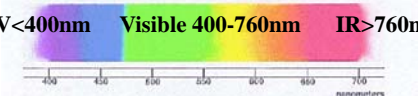


THE COLLECTIONS ENVIRONMENT

Tara D. Kennedy
Preservation Consultant

Light

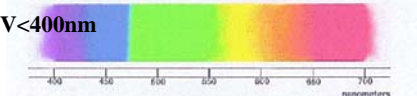
Light



UV < 400nm Visible 400-760nm IR > 760nm

400 450 500 550 600 650 700
nanometers

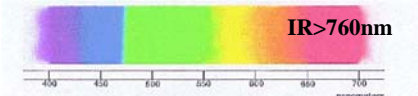
Light



UV < 400nm Visible 400-760nm

400 450 500 550 600 650 700
nanometers

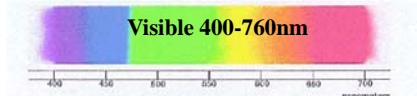
Light



Visible 400-760nm IR > 760nm

400 450 500 550 600 650 700
nanometers

Light



UV < 400nm Visible 400-760nm

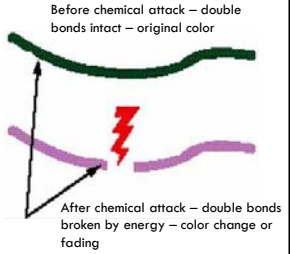
400 450 500 550 600 650 700
nanometers

Light

- No UV/ No IR
- Keep in mind:
 - All Types of Light Will Cause Damage!

What Does Light Do to Objects?


- Chromophores
- Chromophores have double bonds.
- Double bonds break readily during chemical reaction.



Before chemical attack – double bonds intact – original color

After chemical attack – double bonds broken by energy – color change or fading

What Does Light Do to Objects?



“Echo” by Jackson Pollock from the Museum of Modern Art, NYC

What Does Light Do to Objects?

- Total lifetime exposure is the important factor

What Does Light Do to Objects?

- Total lifetime exposure is the important factor
- Total exposure = (intensity of light) x (time)

What Does Light Do to Objects?

- Total lifetime exposure is the important factor
- Total exposure = (intensity of light) x (time)
- Fading and color change cannot be reversed!

Where'd the Ink Go??



Types of Artificial Light Sources

- Incandescent lights
 - ▣ Low UV
 - ▣ High IR



Types of Artificial Light Sources

- Halogen lights
 - ▣ Moderate UV
 - ▣ Moderate IR



Types of Artificial Light Sources

- Fluorescent lights
 - ▣ High UV
 - GE CovRGuard lamps have low UV emissions
 - ▣ Low IR



Types of Artificial Light Sources

- High Intensity Discharge (HID) - Mercury or Metal Halide
- Sodium HID is OK



Types of Artificial Light Sources

- Fiber Optic
 - ▣ Very low UV
 - ▣ Best for darker spaces
 - ▣ Light box needs ventilation – emits heat



Types of Artificial Light Sources

- Light Emitting Diode (LED)
 - No UV
 - No heat gain
 - Available now in a wider variety of color temperatures



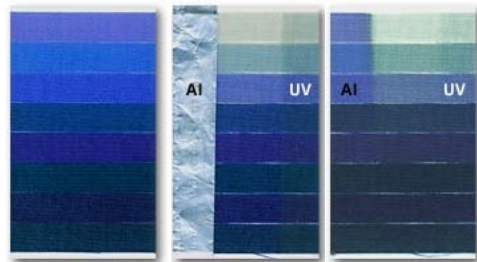
Which Do I Choose?

- Cost
 - Is filtration possible?
- Application

Measuring and Monitoring Light

- Passive method – blue wool standard cards

Blue Wool Cards in Action!



Measuring and Monitoring Light

- Passive method – blue wool standard cards
- Active method – light meters



Measuring and Monitoring Light

- Passive method – blue wool standard cards
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Measuring and Monitoring Light

- Passive method – blue wool standard cards
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Measuring and Monitoring Light

- Passive method – blue wool standard cards
- Active method – light meters



Measuring and Monitoring Light

- Passive method – blue wool standard cards
- Active method – light meters
- Keep records of light levels

Recommended Display Light Levels

- 50 lux (5 foot candles) for light-sensitive artifacts
- 50 – 200 lux (5-20 foot candles) for less sensitive artifacts
- UV - 75 microwatts per lumen ($\mu\text{w}/\text{l}$)

Control of Light in Exhibit Space

- Skylights

Control of Light in Exhibit Space

- Skylights
- Filters

Control of Light in Exhibit Space

- Skylights
- Filters
- Dimmers


Control of Light in Exhibit Space

- Skylights
- Filters
- Dimmers
- User-activated lighting systems

Relative Humidity and Temperature

What is Relative Humidity?

- Water can exist as a solid (ice), a liquid (water) or a gas (vapor)




What is Relative Humidity?

- Absolute Humidity
 - ▣ The amount of water (vapor) in a given volume of air

What is Relative Humidity?

- Absolute Humidity
 - ▣ The amount of water (vapor) in a given volume of air
- Relative Humidity
 - ▣ The amount of water vapor in a given volume of air RELATIVE to the temperature of the air

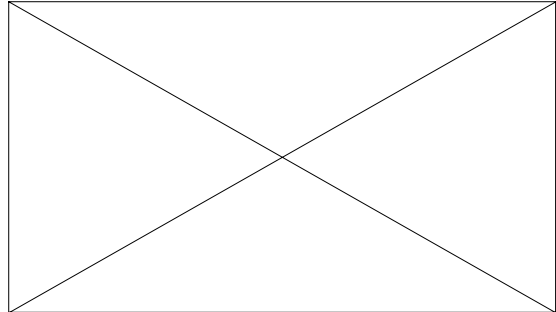


What is Dew Point?

- The **MAXIMUM** amount of water that can be held in the air at a given temperature is called the **DEW POINT** or **SATURATION POINT**
- Moisture will condense out of the air at this point



Still Confused? Let Vince Explain...



Measuring Relative Humidity

- Hair hygrometer



Measuring Relative Humidity

- Hair hygrometer
- Indicating cards



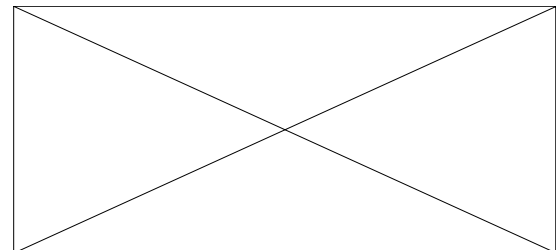
Measuring Relative Humidity and Temperature

- Psychrometer



Measuring Relative Humidity and Temperature

- Psychrometer
 - Here's a sling psychrometer in action!



Measuring Relative Humidity and Temperature

- Psychrometer
- Recording hygrothermograph



Measuring Relative Humidity and Temperature

- Psychrometer
- Recording hygrothermograph
- Data loggers



Recommended Levels

- LACK OF FLUCTUATION WITHIN A RANGE is the most important factor rather than exact temperature or RH
- Set points for different materials range from 30% to 55% (+/- 5%) for RH
- Set points for temperature should be no higher than 70°F if possible

How Does the Environment Affect Your Collections?

- Three basic forms: physical, chemical and biological

Physical

Cracking Emulsion on Photo



Sprung Vellum Binding



Chemical

Corrosion Due To Acid Rain




Silver Mirroring on Photo



Biological

Mold on Bound Maps



Starch Book Cloth Eaten by Insects



Controlling Relative Humidity and Temperature

- Low Cost/ No Cost to Improve Conditions
 - Keep Winter Heat Low
 - Keep Summer Temps Moderate
 - Evening Setbacks are Okay!
 - Seal Windows
 - Keep Outside Doors and Windows Closed
 - Block Radiant Heat from Radiators
 - Separate Collections that Need Special Conditions

Controlling Relative Humidity and Temperature


- Microclimates, Microclimates!

Creating Microclimates

- Buffers for RH control

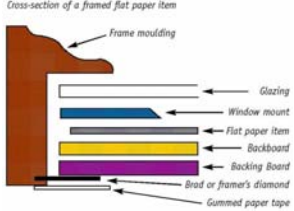
Creating Microclimates

- Buffers for RH control
 - Silica gel



Creating Microclimates

- Buffers for RH control
 - Silica gel
 - Saturated Salts
 - Buffer with layers




Cross-section of a framed flat paper item

Pollutants

Airborne and Gaseous Pollutants

- Particulates
 - ▣ Sources



Microscopic photograph of dust

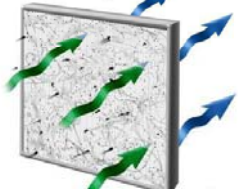
Airborne and Gaseous Pollutants

- Particulates
 - ▣ Sources
 - ▣ Measurement and standards

Airborne and Gaseous Pollutants

- Particulates
 - ▣ Sources
 - ▣ Measurement and standards
 - ▣ Control
 - Multi-stage filtration – triple bank filters
 - Minimum Efficiency Reporting Value (MERV)

A HEPA air filter can reduce the amount of airborne allergens




Airborne and Gaseous Pollutants

- Gaseous Pollutants
 - ▣ Sulfur dioxide + Water = Sulfuric Acid
 - ▣ Nitrous oxide + Water = Nitric Acid
 - ▣ Ozone
 - ▣ Formaldehyde
 - ▣ Acetic Acid
 - ▣ Chlorides

Airborne and Gaseous Pollutants

- Gaseous Pollutants
 - ▣ Sources
 - External




Airborne and Gaseous Pollutants

- Gaseous Pollutants
 - Sources
 - External
 - Internal


Airborne and Gaseous Pollutants

- Gaseous pollutants
 - Sources
 - Measurement and monitoring



Airborne and Gaseous Pollutants

- Gaseous pollutants
 - Sources
 - Measurement and monitoring



Airborne and Gaseous Pollutants

GASEOUS POLLUTANT LEVELS AND STANDARDS FOR CULTURAL PROPERTY			
POLLUTANT	PEAK URBAN CONCENTRATION	EPA LEVELS	RECOMMENDED CONTROL LEVELS
Sulfur dioxide	100-750 ppb	30 ppb	≤0.4 ppb
Nitrogen dioxide	40-100 ppb	50 ppb	≤2.5 ppb
Ozone	20-40 ppb	120 ppb	≤1.0 ppb


Pollution levels for cultural property (Banks)

Airborne and Gaseous Pollutants

- Methods of control
 - Limit exposure


Airborne and Gaseous Pollutants

- Methods of control
 - Limit exposure
 - Filtration
 - Two main types – water spray and activated carbon



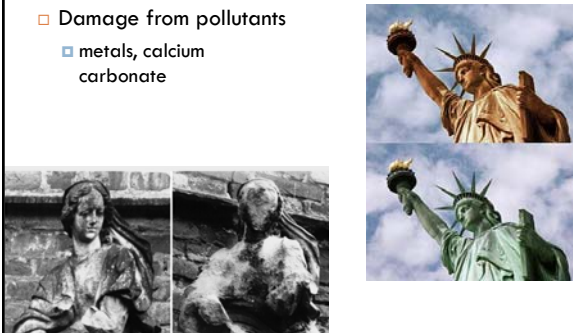
Airborne and Gaseous Pollutants

- Methods of control
 - Limit exposure
 - Filtration
 - Two main types – water spray and activated carbon




Airborne and Gaseous Pollutants

- Damage from pollutants
 - metals, calcium carbonate



Airborne and Gaseous Pollutants

- Damage from pollutants
 - organic materials



Close-up image of red rotted leather

Homework

- Take a short quiz about today's webinar at <https://www.surveymonkey.com/s/basics2>
- Homework link and links to additional resources will be posted on the Collections Care Basics page at <http://www.connectingtocollections.org/courses/collections-care-basics/>

Questions? Drop me a line!

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THANKS FOR TUNING IN!