**Unit Essential Question:** *How does energy and matter flow within natural and designed ecosystems?*

**Overall Unit – All Tasks**

* Unit 3, Task Cards Student Version, Lift-Off and Tasks 1 through 5
* Culminating Project Student Task Card
* Project Organizer
* Projector with Audio (for video or images, whenever needed)

**Lift-Off Task (2 days)**

Per Student

* Task Card Student Version: Lift-Off
* Optional: Printed sets of River Environment Images
* Post-Its (Optional)
* Task Card Student Version: Culminating Project
* Project Organizer

Per Group

* Poster paper and markers

Whole Class

* Poster paper and markers
* Optional: Projector to project River Environment Images
* \*See Instructions in Lift-Off for other optional materials to use for the class concept map

**Task 1 (3 Days)**

Per Student

* Task Card Student Version: Task 1
* Project Organizer

**Task 2 (4 Days)**

Per Student

* Task Card Student Version: Task 2
* Project Organizer
* Optional: “The Science Behind It” Resource Card

Per Group

* Balancing scale or 2 normal scales
* Atom “Pieces”: These can be a modeling kit, unifix cubes, colored beads, legos, jelly beans, or any materials available in three colors
  + 6 for Carbon
  + 12 for Hydrogen
  + 18 for Oxygen
* Colored pencils or crayons

Whole Class

* Candle
* Match or lighter
* Large Clear Jar

**Task 3 (4.5 Days)**

Per Student

* Task Card Student Version: Task 3
* Project Organizer

Per Group

* Small Beaker 1/3 filled with Bromothyml Blue Solution
* Straw
* Investigation Card in sheet protectors for each table group
* 2 Test Tubes or Baby Food Jars
  + If using Test tubes, need test tube racks
* Small Graduated Cylinder (to retrieve BTB solution from teacher)
* 1-2 Sprigs Elodea Plant (available at most local aquariums)
* Straw
* Masking Tape
* Optional: If students actually want to run the experiment described, follow the same instructions as the other jars, except add a sea snail or small fish. Be sure to use distilled water or the snail/fish will likely die before data can be collected.

Whole Class

* Empty Oatmeal Containers or Large Cardboard Box (For dark environment)
* 2 Sun Lamps
* Bromothyol blue solution
  + 1 g bromothymol blue
  + 1 L distilled water
  + 18 drops of 1M sodium hydroxide (Optional: makes it more blue)

**Task 4 (4.5 Days)**

Per Student

* Task Card Student Version: Task 4
* Project Organizer

Per Pair

* Critique, Correct, Clarify – Rock Cycle Model

Per Group

* Modeling the Rock Cycle with Crayons Card (in a sheet protector)
* Crayons (at least two different colors)
* Source of very hot water in container
* Tweezers or small tongs
* Aluminum foil square
* Plastic knives
* Optional: Bring in real rocks as examples of the different types of rocks in the rock cycle

**Task 5 (5.5 – 6.5 Days)**

Per Student

* Task Card Student Version: Task 5
* Project Organizer

Per Group

* Thermal Chemical Reactions Investigation Card (in sheet protector)
* Calcium chlo**r**ide (used to melt ice on d**r**i**v**eways in winte**r**)
* Potassium chlo**r**ide (e.g., Mo**r**ton **L**ite**™**)
* Sodium bica**r**bonate (baking soda)
* Vinegar
* 10 sandwich**-**size zip**-**lock bags (thick and thin options)
* Tablespoon measu**r**ing spoons
* 100 ml graduated cylinder
* 2 500 ml beakers
* Water (Cold and Warm)
* Ice
* Sharpie
* 2 Thermometers
* Additional material choices for building and modification of prototypes (ie. plastic wrap, foil, tape, cloth, felt, containers of different materials and sizes)

**Culminating Project (7 days)**

Per Group: Option A, Aquaponics System

\*Because it is very expensive to provide materials for every group to make a true aquaponics system, students will use a combination of recycled and household materials to make a cheaper version.

* 2 large soda bottles
* String (acts as “water pump” to bring water from fish tank up to soil)
* Gravel
* Growing medium (pea gravel, perlite, peat moss, etc)
* De-chlorinated water
* Fish
* Plants
* Other organisms (based on student choice)
* Scissors
* Electrical Tape
* Materials from Task 5 for heating devices (See Task 5 section above)

Per Class: Option B, Aquaponics System

\*You may choose to gather these materials on your own or purchase an aquaponics “kit,” available online or large hardware stores. Search for aquaponics system building instructions online for more details.

* Glass or plastic tank for the fish (3-20 gallon recommended)
* Gravel (2.5 lbs per 5 gallons of water in fish tank)
* Small circulation or fountain water pump (3-4 watt) to pump water from fish tank to grow bed
* Grow bed (must be able to sit on top of fish tank, 3-8 inches deep, with holes to drain into fish tank)
* Growing medium (pea gravel, perlite, peat moss, etc)
* Aquarium air pump
* De-chlorinated water
* Fish
* Plants
* Other organisms (based on student choice)
* Optional:
  + Plastic tubing
  + Supports for grow bed, if necessary
* Scissors
* Electrical Tape
* Drill
* Materials from Task 5 for heating devices (See Task 5 section above)

Per Student: Aquaponics System Instruction Manuel

* Optional: Instruction Manual Template
* Computer with word processing OR
* Blank computer paper and colored pencils/markers for final draft

**Unit 3 Pop-Out (3.5 days)**

Per Student

* Student Version: Unit 3 Pop-Out

Per Group

* Series of 16 checks in an envelope – 2 options available in Resource provided