damaged.

Scrolls

▲ *Rolling a scroll safely*

- Use the knobs at the side when moving, rolling or unrolling a scroll.

▲ *Pressing on scroll during rolling*

- Do not roll from the middle or press on the surface of the scroll.

3D Objects

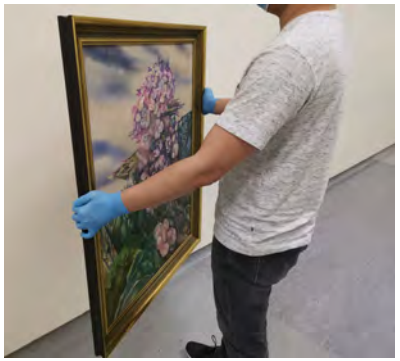
▲ *Lifting an object from its base*

- Life object with both hands at the most stable part at the base.

▲ *Lifting an object using its handle or attachments*

- Never lift object by its handles or other attachments.

Paintings



▲ *Holding painting with both hands*

- Hold by the sides, or with one hand at the base. Face painting inwards so you can maintain watchful supervision, especially for heavy impasto or mixed media works that are three-dimensional.

▲ *Holding painting with one hand*

- Do not carry with one hand or touch the surface of a painting.

▲ *Resting painting on foam support*

- Place painting on top of foam instead of directly on floor to prevent sliding and potential contact with water on the floor.
- Rest them against the wall, positioned face-to-face and back-to-back.

▲ *Pressing on decorative elements*

- Take note of decorative elements on frame and do not press on them when handling painting.

▲ *Resting frame on shoes*

- Plan your route and prepare your space beforehand and never rest painting on shoes.

Handling Textiles and Garments

Handling and Moving a Textile

1 Place the textile on top of acid-free paper.

2 Cover and sandwich the textile in between acid-free paper.

3 Slide a board under the acid-free paper to move textile. Ensure that the board you use is large enough to support the entire textile.

Handling and Moving a Garment

1 Ensure garment is rested on acid-free paper and slide a board underneath it.

2 Use both hands to position the board into an archival box.

3 Gently pull the acid-free paper to slide the garment from the board onto the box.

4 Cover the garment with acid-free paper before using the box to move the garment.

Rolling a Large Textile

1 Place the right side of the textile face down on a clean flat surface. Line 2/3 of the acid-free paper with 3–5cm allowance at the side under the textile.

2 Place the roller on 1/3 of the acid-free paper and begin rolling.

3 Apply even tension along the length of the roller throughout the rolling process.

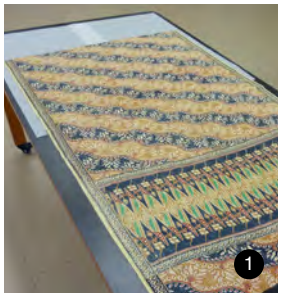
4 Add more acid-free paper to finish the length of the textile. Added acid-free paper should overlap with the previous layer.

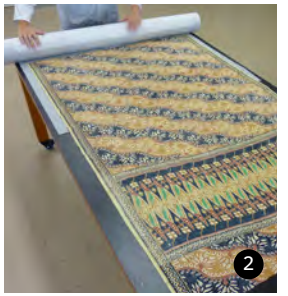
5 Ensure the added acid-free paper is aligned with the previous layer.

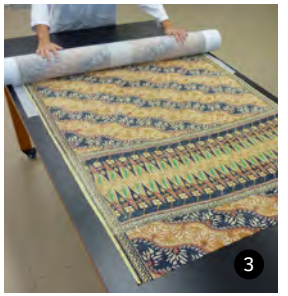
6 Ensure that there is sufficient length of acid-free paper to finish the rolling process.

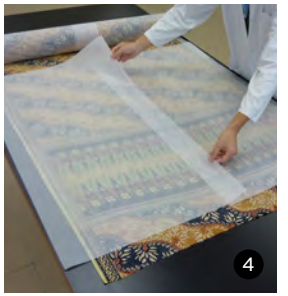
7 Use a woven cotton tape to tie the rolled textile.

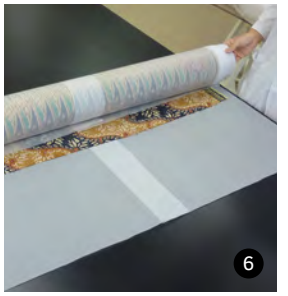
8 A completed rolled textile should feel smooth without lumps.

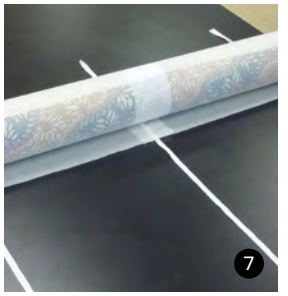


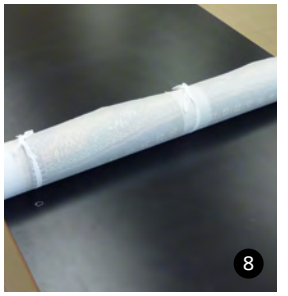










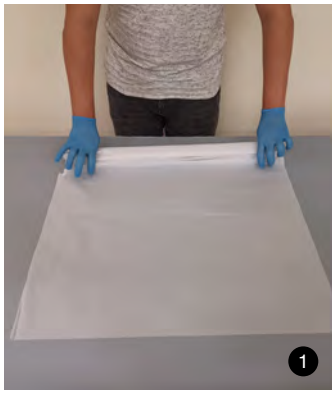


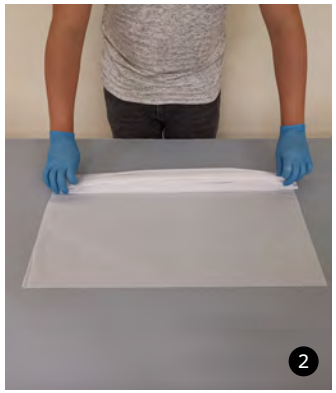
Buffering

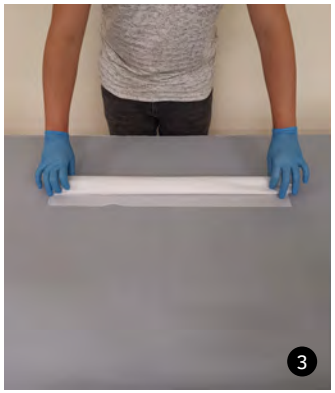
Apart from proper handling, you will need to buffer your objects properly to minimise the risk of physical damage during movement. Follow the basic guidelines below to create "sausage" and "snowball" tissue buffers for cushioning your objects for storage or transport within trays and boxes.

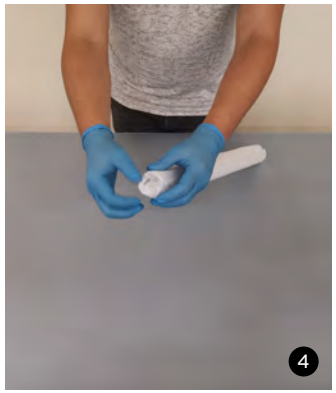
'Sausage' with Tissue

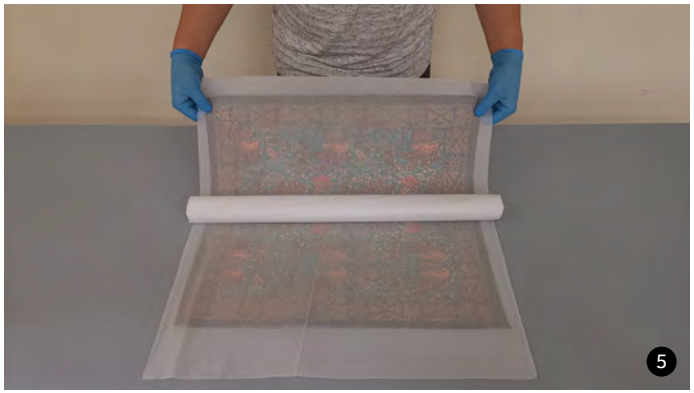
1. Gather 2/3 of the tissue.
2. Roll the remaining 1/3 of the tissue.
3. Ensure the outer surface is smooth and not creased.
4. Tuck in both ends.
5. Use a completed 'sausage' to cushion the fold of a textile.





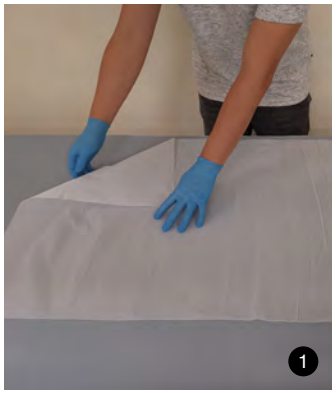


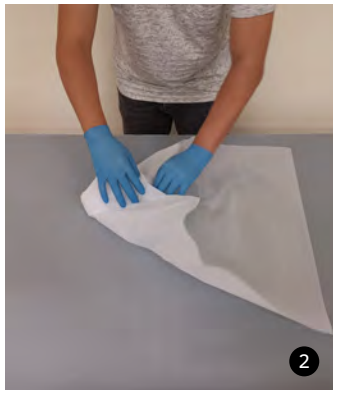


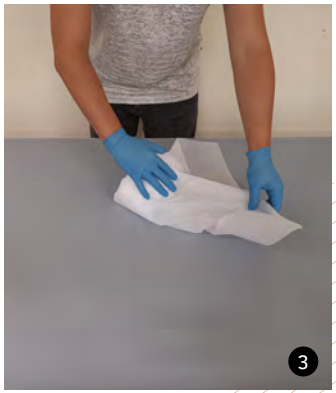


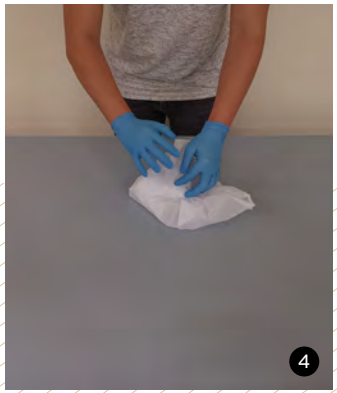
'Snowball' with Tissue

1. Start by folding in one corner of the tissue.
2. Continue to fold inwards from the right.
3. Ensure that the outer surface is smooth.
4. Tuck in all edges and the completed 'snowball' should be firm.
5. Use 'snowballs' to buffer objects in your tray for transportation.





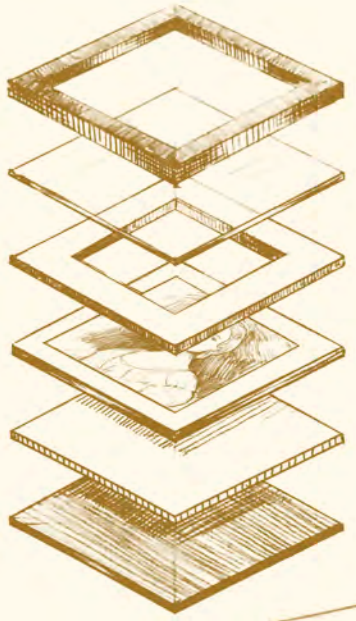


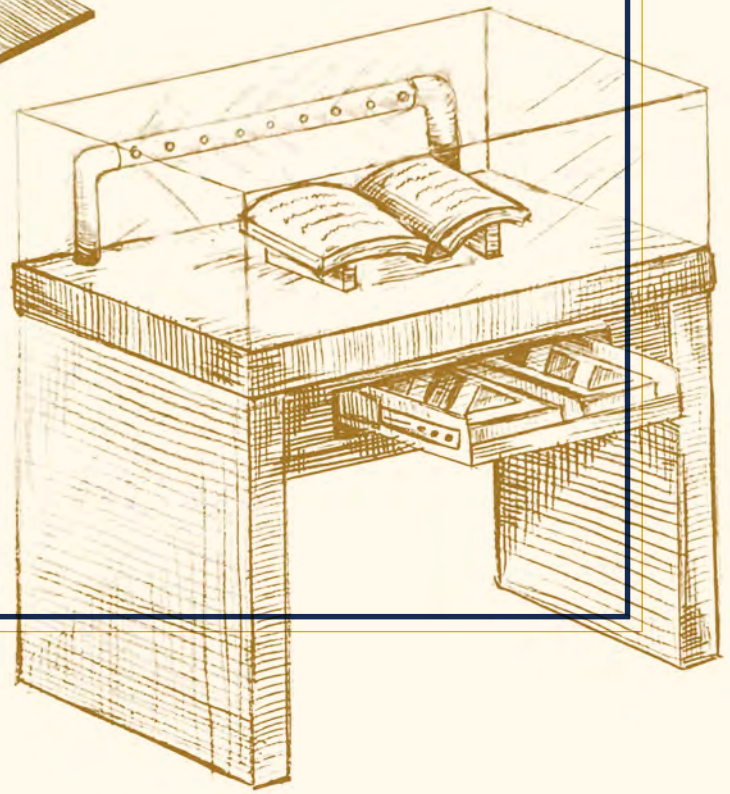


— Chapter IV —

Displaying Your Collection

While you make every effort to protect and properly handle your objects, putting them up on display also requires extra care. Having your carefully curated collection on display is probably your proudest moment! Protect your precious objects by making sure that the display environment is maintained at an optimal level, use good quality display cases, and carry out regular gallery maintenance and housekeeping.





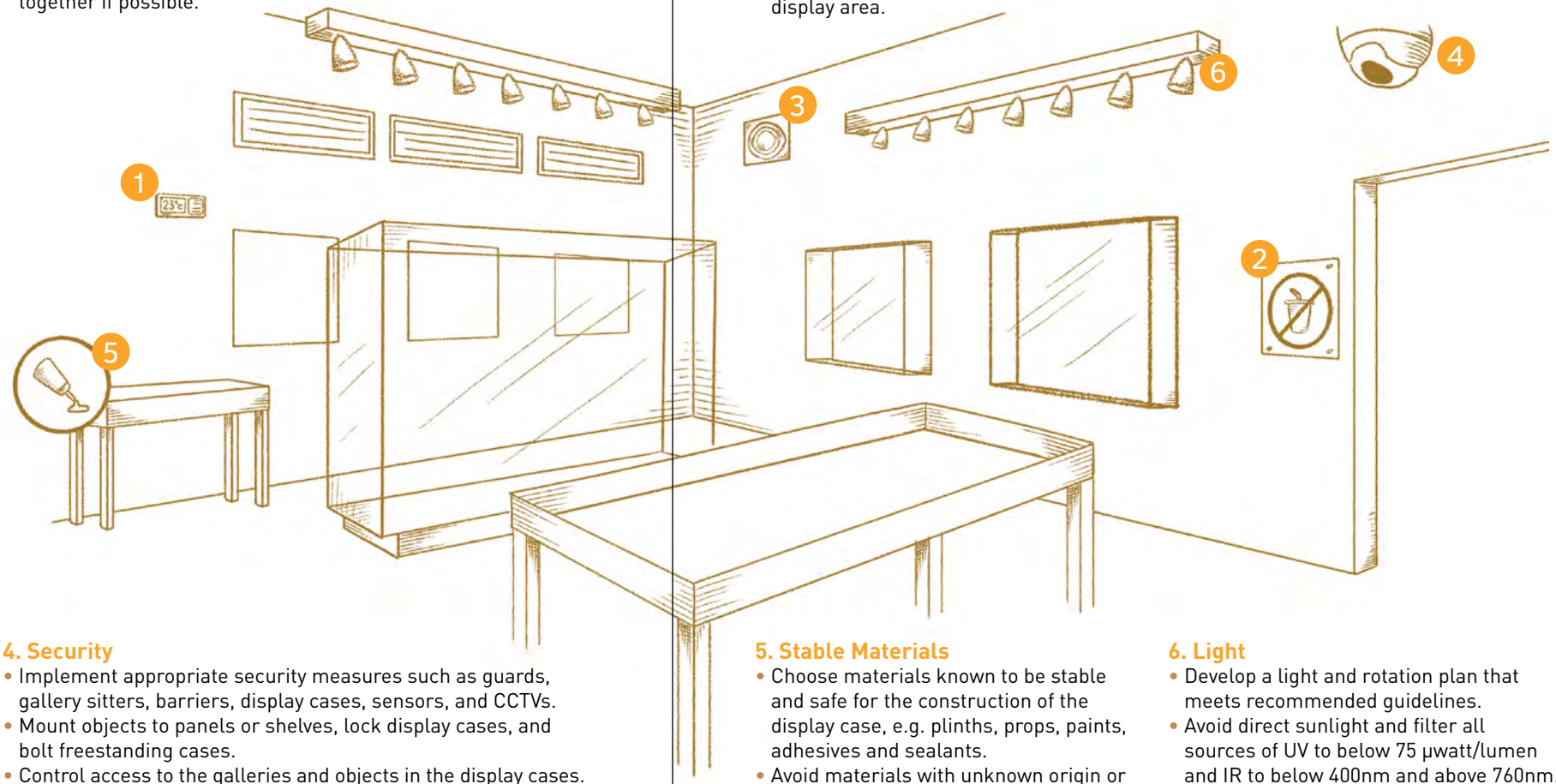
Establishing the Display Environment

It is unlikely that we can create a "perfect" display environment for all your objects, due to physical limitations in our buildings and display spaces, the need to display different material types together, and resource constraints (e.g. budget, manpower, and time).

This means you will need to carefully weigh your options and adopt balanced and pragmatic approaches.

1. Temperature and RH

- Assess the condition of the objects and ensure the display environment is within recommended thresholds.
- Implement additional controls such as conservation grade showcases, microclimate frames, and artsorb/prosorb for sensitive and vulnerable objects.
- Group objects with similar temperature and RH requirements together if possible.



2. Mould and Pests

- Maintain temperature and RH within established thresholds.
- Enclose objects and ensure that any props or textiles used are treated and pest-free.
- Carry out regular housekeeping to prevent dust accumulation which may lead to mould.
- Do not allow any food or drinks in the display area.

3. Pollutants

- Install particulate and chemical filters.
- Aerate display case for at least two weeks before installing objects to allow fresh paint and wood to off-gas acidic gases
- Enclose sensitive objects and incorporate pollutant scavengers.
- Monitor pollutants using metal test coupons or through periodic IAQ tests.

4. Security

- Implement appropriate security measures such as guards, gallery sitters, barriers, display cases, sensors, and CCTVs.
- Mount objects to panels or shelves, lock display cases, and bolt freestanding cases.
- Control access to the galleries and objects in the display cases.
- Ensure fire protection measures are in place and conduct regular risk assessments for theft and vandalism.

5. Stable Materials

- Choose materials known to be stable and safe for the construction of the display case, e.g. plinths, props, paints, adhesives and sealants.
- Avoid materials with unknown origin or composition and consult a conservator when in doubt.

6. Light

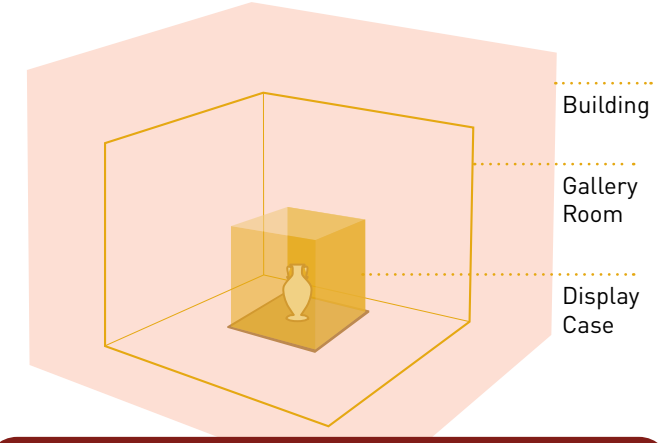
- Develop a light and rotation plan that meets recommended guidelines.
- Avoid direct sunlight and filter all sources of UV to below 75 µwatt/lumen and IR to below 400nm and above 760nm.
- Make use of curtains, a timer, and/or movement sensors to limit light exposure.

Using Conservation Grade Display Case

A well-designed and constructed display case offers a practical solution for protecting an object from physical damage. It also creates a microclimate within the case that satisfies conservation requirements and protects the object on display.

A box within a box

Think of your building as a big "box" or enclosure that buffers and protects your objects from the external environment, the gallery room as a smaller box or zone, and the display case as the third layer of enclosure.



It is much easier and more cost-effective to control the microenvironment within the display case as compared to controlling the environment in the gallery room and the building.

Benefits of Using a Conservation Grade Showcase

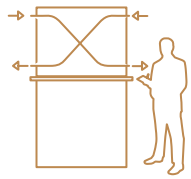
- Protects the object from accidental touch and damage.
- Buffers object from sudden changes in temperature and RH.

- Reduces risk of theft and vandalism.
- Minimize insect entry and dust accumulation.
- Reduces exposure to pollutants.

- Improves ability to control RH within the showcase.
- Allows the suitable RH to be maintained despite a non-controlled outer environment.

As important as it is, designing and fabricating a conservation grade display case could be more complex than you think! Consider these two key components for your display case.

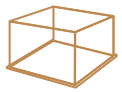
1. Case Performance



- An air exchange rate (AER) of 0.1 is required, and can only be achieved by specialist makers and after tests are conducted to prove the case performance.
- The display case must be maintained and monitored regularly to ensure that it continues to perform as expected.
- Note that opening and closing the case frequently will loosen the case and bring up the AER.

2. Case Design

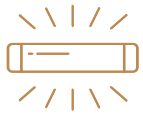
A well-designed display case takes into consideration the following factors:



- **Stability**
  Physically and structurally stable with good quality panels, baseboard, and toughened glass

- **Security**
  Two-stage locking system and alarms (if needed)

- **Access**
  Easy and safe access for maintenance and movement of objects with separate access to the environmental maintenance chamber (e.g. artsorb drawer)



- **Lighting**
  Ability to integrate with various types of lighting equipment to adjust lighting levels and shield from UV and IR. Minimal wiring and external controls to minimise change in internal RH.

- **Safe materials**
  Stable materials used for structure (glass, metal, word), gaskets (silicon sealant), adhesives (acrylic, urea-formaldehyde, polyvinyl acetate), support materials (honeycomb paperboard, foam core), and plastics (acrylics, polyethylene, polyester)

A conservation grade display case takes time and money to construct, and one potential drawback is the concentration of off-gas products from the objects or construction materials within the display case. Apart from using a sealed display case, there are situations where an open display or ventilated display case may be suitable. Here are some guidelines to help you decide if they are viable options.

Open Display

- Suitable for short-term display duration of less than three months (depending on object type and stability)
- Suitable for robust and stable objects, or oversized ones that are impractical to enclose
- Adequate environmental conditions must still be met along with rigorous housekeeping to clean and maintain objects
- Adequate security should be provided to prevent theft or vandalism, and barriers to prevent visitors from touching the objects

Ventilated Display Case

- Suitable when temperature and RH in the gallery can be maintained at required levels
- Suitable for objects less sensitive to changes in the ambient environment
- Can be used when emissions or off-gassing from construction or finishing material becomes concentrated within the case

Gallery Maintenance

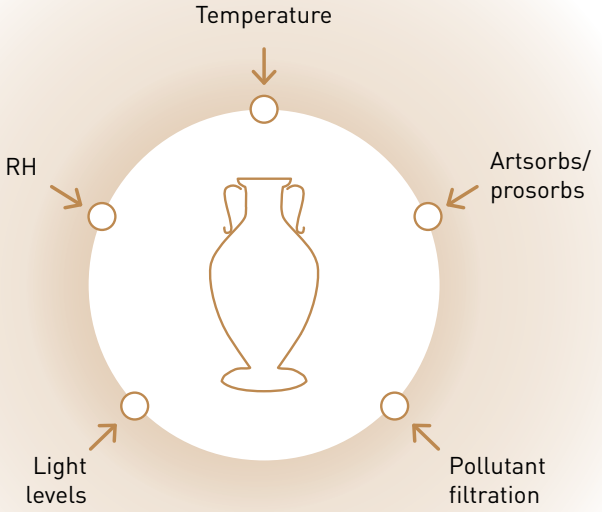
After putting up your objects on display, you will need to monitor and maintain them regularly to ensure that they remain in good condition. Gallery maintenance involves creating a maintenance manual, monitoring the condition of your objects, and performing necessary maintenance tasks and housekeeping to keep your display spaces clean.

Objects on display will suffer from damage and deterioration if maintenance is not carried out, so advanced planning is crucial to ensure sufficient resources (i.e. manpower and money) are committed to maintenance.

Maintenance Tasks

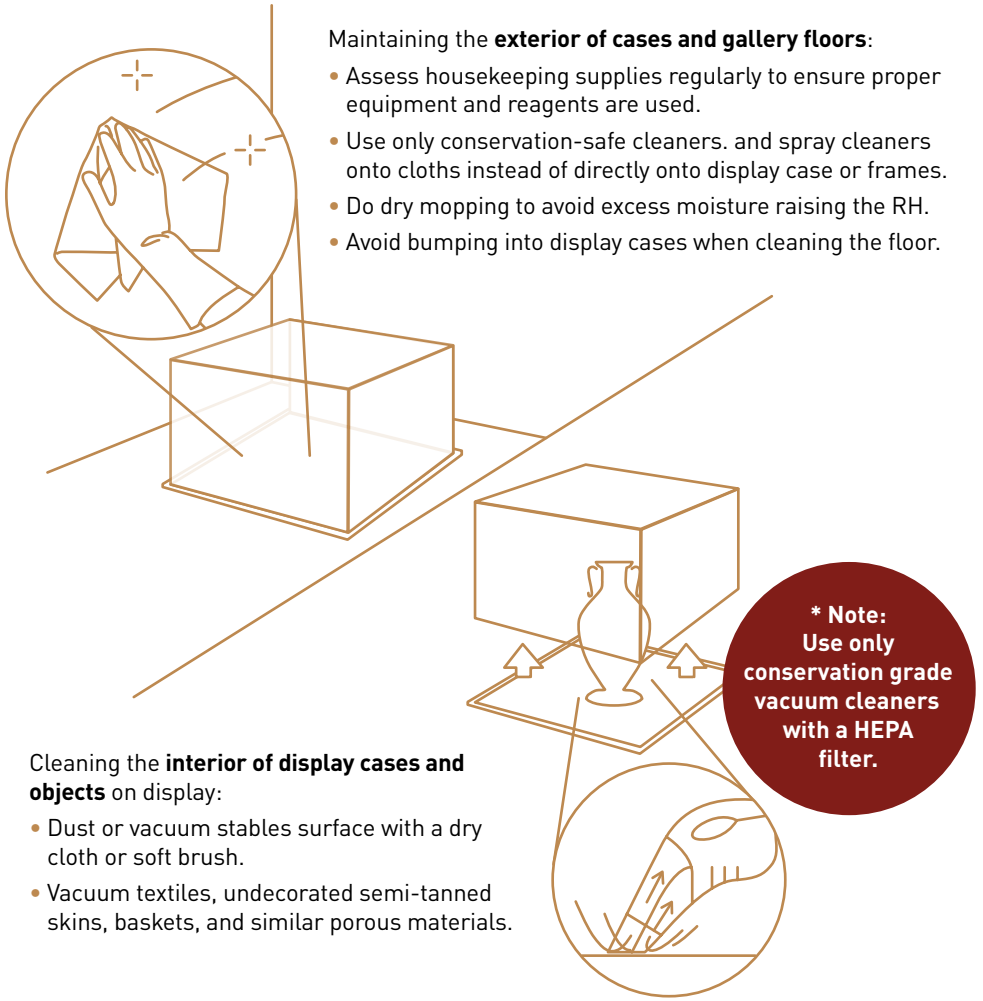
Create a **maintenance manual** to help you keep track of the tasks necessary to keep your objects in good condition while on display. Document and record any changes in the condition of the object while on display and alert a conservator if you notice any anomaly.

Conduct regular checks on the following to make sure they are within expectations:



Housekeeping

This is probably the most important task in gallery maintenance. Clean your display spaces at least once a week. For display spaces with large number of visitors, you may need to have them cleaned as frequently as twice a day.



Maintaining the **exterior of cases and gallery floors**:

- Assess housekeeping supplies regularly to ensure proper equipment and reagents are used.
- Use only conservation-safe cleaners. and spray cleaners onto cloths instead of directly onto display case or frames.
- Do dry mopping to avoid excess moisture raising the RH.
- Avoid bumping into display cases when cleaning the floor.

*** Note: Use only conservation grade vacuum cleaners with a HEPA filter.**

Cleaning the **interior of display cases and objects** on display:

- Dust or vacuum stables surface with a dry cloth or soft brush.
- Vacuum textiles, undecorated semi-tanned skins, baskets, and similar porous materials.

Dust removal is considered a conservation treatment, so it should be carried out only by a conservator or a trained personnel!

Questions to Ask during Routine Maintenance Checks

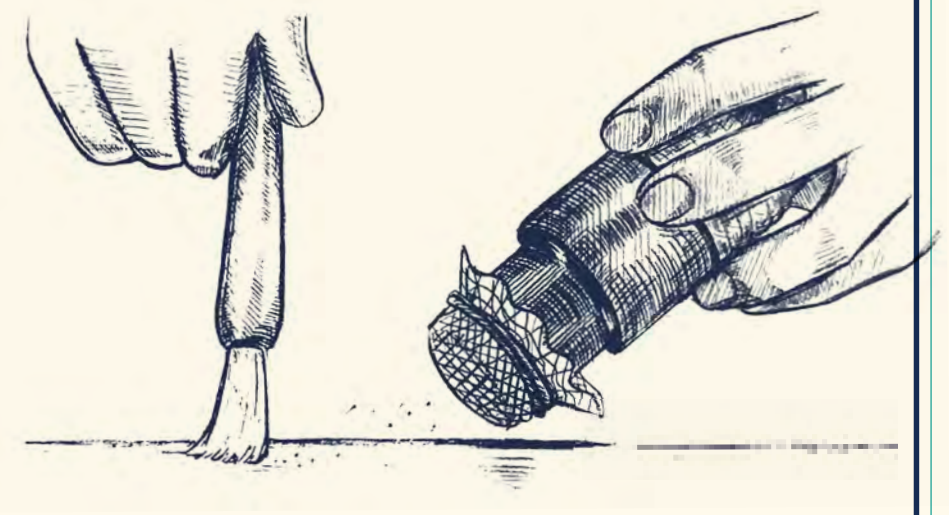
- Are the temperature, RH, light, and cleanliness levels at the display space within expectations/ recommendations?
- Are objects on open display accumulating too much dust?
- Are the interior and exterior of the display cases in good condition?
- Are there any signs of mould or pest infestation, such as frass, around your objects?
- Are there any signs of damage or change in condition of your objects (e.g. paint flaking, paper cockling, notable fading, and stains)? Refer to your previous documentation to confirm this.

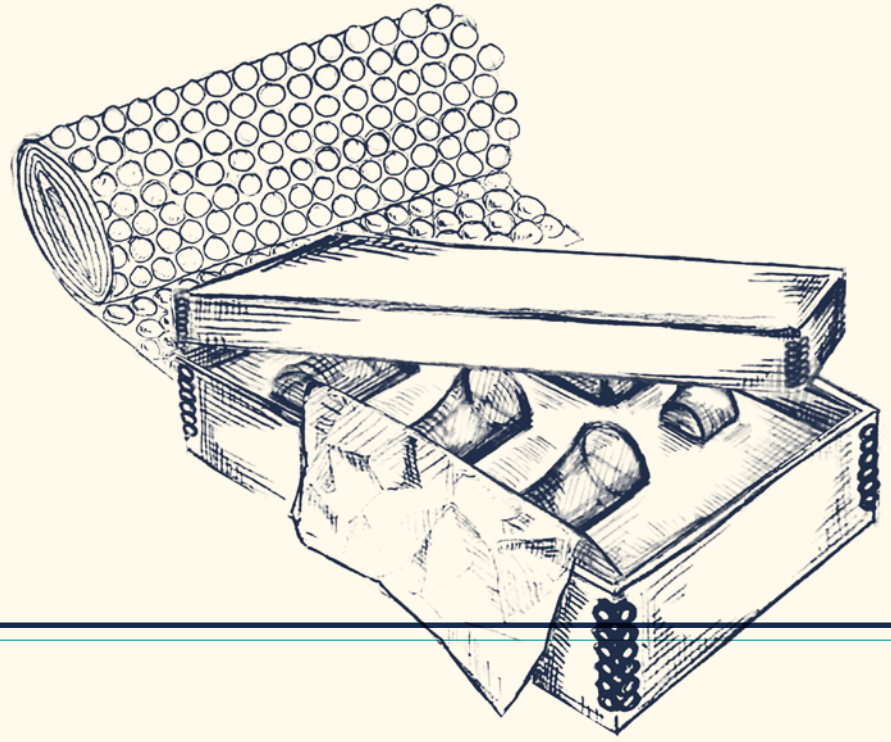
Use the FOCAL approach when conducting your checks!

- **F**eel
- **O**dour
- **C**olour
- **A**ppearance
- **L**ocation

— Chapter V —

Caring for Different Materials



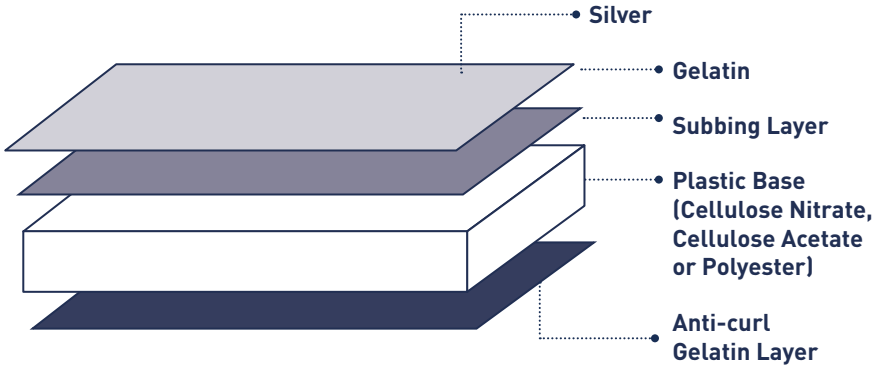


Beyond proper handling of your objects and taking precautions to protect them from deterioration while they are on display, it is also useful to learn about the characteristics of different materials. There's no one-size-fits-all solution when it comes to preserving your collection, as different types of objects and materials will require different approaches of care.

This section provides practical tips and recommendations on how to care for specific materials without the need for highly specialised equipment or exorbitant expenses. Remember, it's always the little preventive measures that will go a long way in safekeeping your collections!

Photographs

A photograph is made up of different component or layers. Most photographs will have a primary support, a binder layer and the final image material. The interaction of these different components with each other and with the environment affects its preservation. Maintaining a suitable environment and proper storage and handling are the key to protecting your photographs.



ENVIRONMENT

Photographs are best preserved in a stable environment that is cool, dry and well ventilated without major fluctuations in temperature and relative humidity.

- Avoid storing photographs in areas of the building that are more susceptible to environmental changes, such as the attic, basement or along walls directly exposed to the exterior environment.
- If you are unable to mechanically control temperature and RH, find a well-ventilated storage space that has the least amount of environmental fluctuation and RH of not more than 60%.

Did you know?

Fading is also temperature dependent and can continue even when photographs are stored in the dark. The higher the temperature the higher the rate of dark fading, so store your photographs in a cool, dry and well-ventilated environment.

Beyond 60% RH, the sensitive gelatin layer will soften and adhere to a contact surface and mould will start feasting on the gelatin.

STORAGE

- House your photographs in enclosures to allow for easier handling and better protection against dust and light.
- Use chemically stable plastic sleeves made from uncoated polyester, polyethylene or polypropylene, or paper enclosures that have passed the Photographic Activity Test (PAT) or are lignan-free.

LIGHT DAMAGE

Photographs are extremely susceptible to light damage, so limit the duration of exposure to control the extent of light fading. Protect them by avoiding prolonged display, and make use of archival and UV filtering materials when displaying them. For important photographs in fragile conditions, make use of reproductions to preserve the original.

Did you know?

The albums in which old photographs are stored can also be considered as an artefact if it is historically significant. However, the sleeves of old albums are often not made of conservation grade material, so you will have to remove the photographs from the sleeves and store them separately even if you are preserving the album.

▲ *Storage of photographs using Mylar sleeves*

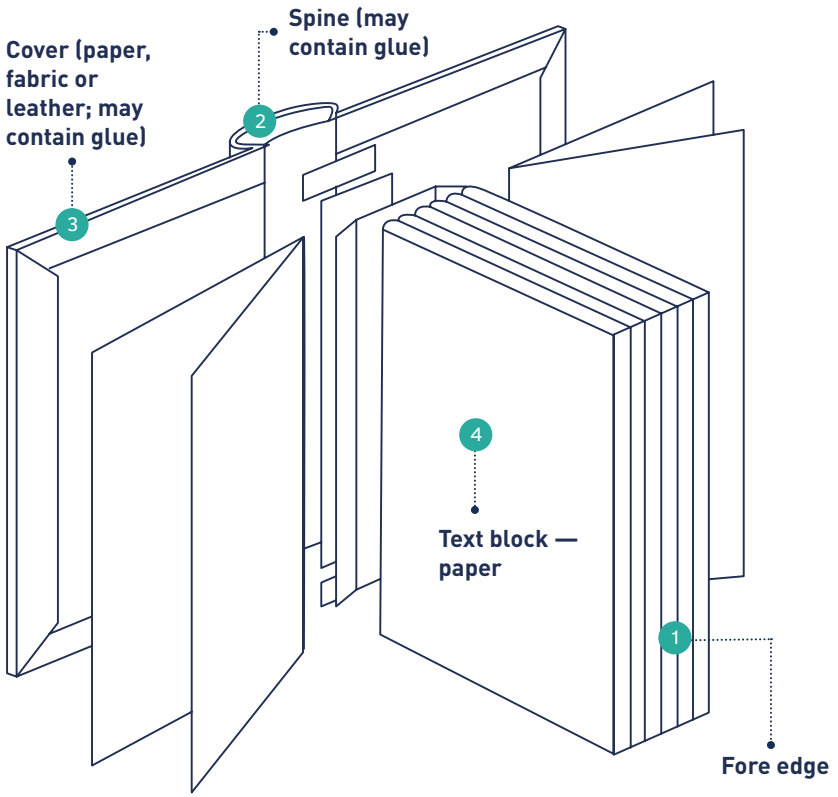
▲ *Use of boxes to organize photographs for protection and easier handling*

DIGITISATION

Digitisation allows you to organise, sort and browse your photograph collection without you needing to handle and subject them to the risk of environmental or physical damage. You can also print a surrogate for research or display if the original is too precious or fragile to handle or display.

Books

Books are made from organic components such as paper, leather, cloth, paste, and glue which are susceptible to damage caused by environmental fluctuations, mould, and pests. They can be constructed, bound and printed using a variety of methods. The paper in books are naturally fragile and must be handled with care and protected from damage by light, pests and pollutants.



A Book refers to the bound volume of papers comprising glue at the spine and paper, fabric, or leather as the cover. It is susceptible to temperature and RH fluctuations, pest and mould damage, and acids from bleaching.

ENVIRONMENT

Keep books and papers in cool, dry conditions around 20°C and 55% RH with minimal environmental fluctuations.

Avoid prolonged exposure to UV and visible light which accelerate fading and discolouration.

Housekeep regularly to prevent dust accumulation and pest infestation. Watch out for common pests that attack papers and books such as silverfish and carpet beetles.

STORAGE AND HANDLING

Use a bookend if storing books upright on shelves and make sure they are supported by neighbouring books (not pressed to tightly) or a bookend – slanted books will warp unevenly.

Retrieve books from the middle of the spine rather than from the top.

Use a book cover to protect your book from dust.

Lay oversized books flat and avoid stacking them high (no more than two to three books, and place protective cushion such as polyester felt between them)

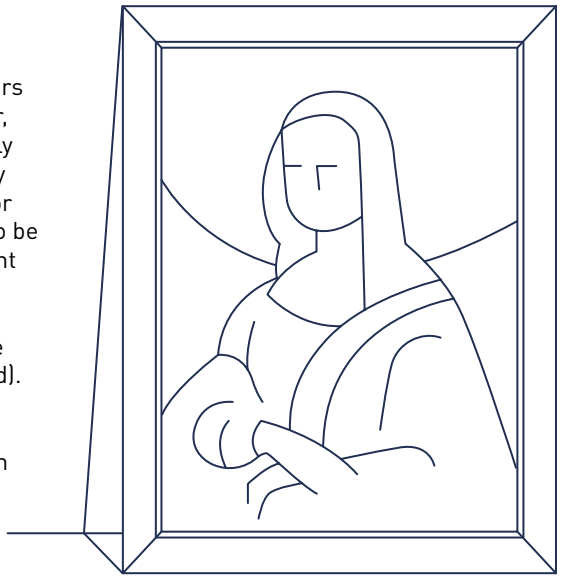
Store papers in buffered acid-free mats or folders, or mylar sleeves, before putting them into archival boxes.

Remove staplers or paper clips as their corrosion permanently stains papers.

Digitise documents before storage, especially those on thin and low-quality papers, as prints, ink, and watercolours deteriorate over time.

Use powder-coated metal shelving. Avoid wooden shelving as they can off-gas and emit acid vapours that damage papers and books.

Paintings



A painting consists of different layers — a paint layer (oil, acrylic, lacquer, impasto, etc.) on a support (typically canvas or wood) which is primed by glue-sizing and/or ground layer. For traditional paintings, there will also be a layer of varnish on top on the paint layer. The canvas is then stretched over an auxiliary wood support (called a stretcher if it is adjustable or a strainer if the corners are fixed). The medium, support, and multi-layered components of a painting have different characteristics which makes it particularly sensitive to environmental fluctuations.

ENVIRONMENT

Keep paintings at a temperature of around 20°C and 55% RH with minimal environmental fluctuations.

Large fluctuations in temperature and RH affect both the paint and the support medium. The canvas may become relaxed or taut. The wooden panel may become structurally damaged (i.e. warping, splitting, breaking).

Frequent expansion and contraction can also make the paint brittle, crack or detach from the support.

STORAGE

The safest method of storing paintings is to frame them up properly and hang them on a wall or movable compactors. They can also be lined up and stored vertically provided a board is used to protect the image side of each painting.

Avoid hanging or storing paintings near places that may be affected by water leakage, temperature change, pests, or accidental knocking (e.g. near the aircon, window, heater). Housekeep regularly to prevent dust accumulation and mould growth.

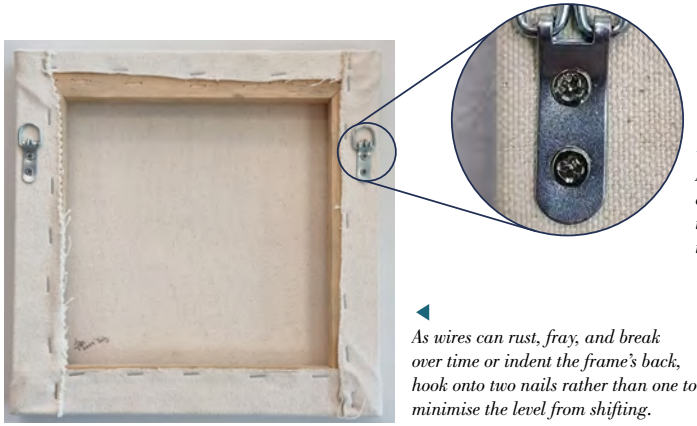
DAMAGE

The darkening or yellowing of the surface of a painting is usually caused by the accumulation of dust and dirt and yellowing of the vanish over time. Other types of damages common in paintings are tears, flaking or cracking paint and mould infestation.

Never attempt to clean a painting by yourself as it may lead to irreversible damage. Always consult a conservator – surface vanish that has discoloured can usually be removed and there are always treatment options for different types of damages.

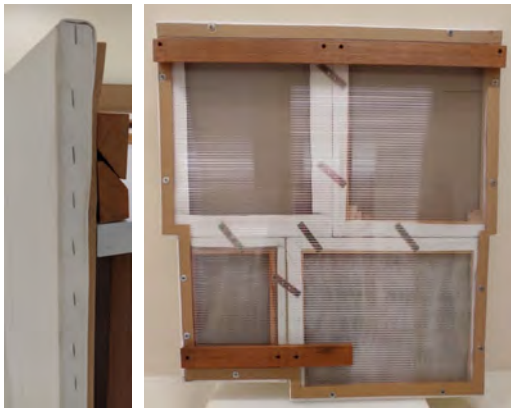
FRAMING AND HANGING

One of the best ways to protect your painting is by getting it properly framed and installed with suitable hanging mechanism. Discuss your requirements with a conservator or framer, and invest in museum grade framing that can provide long-term protection for your painting.



A pair of D-rings is stable and creates a flushed back surface that won't damage the wall or the frame's backing.

As wires can rust, fray, and break over time or indent the frame's back, hook onto two nails rather than one to minimise the level from shifting.



French cleats are suitable for very heavy frames that exceed the weight limit of D-rings.

Ceramics and Glasses

Ceramics and glass have aesthetic appeal and can be found in many of the objects that we collect such as pottery, earthenware, porcelain, decorative glassware, jewellery and sculptures. The primary and most common cause of damage to ceramics and glass is accidental scratching, cracking, chipping or breakage caused by improper handling, storage, or display. Other causes of deterioration could be due to poor quality of the material or manufacturing method used.

ENVIRONMENT

Keep ceramics and glass in temperatures of around 20°C and 55% RH with minimal environmental fluctuations.

Ceramic material is generally not affected much by ambient RH, but mould can still grow on their surface at high RH and adhesives used in past repairs can deteriorate. Spalling is also a common concern for ceramic contaminated with salts (e.g. archaeological materials).

Glass disease, which leads to weeping, leaching, crizzling, cracking and fragmentation can occur when there are large fluctuations and high levels of RH.

STORAGE AND DISPLAY

Dos

- Store or display on sturdy and level surfaces and pad storage enclosure or base of shelving with polyethylene foam.
- Store top-heavy objects with small unstable base upside down or on their side for greater stability.
- Buffer your ceramics or glass with acid-free tissue paper or foam padding to prevent them from abrading or knocking against each other during transportation.

Don'ts

- Do not use newspaper to wrap or store your glass or ceramic as they are acidic and can cause discolouration or staining.
- Do not use boxes that are not strong enough (without a secure base) to store your glass and ceramics.
- Do not use display brackets with sharp edges that may damage the object surface.

DAMAGE

Handling

- Improper handling and carelessness are the main culprits for damage to glass and ceramics. Cracks will start to appear if glass and ceramics are repeatedly stressed and weakened by bad handling practices. Dropping them accidently onto a hard surface will of course lead to catastrophic and irreversible damage.
- Be extra cautious when handling or transporting glass or ceramics. Make sure you handle them at the most stable area and transport them using appropriate equipment (e.g. in a padded tray or box on a trolley instead of carrying on your hands). Never lift them using the handles or spouts.

Old Repairs

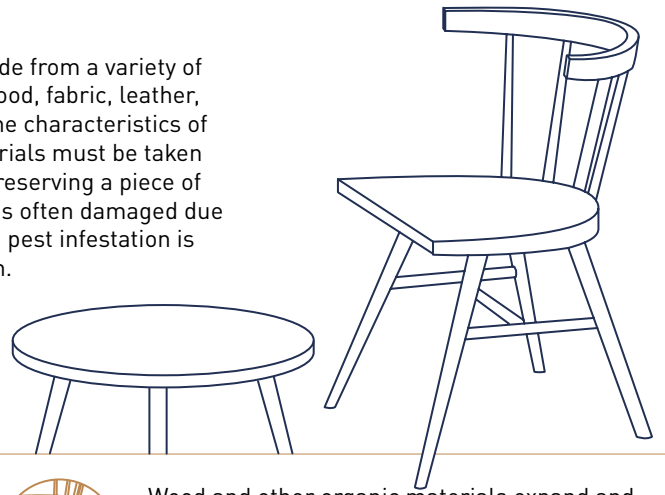
- Watch out for old repairs and be extra cautious when you see them on your glass or ceramics. The adhesive used to repair past damages may have weakened or deteriorated and can no longer provide adequate support.
- Consult a conservator if you are unsure of the condition and whether it is safe to handle.

▲ *Handle ceramics at the base where it is most stable and strong*

▲ *Watch out for fragile areas and never handle by the handles or attachments*

Furniture

Furniture can be made from a variety of materials such as wood, fabric, leather, metal and plastic. The characteristics of these different materials must be taken into account when preserving a piece of furniture. Furniture is often damaged due to poor handling and pest infestation is also a major concern.



ENVIRONMENT

Keep furniture in temperatures of around 20°C and 55% RH with minimal environmental fluctuations.

Wood and other organic materials expand and contract in response to environmental changes. Structural damages such as warping or splitting can occur when there are too much environmental fluctuations.

When RH is too high (e.g. above 70%) for a prolonged period of time, the risk of pest and mould infestation also increases greatly.

STORAGE AND DISPLAY

Ensure appropriate lighting level as wood is susceptible to light damage (particularly visible and UV light) and wood finishes can darken and fade due to prolonged exposure.

Do not stack furniture (e.g. chairs).

Ensure furniture is kept away from direct sunlight and limit exposure to both natural and artificial light when they are in storage or on display. Install UV filters on windows and fluorescent lighting.

Do not store furniture directly on the ground. Store them on top of pallets or on shelves to protect them from water damage (e.g. from water leaks)

HANDLING

Handling

- Inspect for structural weakness such as weak or damaged joinery before moving and secure any loose components (e.g. doors and drawers) that cannot be removed.
- Lift furniture at its strongest part and do not attempt to move heavy furniture on your own without help.
- Use appropriate equipment (e.g. a dolly) and never slide furniture across the ground.

Cleaning

- Avoid applying furniture oils as they can lead to different problems such as darkening or obscuring the grain of the wood and attracting more dust and dirt.
- Wax can be applied by a trained person to protect the furniture surface from dust and handling. They also make dusting easier and provide protection from moisture and airborne pollutants.

Pest Infestation

- Inspect your furniture regularly for signs of pest infestation such as flight holes, frass, and carcasses.
- Isolate and seal object immediately and active infestation is found.
- Engage a pest control specialist familiar with heritage conservation.

▲ *Avoid handling furniture at parts that may be fragile and cannot withstand pressing pressure*

▲ *Handle at the base at the most stable part of the furniture.*

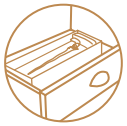
Metals

Many different types of objects such as jewellery, weapons, tools, sculptures, and kitchenware are made from metals or metal alloys such as gold, silver, copper, and iron.

Corrosion is the primary cause of deterioration for metal objects and each type of metal has its own degree of susceptibility to corrosion.

ENVIRONMENT

Keep metals in temperatures of around 20°C and below 55% RH with minimal environmental fluctuations. High RH is the main contributor of corrosion of metals.



Dust and dirt that accumulate on the surface of metal can attract moisture which hastens the corrosion of metals. Protect metal objects by using dust covers or store them in boxes, drawers or cabinets.

Harmful gases and pollutants in the air such as car exhaust and acidic gases from wooden storage and display materials can attack and damage metal objects. Protect metal objects by installing filters against air pollutants and using safe storage and display materials.

STORAGE

Buffer and pad metal objects with acid-free, inert material. Avoid having metals in contact with each other to prevent galvanic corrosion.

Use powder-coated metal shelves and cabinets. Avoid storing metals objects near acid-emitting materials such as wooden shelves and cardboard boxes.

Store silver in "silver cloth" which can slow the rate of tarnishing by preventing sulphur gas from reaching the silver object.

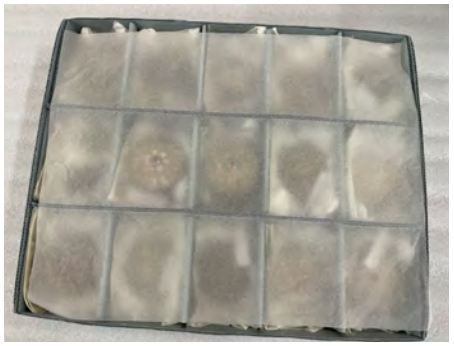
HANDLING AND CLEANING

Handling

Handling metal objects with bare hands will cause the oils and acids on our fingers to be deposited onto the metal surface and lead to corrosion. Metal objects must always be handled with gloves.

Cleaning

Polishing or aggressive cleaning of metal objects should be avoided, as a thin surface layer of the metal surface is removed each time it is done. If done repeatedly, the surface will deteriorate and holes may even form. Use only mild and non-abrasive cleaning methods, and take a preventive approach to keep your objects in good condition to prevent tarnishing.

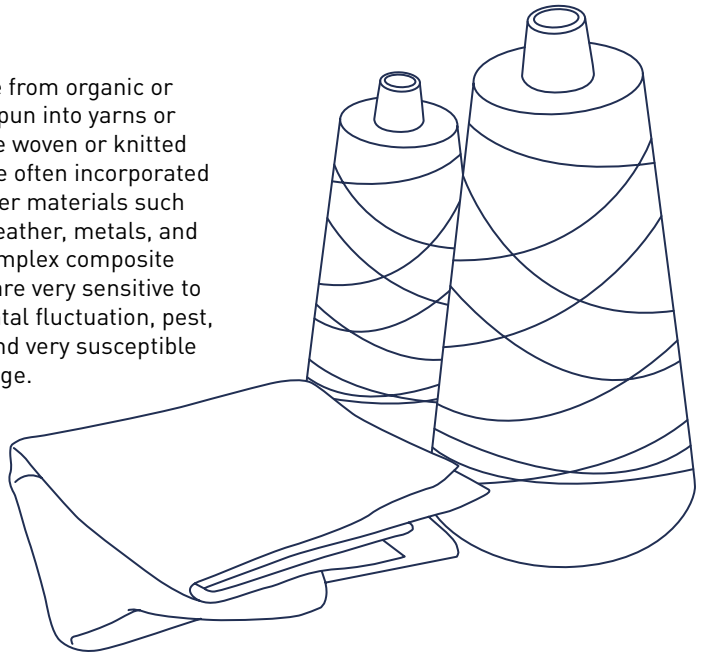


▲ *Use boxes to organize smaller metal objects for protection and easier handling*

▲ *Store metal objects on power-coated shelves with sufficient space for handling to reduce risk of accidental knocking and abrasion.*

Textiles

Textiles are made from organic or synthetic fibres spun into yarns or threads which are woven or knitted together. They are often incorporated together with other materials such as paper, wood, leather, metals, and paints to form complex composite objects. Textiles are very sensitive to light, environmental fluctuation, pest, and pollutants, and very susceptible to handling damage.



ENVIRONMENT

Keep textiles in temperatures of around 20°C and 55% RH with minimal environmental fluctuations.

Keep textiles away from natural or artificial light as they can fade colours and accelerate the deterioration of fibres.

Light damage is cumulative and irreversible. Protect textiles by limiting exposure (i.e. rotating the display) and using UV filtering on frame glazing, windows, and other light sources.

Monitor the underside of the textiles or garments frequently for any fading.

Avoid storing textiles near heat sources (e.g. spotlight, windows) as a higher temperature accelerates the deterioration of fibres and dyes.

STORAGE

Being flexible by nature, distorting and wrinkling can result from inappropriate storage methods and cause damage to textile fibres. Depending on their sizes and types, textiles and garments may be stored in the following ways:

Flat
for heavily ornamented garment or smaller textiles

Rolled
for large textiles

Padded hanger lined with unbuffered acid-free paper
for garments apart from those cut on bias or knitted (prone to become stretched)

HANDLING

Handling

- Handle textiles carefully as fibres can easily be caught and weakened by careless or rough handling.
- Wear gloves when handling textiles as oils and salts on fingers are easily absorbed and cause staining over time.

Dust

- Housekeep regularly to prevent dust accumulation and reduce the risk of pest or mould infestation.
- Conduct routine inspection and remove dust using a soft brush to dust gently into a vacuum nozzle that has suction control.

HOUSEKEEPING

Now that you've read through the various aspects of collections care, it shouldn't come as a surprise that something as simple as having a housekeeping routine is the most effective way to protect your objects. Follow these guidelines:

- Create a housekeeping manual with clear description of tasks, schedules, and roles and responsibilities.
- Inspect and clean the dark corners of your storage and display rooms frequently.
- Use a vacuum cleaner with HEPA filtration system and suction control to clean dust off your objects. Cover the nozzle with tulle, nylon, or stockings when vacuuming to prevent the strong suction from dislodging parts of your objects.

Dusting is considered a type of interventive treatment, so you need to be trained and should consult a conservator whenever you are unsure.

What do you do when your objects are damaged?

Stay calm when you discover that an object has been damaged. Report the incident immediately and document the object's condition with notes and photographs. When in doubt on whether a damage has occurred, don't be afraid to consult a conservator. Also, never attempt to repair any damages! A botched repair may aggravate the condition and damage the object further.

ENGAGING A CONSERVATOR

In the event that you need to engage a conservator to assess or conserve your objects, note the following guidelines:

- Check the background and review of the conservator or company.
- Seek a second opinion (if necessary).
- Discuss insurance coverage (yours and the conservator's).

What to Expect:

- ☑ Physical viewing of the damaged object to make an assessment will need to be conducted.
- ☑ Two to three treatment proposals ranging from minimal treatment to maximum intervention will be provided.
- ☑ An estimated time frame for treatment and quotation based on per hour charges will be provided.
- ☑ Cost of tools and materials may be charged to you, so check and negotiate.
- ☑ Condition report with detailed documentation of treatment, and materials and tools used must be provided. Request for both hardcopy and softcopy reports, and all images taken before and after the treatment.

There is no one fixed way to carry out a treatment. Different conservators may offer slightly different solutions, so evaluate their proposals carefully before making your decision.

Glossary

A-D (Acid-Detection) strip	A dye-coated paper strip that detects and measures the severity of acetate film deterioration, a.k.a. vinegar syndrome, in film collections.
Air exchange rate (AER)	A measure of the airtightness of a display case – the rate of air exchange between the display case interior and the ambient environment of the exhibit space.
alloy	A mixture of more than one metal.
anoxic	A method that safely removes pests from infected objects using inert gases.
artsorb/prosorb	A pre-conditioned silica gel that has a unique ability to both absorb and release atmospheric moisture in order to maintain a pre-set relative humidity within a sealed environment. Able to absorb up to five times us much moisture as regular density silica. A silica gel for stabilising the relative humidity in museum showcases, being able to absorb and release an exceptional large amount of water vapour between 30% and 60% RH.
cockle	The forming of wrinkles or puckers on paper.
delaminate	This happens when an object separates into its constituent layers.
dissociation	This happens when parts of an object are separated, or when a label separates from its object, resulting in the loss of its complete identity.
DSLR (Digital Single Lens Reflex)	A camera that operates with a fixed, digital sensor, using the same lens for framing, focusing, and taking the photograph. This allows the user to see an exact, optical view of the scene.
embrittle	To lose ductility and become susceptible to cracking, crumbling, or breaking. In this case, the object will be in a drastic state of disrepair.
frass	Fine powdery refuse or fragile perforated wood produced by the activity of boring insects.
galvanic corrosion	Chemical damage induced when a more reactive metal corrodes preferentially to the other metal it is in contact with.
Indoor Air Quality (IAQ) test	A test done to measure the level of pollutants in the air.
Lignin	An organic substance found in wood pulp. Paper or board that is not lignin free will become acidic over time and affect your object.
lux	A unit of measurement for light; 1 lux = 1 lumen per square metre.
microns	A unit of measurement for particulate pollutants.
Mylar sleeve	An archival polyester film that offers a glass-clear, acid-free, non-yellowing/clouding, protective sleeve material, allowing one to handle and view works of art on paper. 'Mylar' is the trade name.
test	A test used to roughly estimate the suitability of materials used in display cases, cabinets, museum showrooms, and packaging.
B72 & 67	Resin commonly used by museums for labelling objects. B72 is normally used as the base coat while in B67 is used as the top coat. Both can be purchased in pre-mixed form.
Photographic Activity Test (PAT)	Test that demonstrates the material is safe for direct contact with a silver photographic image.
psychrometer	A device used for determining air humidity be comparing the difference between a dry thermometer and a wet thermometer that has lost moisture through evaporation.
RAW	The most common file format for uncompressed images which contains direct image data from the camera sensors with no loss of quality and alteration. Generally large in size.
spalling	A process in which salt flakes out from a ceramic as moisture is removed.
spore	A reproductive cell capable of developing into a new individual without fusion with another reproductive cell.
surrogate	A replica of an original photo.
taut	Stretched or pulled tightly.
weeping	A process in which carbonates and oxides in glass attract water from the atmosphere, causing droplets to form on the glass surface.

Note

Note

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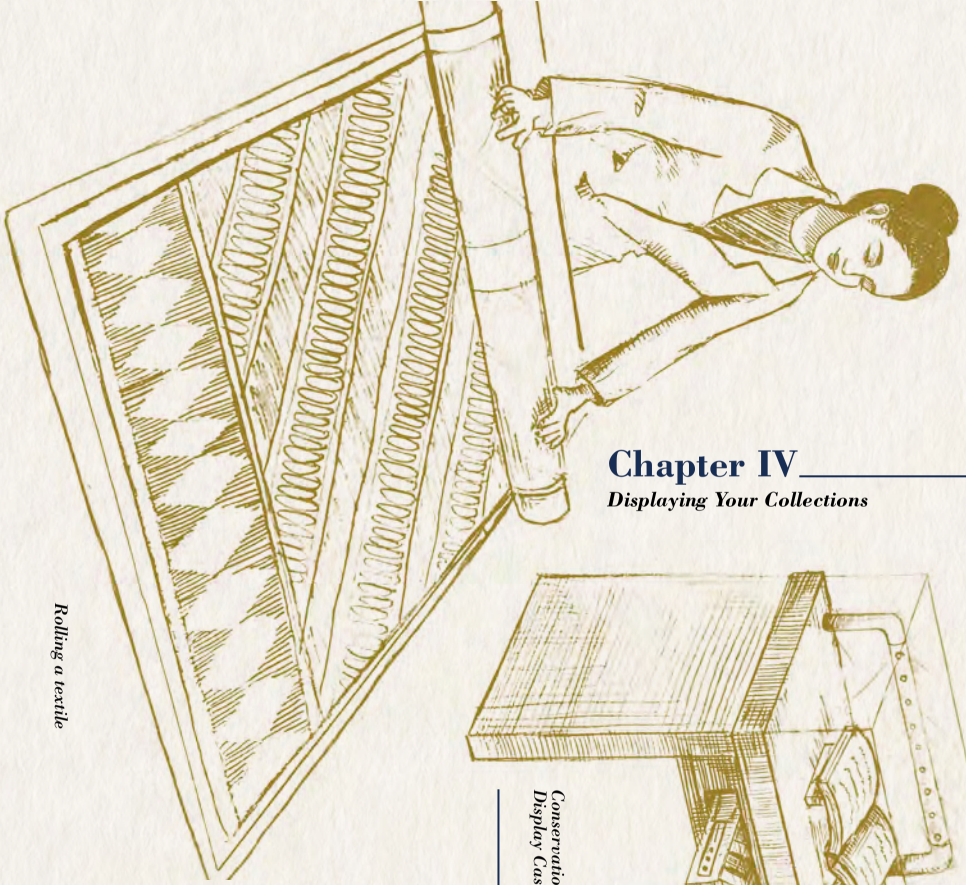
For further reading on collections care, please refer to the following resources. These resources were also consulted with in the production of this booklet.

National Parks Service (NPS) Museum Handbook
https://www.nps.gov/museum/publications/handbook.html

Canadian Conservation Institute (CCI) Care of Objects and Collections
https://www.canada.ca/en/conservation-institute/services/care-objects.html

American Institute for Conservation (AIC) Caring for Your Treasures
https://www.culturalheritage.org/about-conservation/caring-for-your-treasures



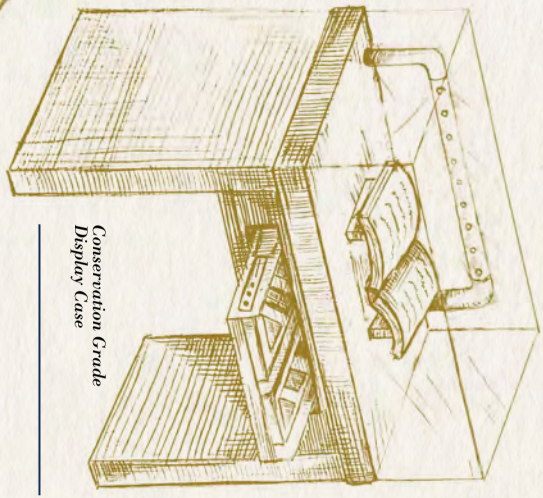
Rolling a textile

Chapter III

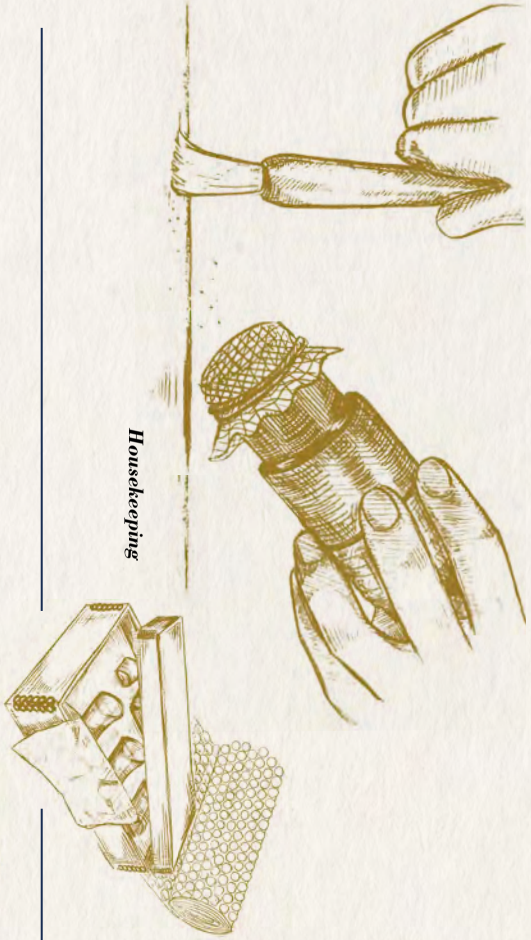
Handling Your Collections

Chapter IV

Displaying Your Collections



Conservation Grade Display Case



Housekeeping

Chapter V

Caring for Different Materials