

Compost Operators Training Certificate
Course:

The Biology and Core Principles of Composting

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Definition of Composting is:



An aerobic process in which microorganisms decompose various organic materials to yield CO₂, water, and a stable, soil-like product called compost, or humus. The controlled process of decomposition.

Terms you will hear today

- Compost (just mentioned)
- Humus (not hummus)
- Aerobic (with oxygen)
- Anaerobic (without oxygen)
- C:N (carbon to nitrogen ratio)
- Biodegradable (biological decomposition possible not to be confused with “compostable”)
- MRF (Material Recovery Facility)

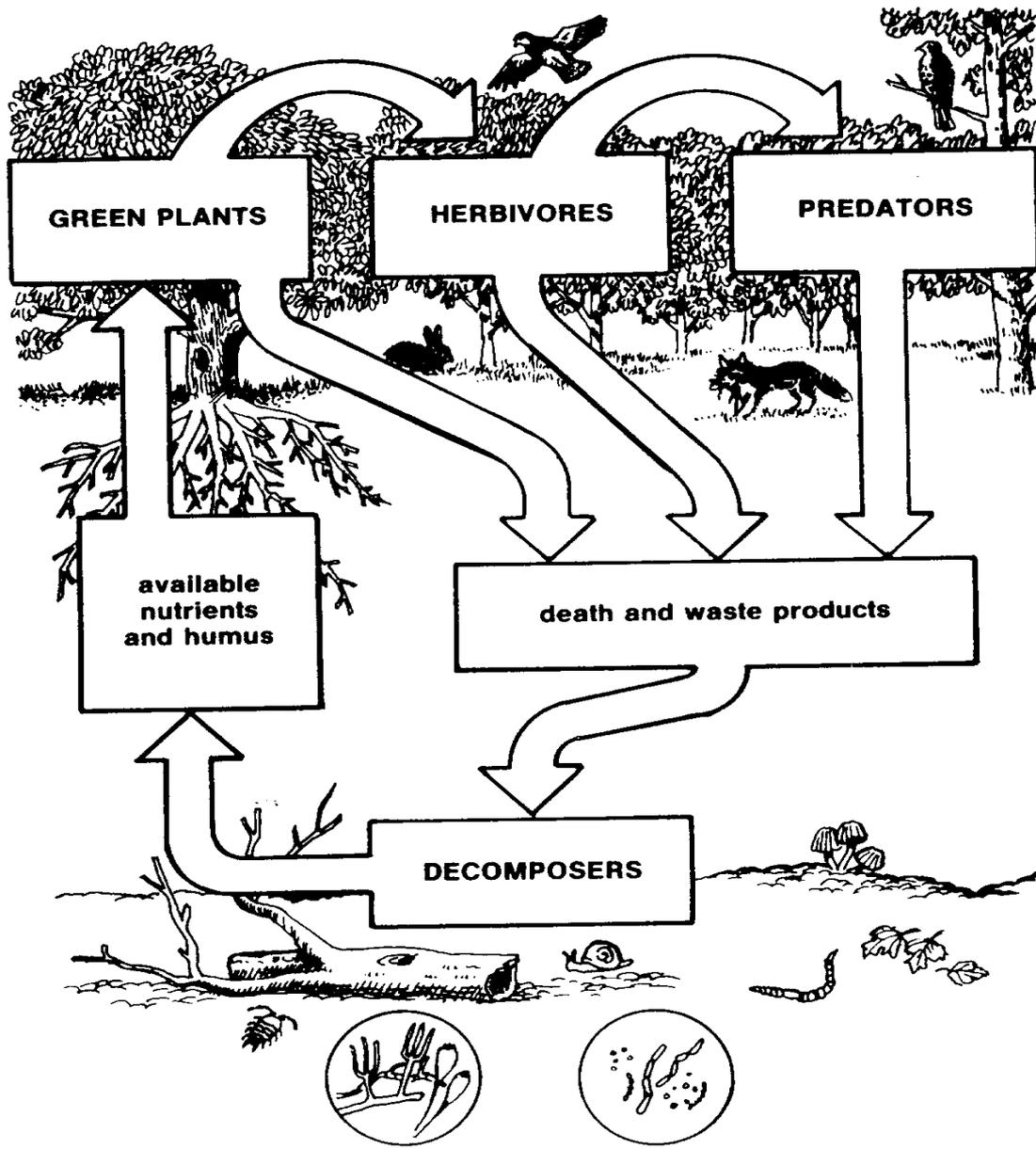


Objective of Composting



The Composting Process

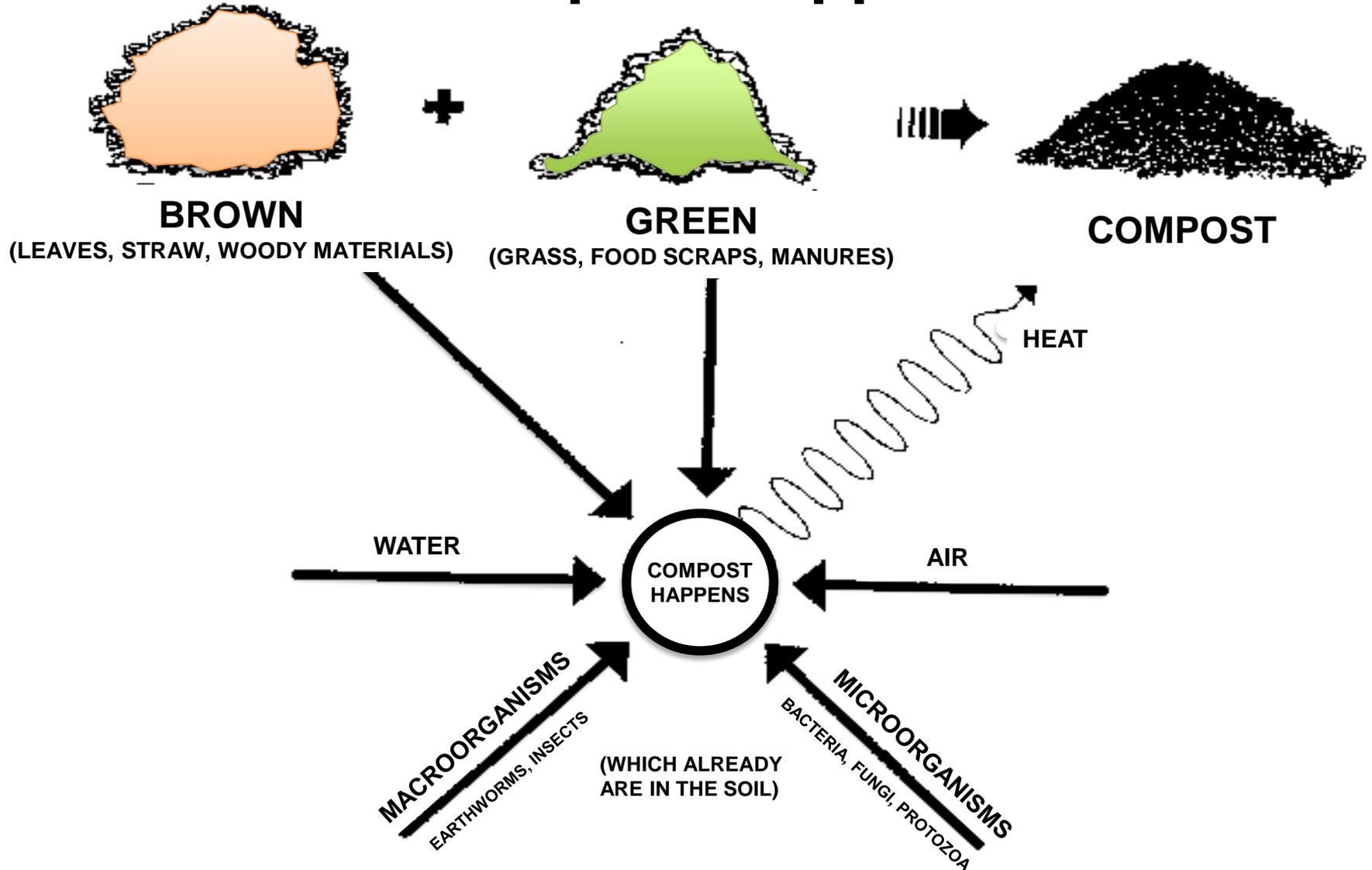
1. Microbial breakdown of organic matter
2. Reduction in particle size
3. C:N ratio decreases due to carbon loss
4. Odors occur due to gasses & VFAs
5. pH rises above neutrality
6. Volume reduction of 50-60%
7. Weight reduction of 40-80%



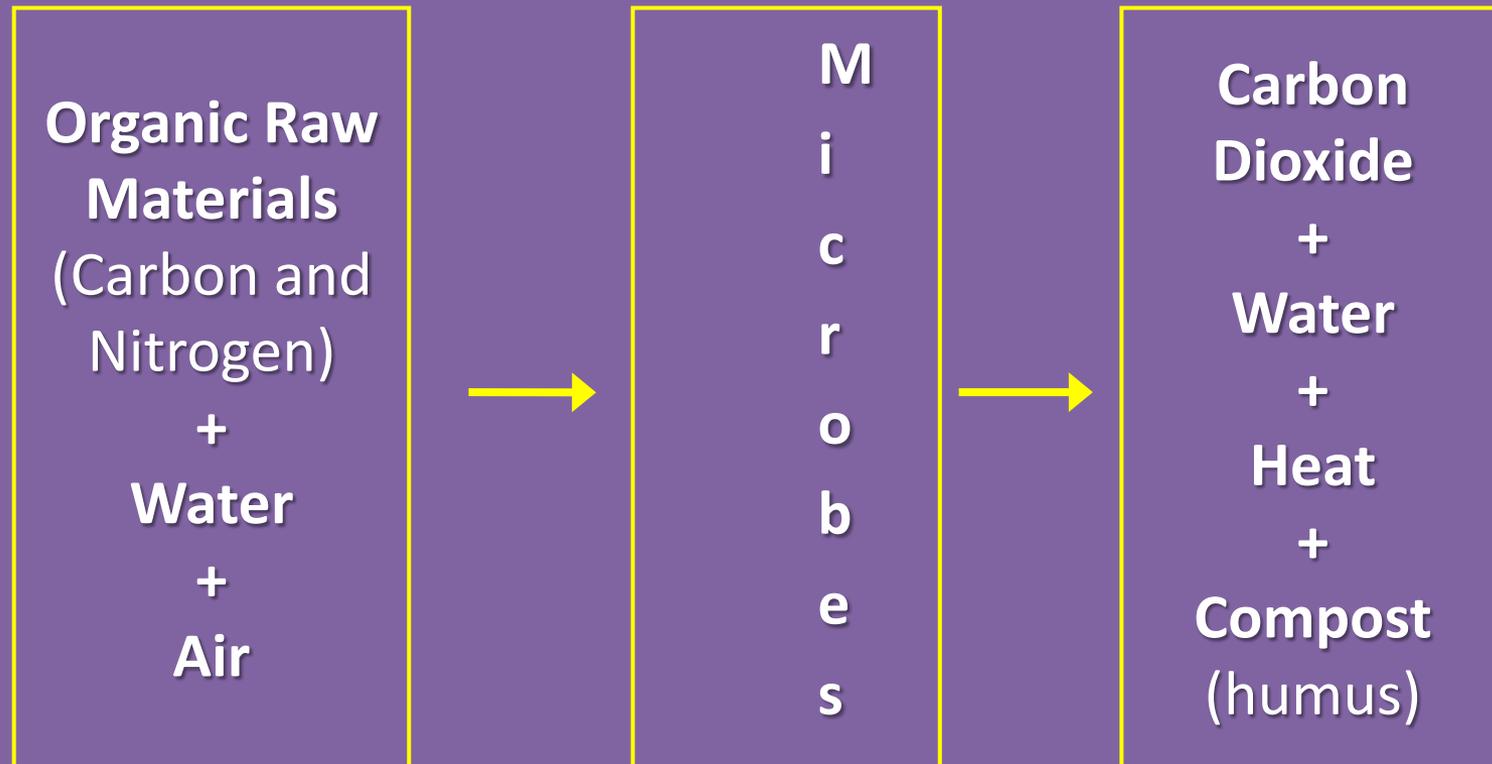
Decomposition Cycle

In the forest, nutrients are recycled through the natural decomposition of plant and animal waste.

Compost Happens



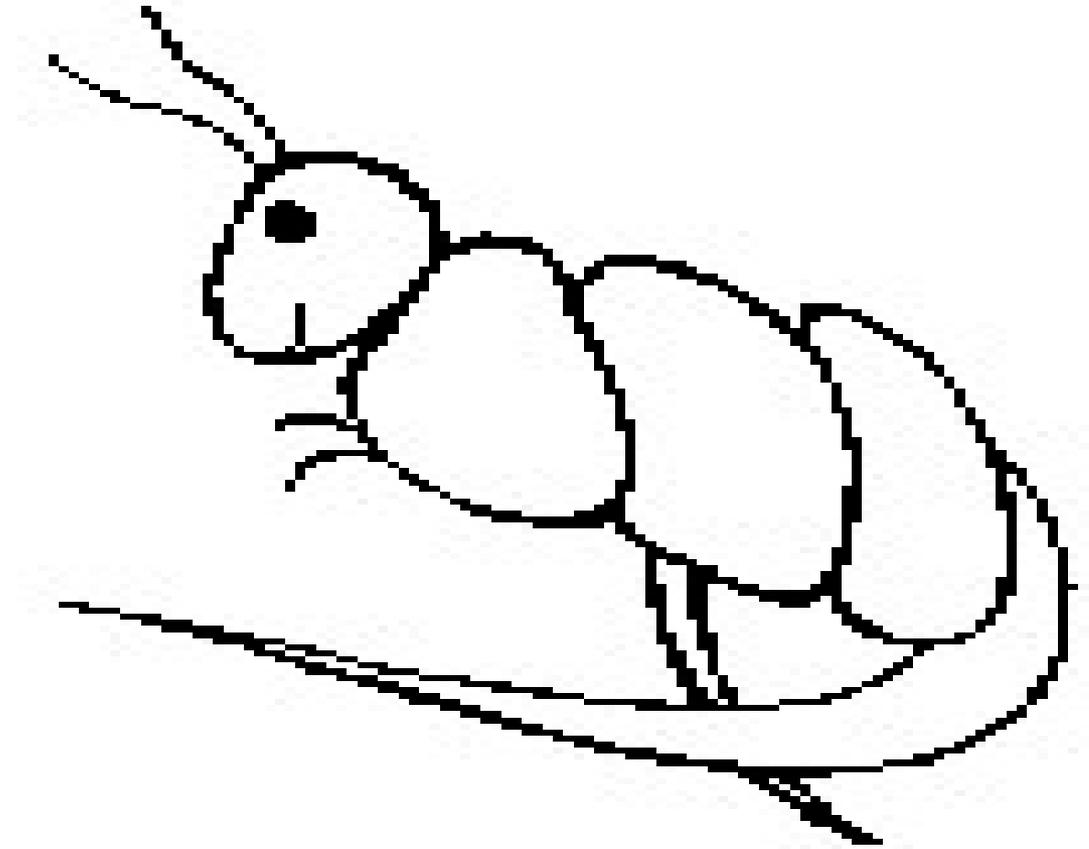
The Composting Process



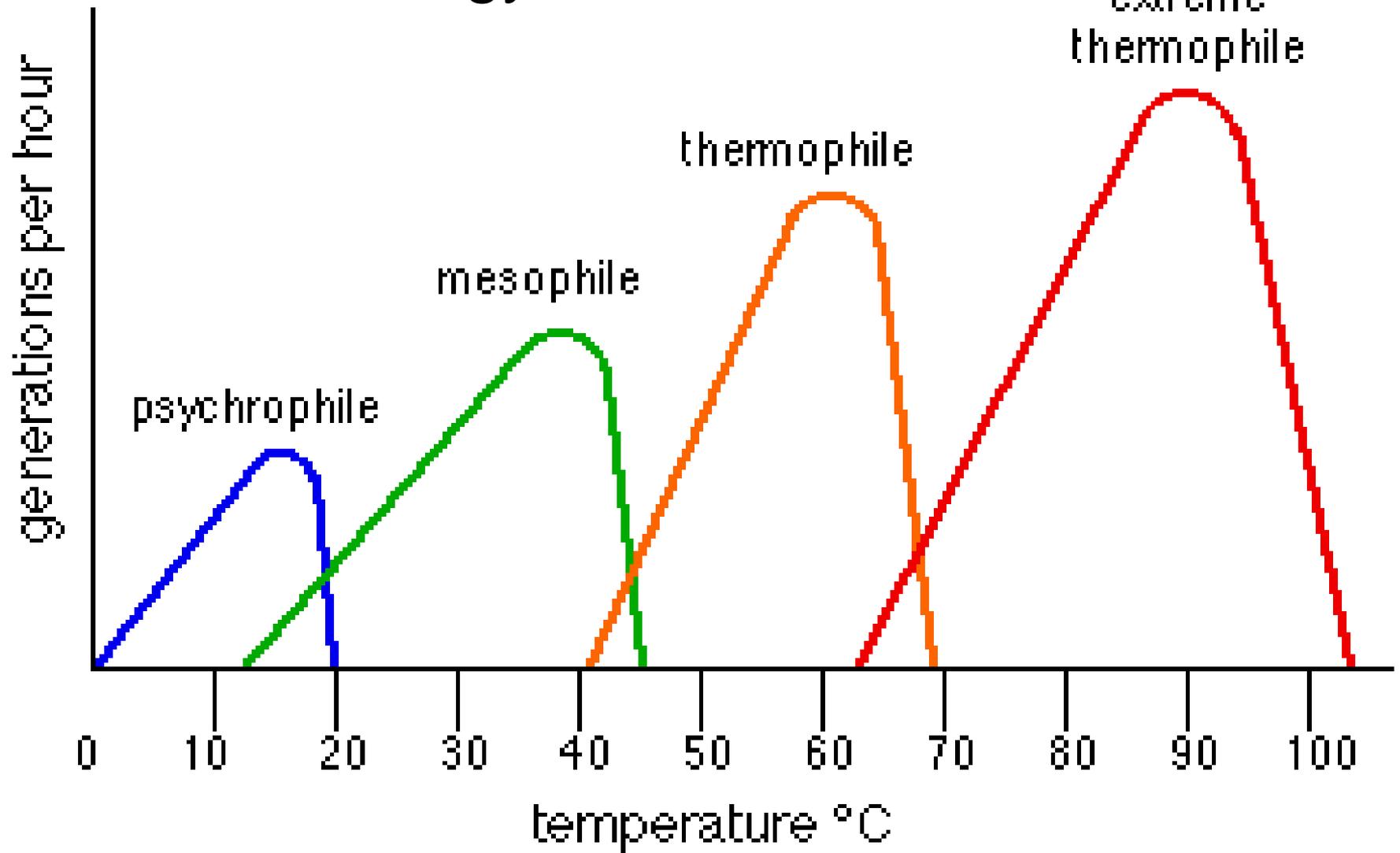
Aerobic vs. Anaerobic

- Aerobic Decomposition:
 - Decomposition of organic matter by microorganisms in the presence of air
 - By-products of aerobic decomposition are carbon dioxide and water.
- Anaerobic Decomposition:
 - Decomposition by microorganisms in the absence of air.
 - By-products include methane gas, alcohols or other organic compounds and carbon dioxide.

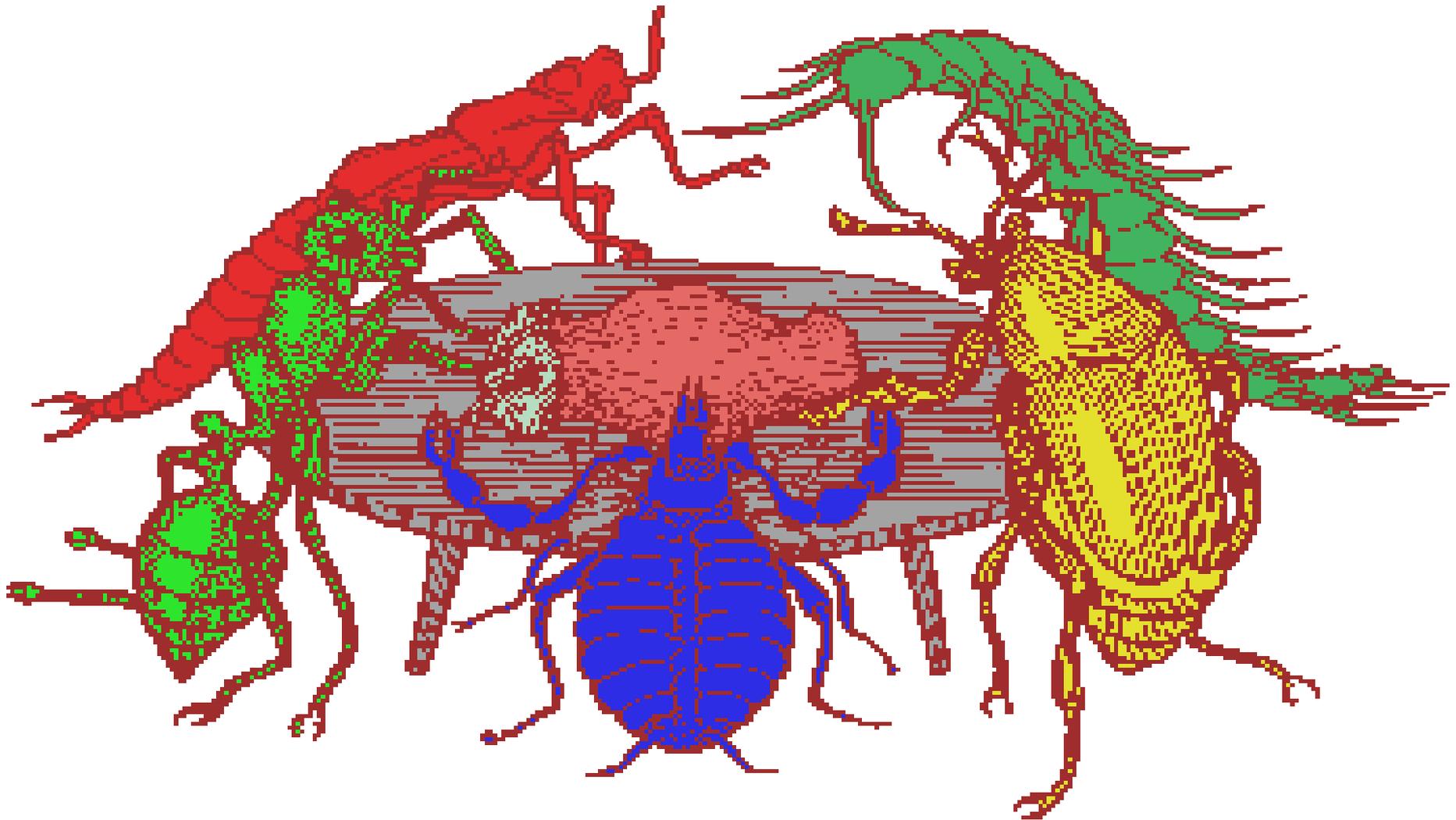
Microbes



Microbiology



Common Compost Organisms



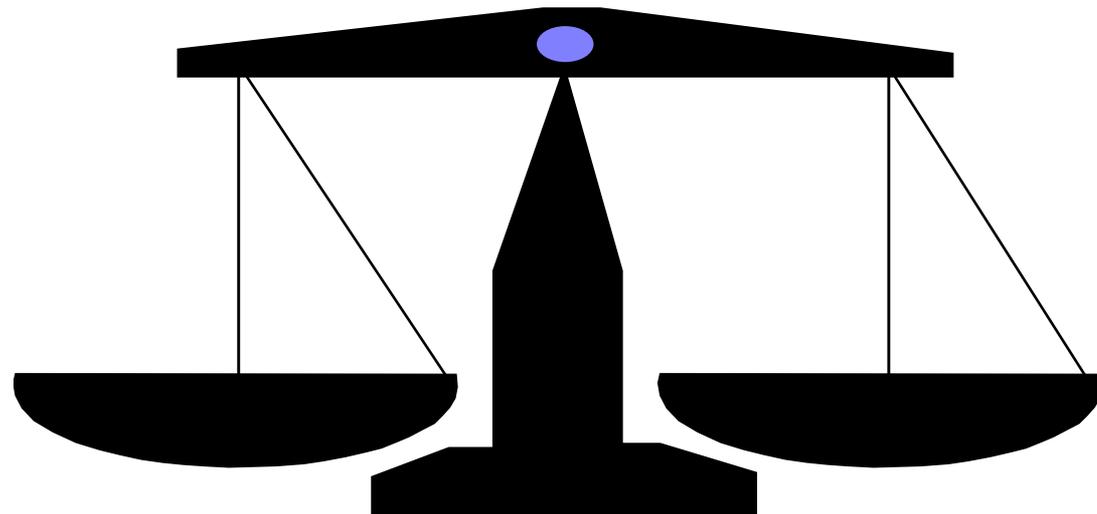
Let's talk about: Chemical Factors Affecting Composting



Carbon to Nitrogen Ratios for Common Composting Materials

C:N Ratio by weight - 30:1

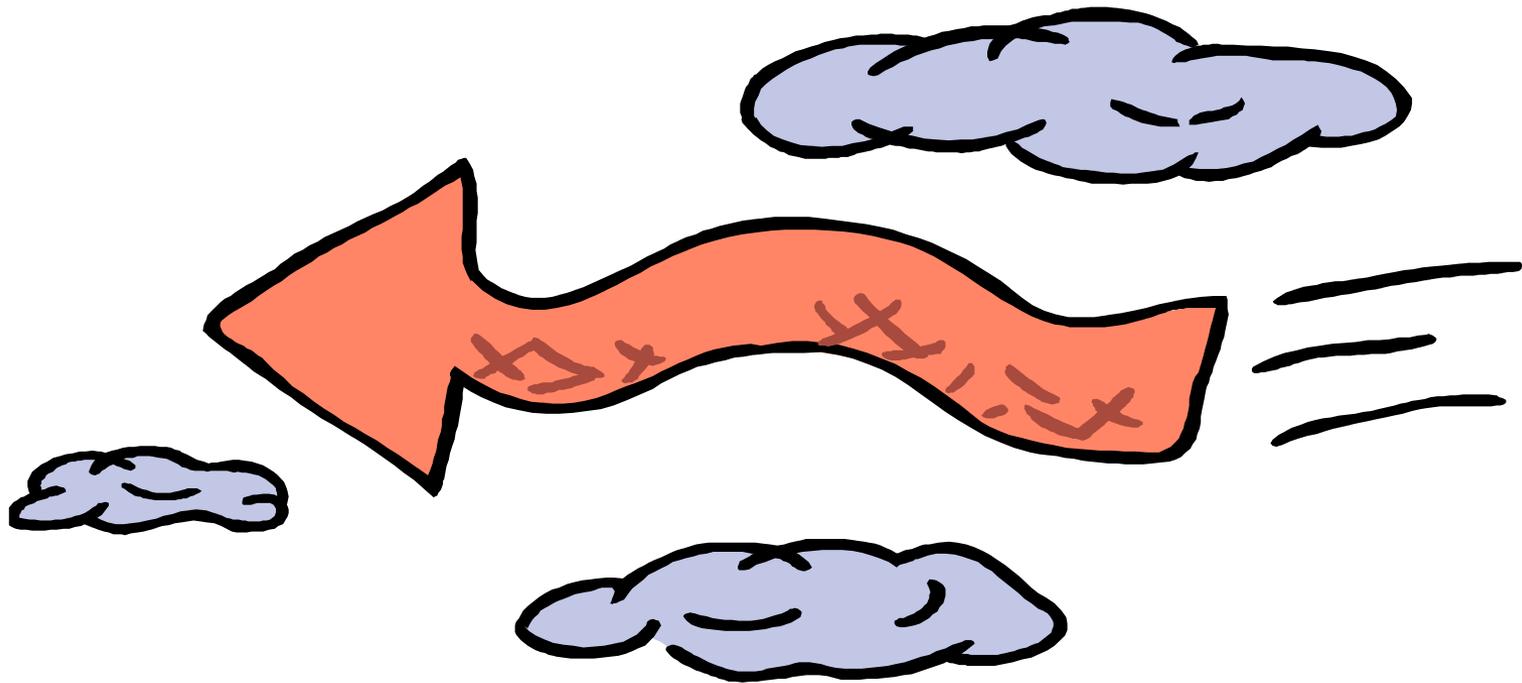
C:N Ratios by volume - 2:1



Carbon to Nitrogen ratios for common materials (by weight)

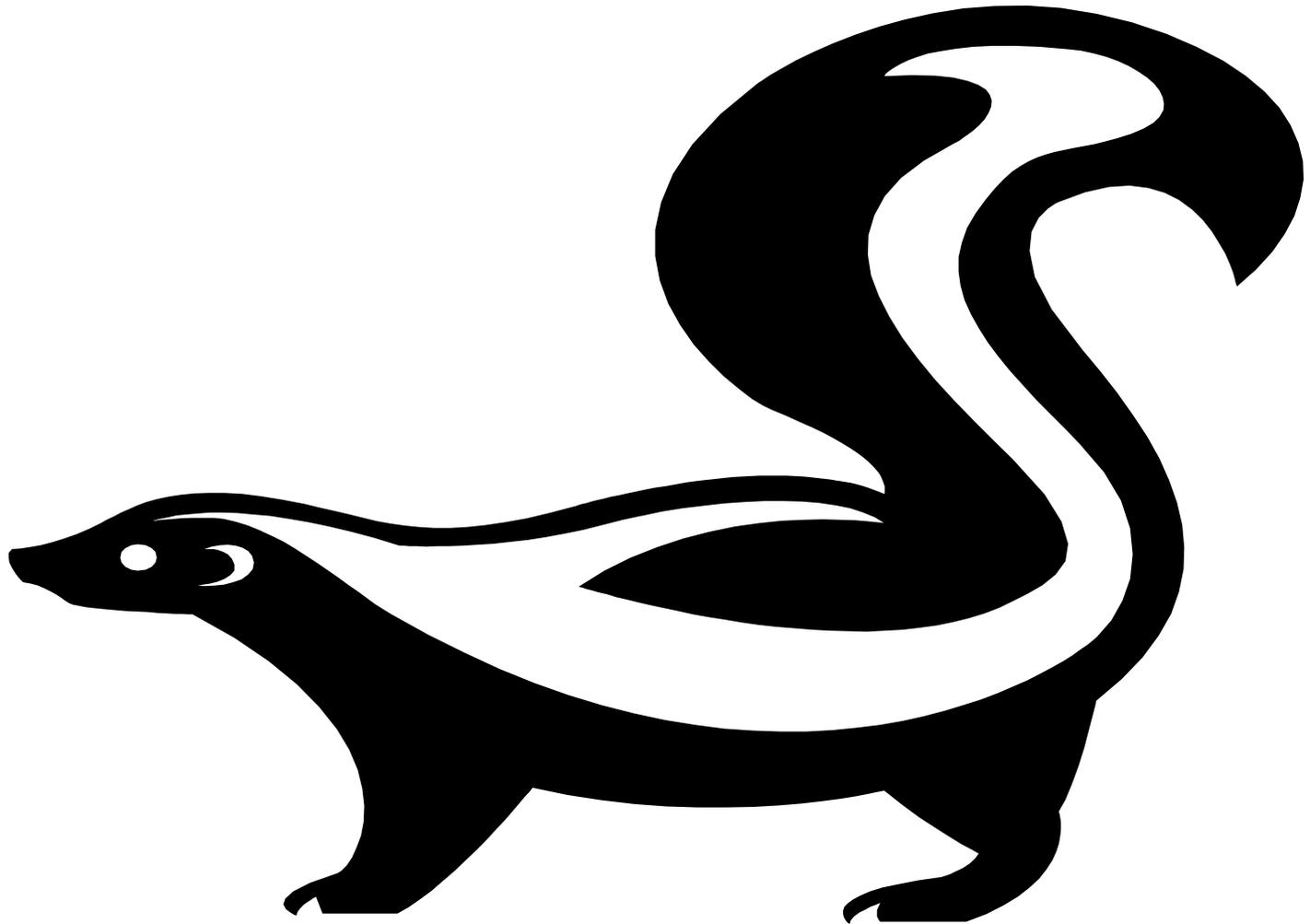
Material	C:N Ratio
Leaves	30-80:1
Sawdust	200-500:1
Straw	40-100:1
Manure	20-60:1
Coffee grounds	20:1
Vegetable wastes	12-20:1
Grass	12-25:1
Wood chips	500-700:1
Seaweed	19:1

Aerobic Decomposition



Oxygen (gasses)

Anaerobic Decomposition



Nutrients

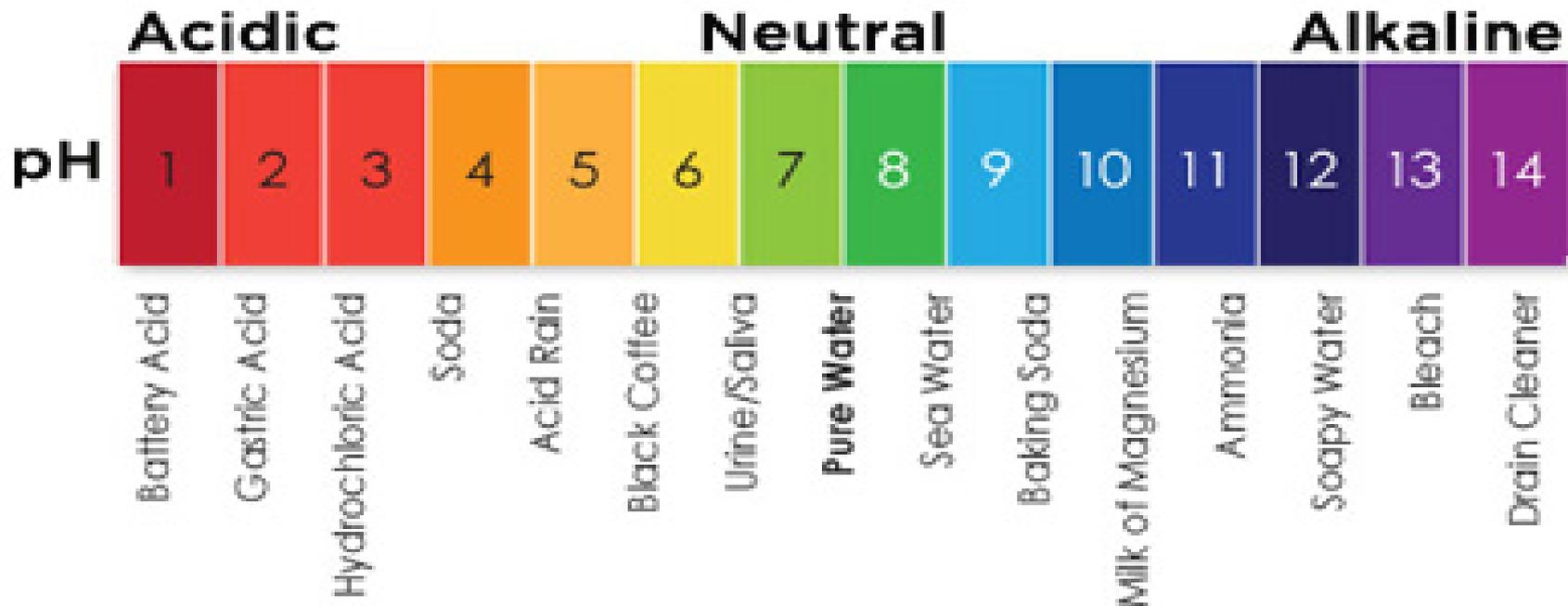
H O P K I N S

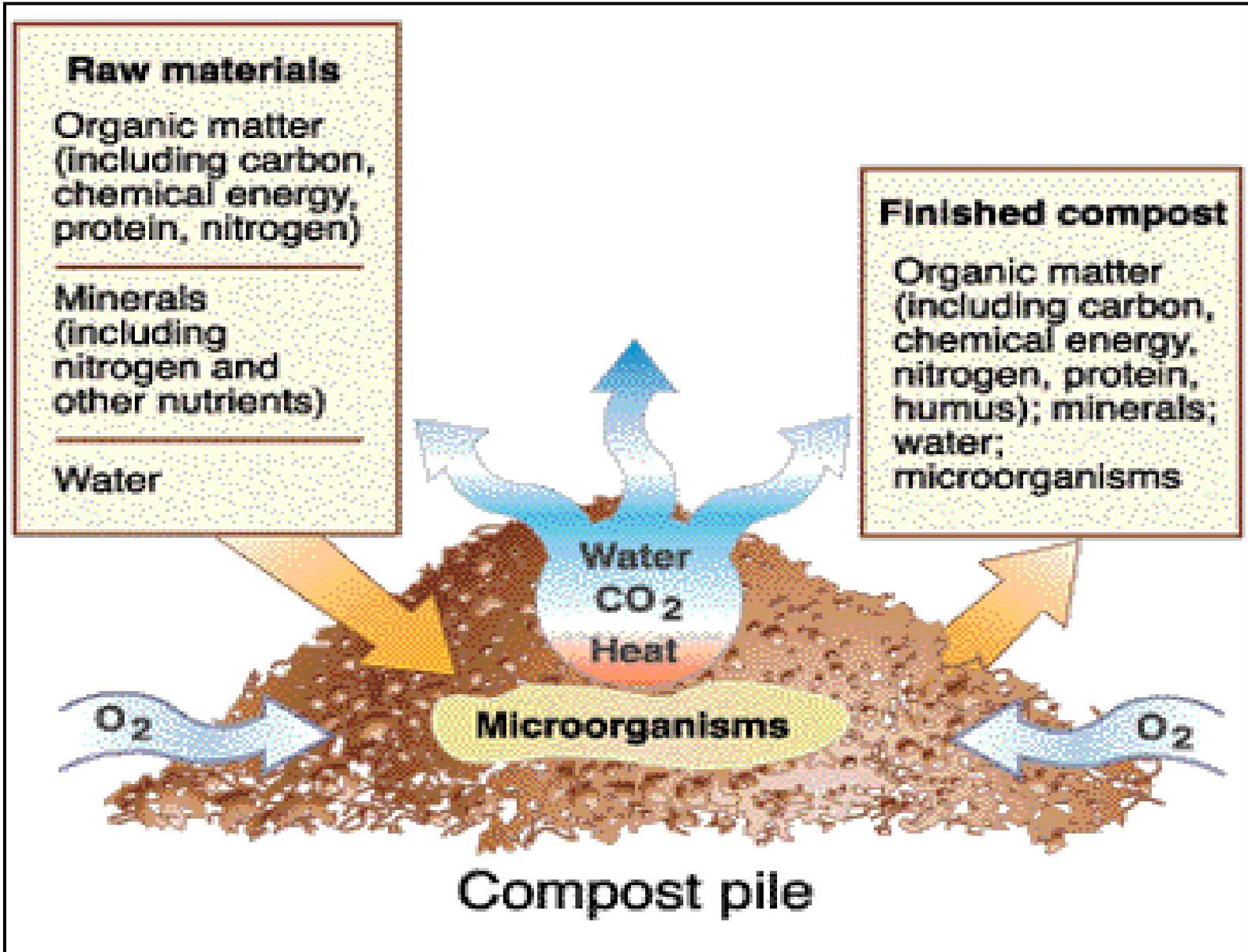
Ca Fe C B Mg Cl Mn

Mo Cu Zn

pH

- pH is the log rhythm of Hydrogen ions
- Log rhythms are by the power of ten
- Each number change on the pH scale then is times 10

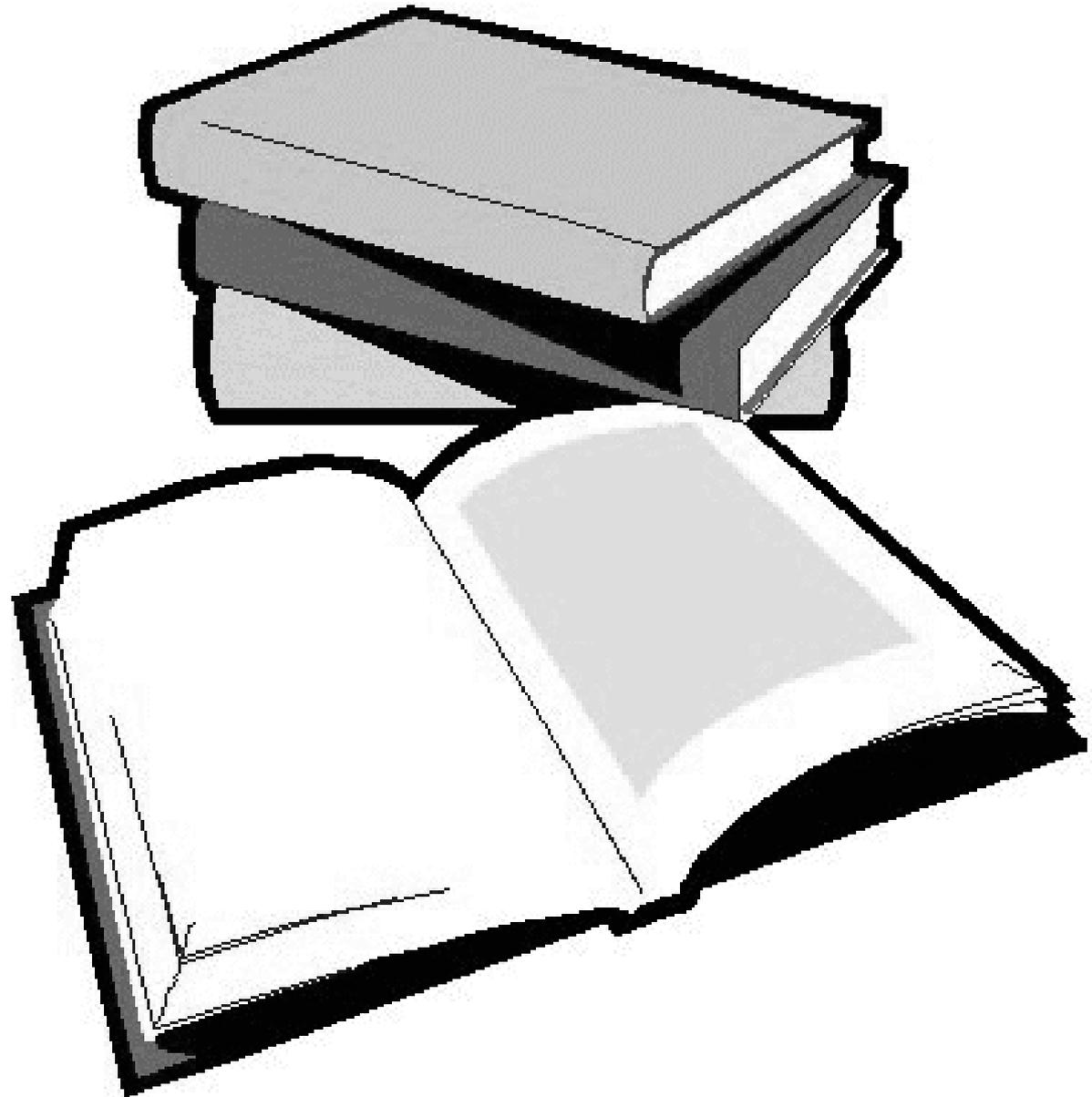




Physical Factors Affecting Composting



Surface Area

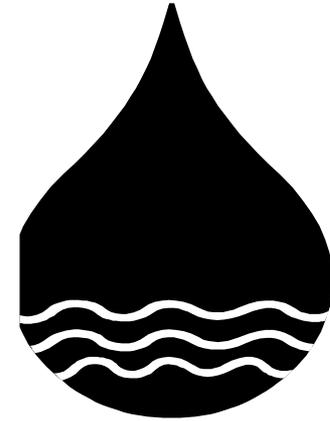




Water

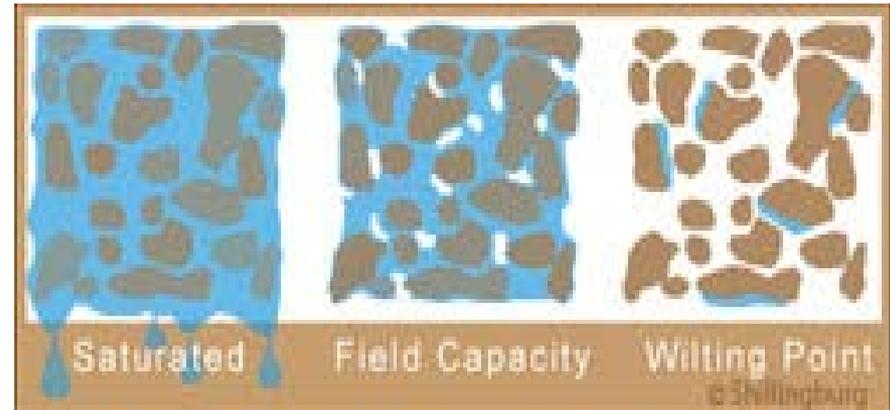
The right balance nourishes
microbial organisms

Target Range: 50-60% by weight



Measuring % Moisture

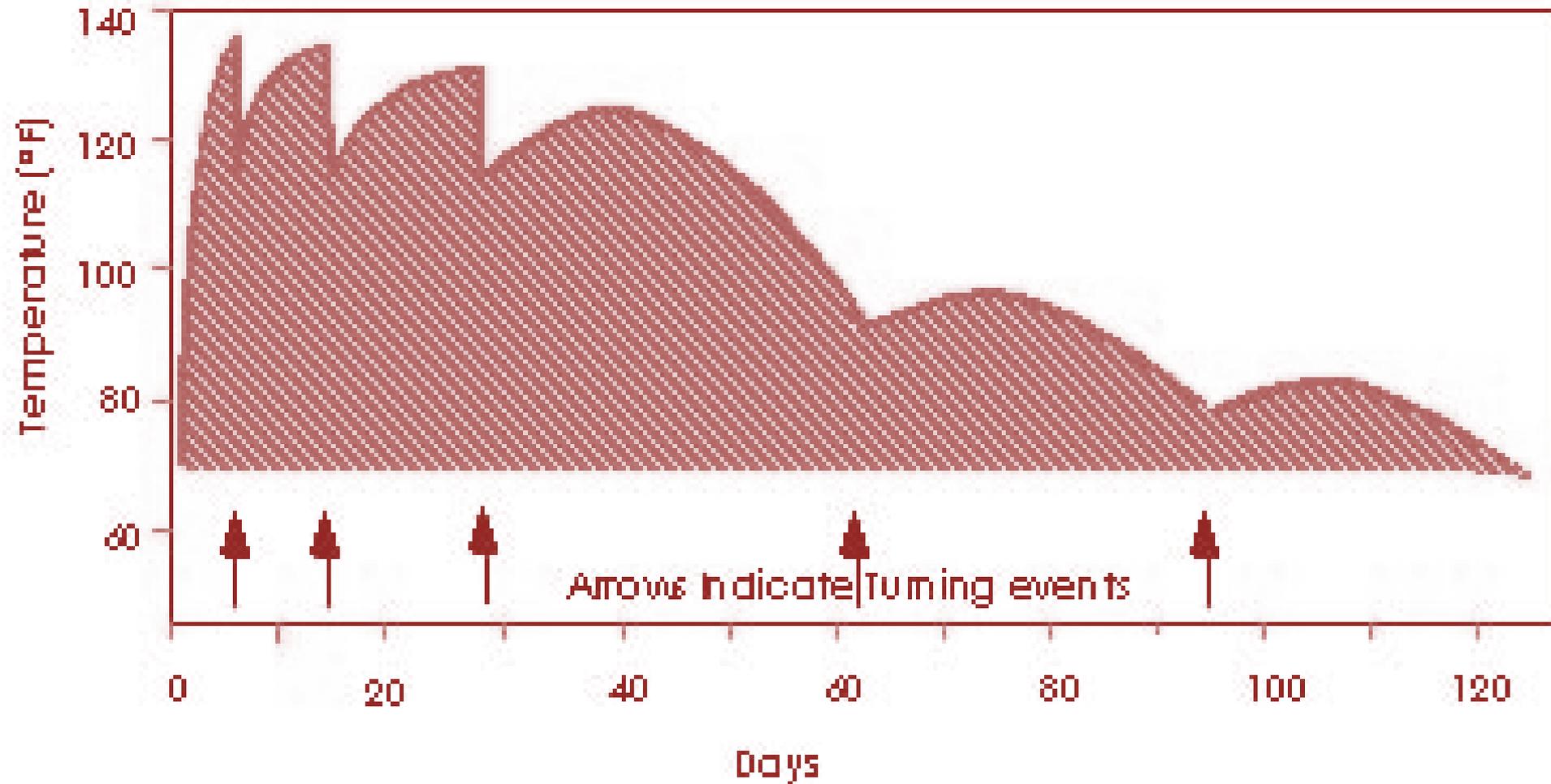
$$\left(\frac{\text{Weight of wet sample} - \text{weight of dry sample}}{\text{Weight of wet sample}} \right) \times 100$$



Temperature: Pop Quiz



Typical Temperature Profile



How Temperatures Affect the Process

Temperature Ranges

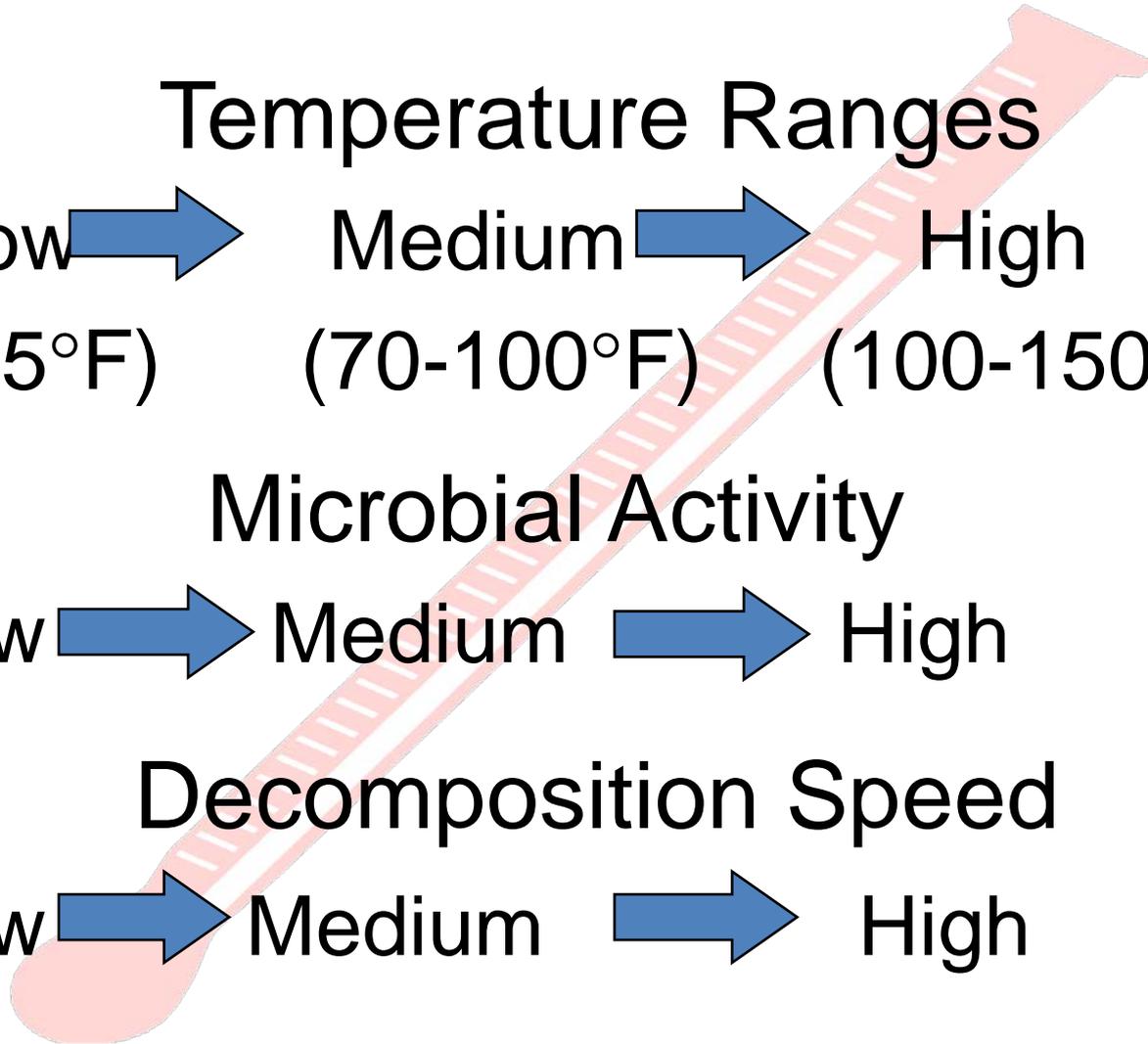
Low → Medium → High
(55°F) (70-100°F) (100-150°F)

Microbial Activity

Low → Medium → High

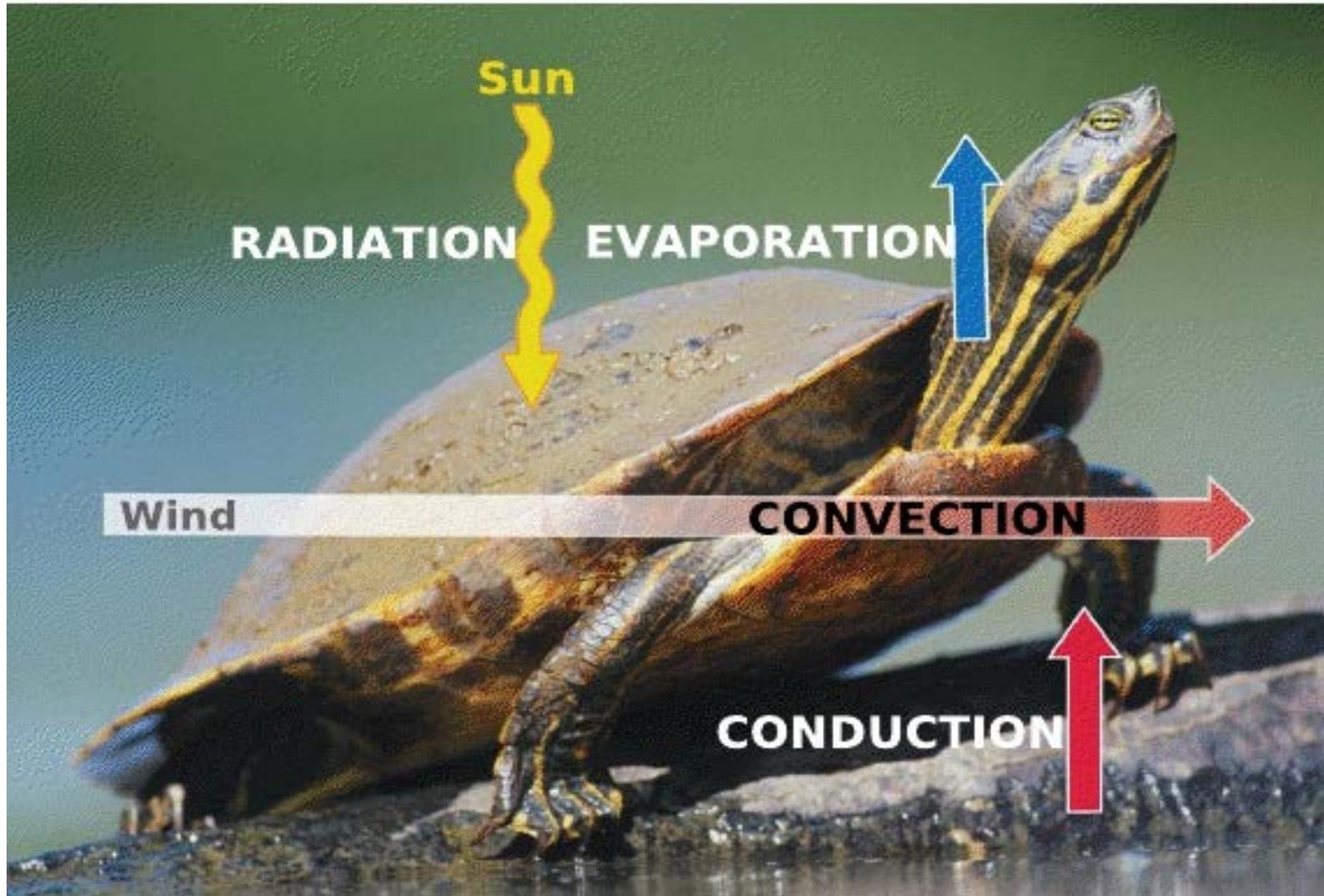
Decomposition Speed

Low → Medium → High





Mechanisms for Heat Loss



Time



C:N ratio, oxygen, moisture, particle size, mixing and temperatures effect the time it takes to reach stable compost

Factors That Affect Composting

- Feed stocks
- C:N Ratio
- Moisture Content
- Organic matter content
- pH
- Porosity, bulk density
- Particle size
- Aeration
- Turning frequency
- Configuration

Bulk density is measured in pounds per cubic yard

For example:

Grass clippings	:	300-400 lbs./cy
Leaves	:	100-300 lbs./cy
Shrub trimmings	:	400-450 lbs./cy
Tree trimmings	:	1000-1300 lbs./cy
Wood chips	:	440-620 lbs./cy
Food	:	1800-2000 lbs./cy



Winter source bulking agent



Odor Problems Occur when . . .



LEADING THE WAY

NEWS ▾ WEATHER ▾ BLITZ5 ULOCAL ▾ ON TV ▾ VIDEO ▾ 1/2 OFF CINCY PRE

Home / Local News



By Tammy Mutasa

Residents angry about smelly situation at former Compost Cincy site

City leaders say with cleanup, smell will get worse before better

Published 8:07 PM EDT Jul 14, 2014

Text Size: A A A



SHOW TRANSCRIPT »

Advertising

tion-at-former-compost-cincy-site/26951372

CINCINNATI — It's a nasty odor that can be smelled for miles.

Principles to Minimize Odors

1. Increase oxygen availability
2. Correct moisture content
3. Adequate bulking agents, porosity, turning
4. Provide adequate C:N ratio of approximately 30:1
5. Adequate drainage on site

When is the compost finished?



Finished Compost Characteristics

- Stable heat and pH levels
- Humification complete
- C:N Ratio is about 10:1
- Lack of odors (smells like fresh soil)
- Seed germination test
- Plant growth
- Consistent odor, bulk density, particle size



END



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