

Appendix: Equipment list

The equipment list provides the material and equipment needed per student, pair, or group.

IS 1: Ecosystem Interactions and Energy

INVESTIGATION 1.1

Creating a model of logistic growth

Per student/pair
Computer
Spreadsheet application e.g. Excel

INVESTIGATIONS 1.2-1.4 (population growth models)

Per student/pair
Computer and online access to Populus software (free)
<https://cbs.umn.edu/populus/overview>

INVESTIGATION 1.5

Exploring biomass pyramids

Per student/pair
Computer and online access to HHMI interactive module
<https://www.biointeractive.org/classroom-resources/exploring-biomass-pyramids>

INVESTIGATION 1.6

Pathways for toxins in food webs

Per group
Tape (for writing on)
Marker pen
Bag of small colored beads
1 x syringe or pipette capable of delivering 0.5 mL
10 x small test tubes
3 x medium test tubes
1 x large test tube
1 x 50 mL beaker
1 x 100 mL beaker
Test tube rack(s)

IS 2: History of the Earth's Atmosphere: Photosynthesis and Respiration

INVESTIGATION 2.1

Carbon dioxide use by *Cabomba*

Per group
1 x 250 mL beaker
4 x test tubes
4 x test tube stoppers
Aluminum foil
1 x straw
100 mL water
3 drops bromothymol blue (BTB)
2 x *Cabomba* sprigs

INVESTIGATION 2.2

Measuring bubble production in *Cabomba*

Per group
1 x boiling tube
1 x boiling tube rack
1 x lamp
1 x 30 cm ruler or measuring tape
1 x timer
1 x glowing splint
1% sodium hydrogen carbonate (NaHCO_3) solution
1 x 7 cm sprig of *Cabomba*

INVESTIGATION 2.3

The iodine test for starch

Per group
2 x test tubes
1 x eye dropper or pasteur pipette
0.01 M Iodine solution
10 mL 1% cornstarch solution
10 mL distilled water

INVESTIGATION 2.4

Testing leaves for starch

Per group
1 x potted plant
Aluminum foil
Heating plate or Bunsen burner
Tripod
Forceps
2 x 250 mL beakers
2 x boiling tubes
2 x petri dishes
2 x white tiles (optional)
1 x eye dropper or plastic pipette
20 mL 90% ethanol
0.01 M Iodine solution

INVESTIGATION 2.5

Measuring respiration in germinating seeds

Per group
3 x boiling tubes
Marker pen
6 x cotton balls
1 x eye dropper or plastic pipette
3 x gauze pieces
Germinated bean seeds (enough to fill one quarter of the boiling tube)
Ungerminated bean seeds (enough to fill one quarter of the boiling tube)
Glass beads (enough to fill one quarter of the boiling tube)
3 x 2-hole tube stoppers
3 x bent glass tubes or pipettes
3 x tubes (must be able to be clamped shut)
3 x screw clips
1 x eye dropper or fine pipette
A few drops of colored liquid
3 x syringes (must fit tube with screw clamp attached)
3 x clamp stands
Water bath
Ruler
Timer
15% KOH solution

INVESTIGATION 2.6

Modeling photosynthesis and respiration

Per student/pair
Scissors

INVESTIGATION 2.7

Designing a wastewater treatment plant

Per group
Scissors or craft knife
7 x 2 L clear soda bottles
Marker pen
Mesh to cover 1 bottle (e.g. onion bag)
2 x rubber bands

1 -2 cotton wool balls
Small piece of netting
500 mL warm tap water
1 teaspoon Rooibos tea leaves
1 teaspoon dried, crushed leaves
1 x stirring rod
1 x shredded empty teabag
1 teaspoon washed small stones/grit
1 teaspoon cooking oil
1 teaspoon sugar
1 teaspoon fine dry sand
2 teaspoons effervescent salts (ENO®)
2 teaspoons bleach

INVESTIGATION 2.8

Use of glucose by *Saccharomyces* yeast

Per group
1 x stirring rod
8 x 1 L beakers
Aeration unit with four tubes
Plastic wrap
Water bath
Glucose test paper strips
14 g dried *Saccharomyces* yeast
40 mL warm water
500 mL glucose solution (100 g/L conc)

INVESTIGATION 2.9

Using M&Ms® to model half lives

Per group
100 M&Ms®
1 x lidded container
1 x plate

INVESTIGATION 2.10

Model of the carbon cycle

Per group
1 x 2 L clear soda bottle with lid
1 scoop aquarium gravel
Several dead leaves
1 x aquatic plant (e.g. *Cabomba*)
3-4 small pond snails
2 L filtered pond water

INVESTIGATION 2.11

Measuring the pH of substances

Per group
Solutions of the following:
- Tap water
- Distilled water
- Milk
- Yoghurt
- Lemon juice
- Vinegar (any kind)
- Black tea
- Green tea
- Cola
- Black coffee
- Baking soda
- Bleach
pH indicator paper (pH 1-14 range)
12 x watch glasses or small beakers
12 x plastic pipettes

INVESTIGATION 2.12**How does dry ice affect pH?**

Per group
 2 x 250 mL conical flasks
 Tongs
 Dry ice
 200 mL tap water
 Universal indicator
 1 M NaOH solution

IS 3: Evidence of Common Ancestry and Diversity**INVESTIGATION 3.1****Using stream trays to model erosion**

Per group
 1 x plastic tray (at least A3 in size) with a water inlet and outlet
 Hose and connectors
 Substrate (gravel, silt, sand, clay)
 Large rocks
 Vegetation

INVESTIGATION 3.2**Surface area and limestone dissolution**

Per group
 3 x 50 mL beakers
 1 x timer/stopwatch
 1 g piece calcium carbonate (CaCO₃)
 1 g CaCO₃ crumbled in rough pieces
 1 g CaCO₃ crushed into fine powder
 1 Mol/L HCl

INVESTIGATION 3.3**Investigating coastal erosion**

Per group
 1 x plastic tray (30 x 40 cm)
 Sand, gravel, or small rocks
 Water

INVESTIGATION 3.4**Investigating coastal defenses**

Per group
 1 x plastic tray (30 x 40 cm)
 Sand, gravel, or small rocks
 Water
 3–6 wooden or plastic blocks

INVESTIGATION 3.5**Phenotypic variation in your class**

No equipment required

INVESTIGATION 3.6**Modeling selection with M&Ms®**

Per group
 1 bag of M&Ms®
 1 x plate or container

INVESTIGATION 3.7**Modeling antibiotic resistance**

Per student/pair
 Computer
 Spreadsheet application e.g. Excel

INVESTIGATION 3.8**Making square world**

Per student/pair
 Scissors
 Tape or paste

INVESTIGATION 3.9**Modeling continental drift**

Per student/pair
 Scissors
 Tape or paste

IS 4: Inheritance of traits**INVESTIGATION 4.1****Making a DNA model**

Per student/pair
 Scissors
 Tape or paste

INVESTIGATION 4.2**Modeling meiosis using Popsicle sticks**

Per pair
 8 x Popsicle sticks
 8 x sticky dots
 Colored pencils or markers
 Marker pen

INVESTIGATION 4.3**Achoo syndrome**

Per class
 Bright lamp

IS 5: Structure, Function, and Growth**INVESTIGATION 5.1****Forearm movements**

No equipment required

INVESTIGATION 5.2a–5.2b**Gas exchange system model**

Per student/pair
 1 x 500 mL plastic bottle
 Utility or craft knife
 2 x rubber bands
 6 x balloons
 1 x flexible rubber tubing
 1 x Y-connector
 1 x stopper or bottle lid with hole

INVESTIGATION 5.3**Protein denaturation**

Per group
 2 x 250 mL beaker
 Heating plate or Bunsen burner
 Tripod
 1 x stirring rod
 2 x fresh eggs
 100 mL water
 100 mL isopropyl alcohol

INVESTIGATION 5.4**Modeling protein structure**

Per student/pair/group
 Pipe cleaners (2 white, 2 pink, 2 purple, 4 blue)
 Sticky tape
 2 x binder clips or paper clips

INVESTIGATION 5.5**Effect of temperature on enzyme activity**

Per group/temperature
 1 x spotting plate/reaction plate 1 x test tube
 1 x plastic pipette
 Water bath
 Timer
 0.1 M iodine solution (I₂KI)
 2 mL 1% amylase solution
 1 mL buffer solution (pH 7.0)
 1 mL 1% starch solution

INVESTIGATION 5.6**Modeling mitosis**

Per student/pair
 4 x pipe-cleaners (2 colors) cut in half

Yarn

A3 sheet of paper

Marker

INVESTIGATION 5.7a**Changes in heart and breathing rates**

Per pair
 Timer

INVESTIGATION 5.7b**Evaluating the effect of exercise on heart rate**

No equipment needed

INVESTIGATION 5.8**Modeling the effect of insulation**

Per pair/group/test material
 2 x 250 mL beakers
 2 x 100 mL beakers
 2 x thermometers
 2 x larger containers (to fit beakers)
 Insulating material (fat/lard, feathers, wool, cotton balls)
 Weights or tape (optional)
 Timer
 2 x 100 mL warm tap water (~45°C)
 Iced water

INVESTIGATION 5.9**Body shape and temperature gain/loss**

Per group
 Aluminum foil
 Scissors
 Thermometer
 Heat lamp

IS 6: Ecosystem Stability and the Response to Climate Change**INVESTIGATION 6.1****Factors influencing atmospheric temperature**

Per pair/group
 3 x small soda cans
 3 x thermometers
 2 x ziplock bags
 Heat lamp (optional)
 150 mL tap water
 2 x Alka-Seltzer tablets

INVESTIGATION 6.2**Albedo and ice sheet melting**

Per pair/group
 2 x Florence or Erlenmeyer flasks
 Black paint
 Aluminum foil
 Ice cubes
 2 x thermometers
 60W tungsten lamp (optional)
 Timer

INVESTIGATION 6.3**Effect of temperature on *Vibrio* doubling time**

Per student
 Computer
 Spreadsheet application e.g. Excel