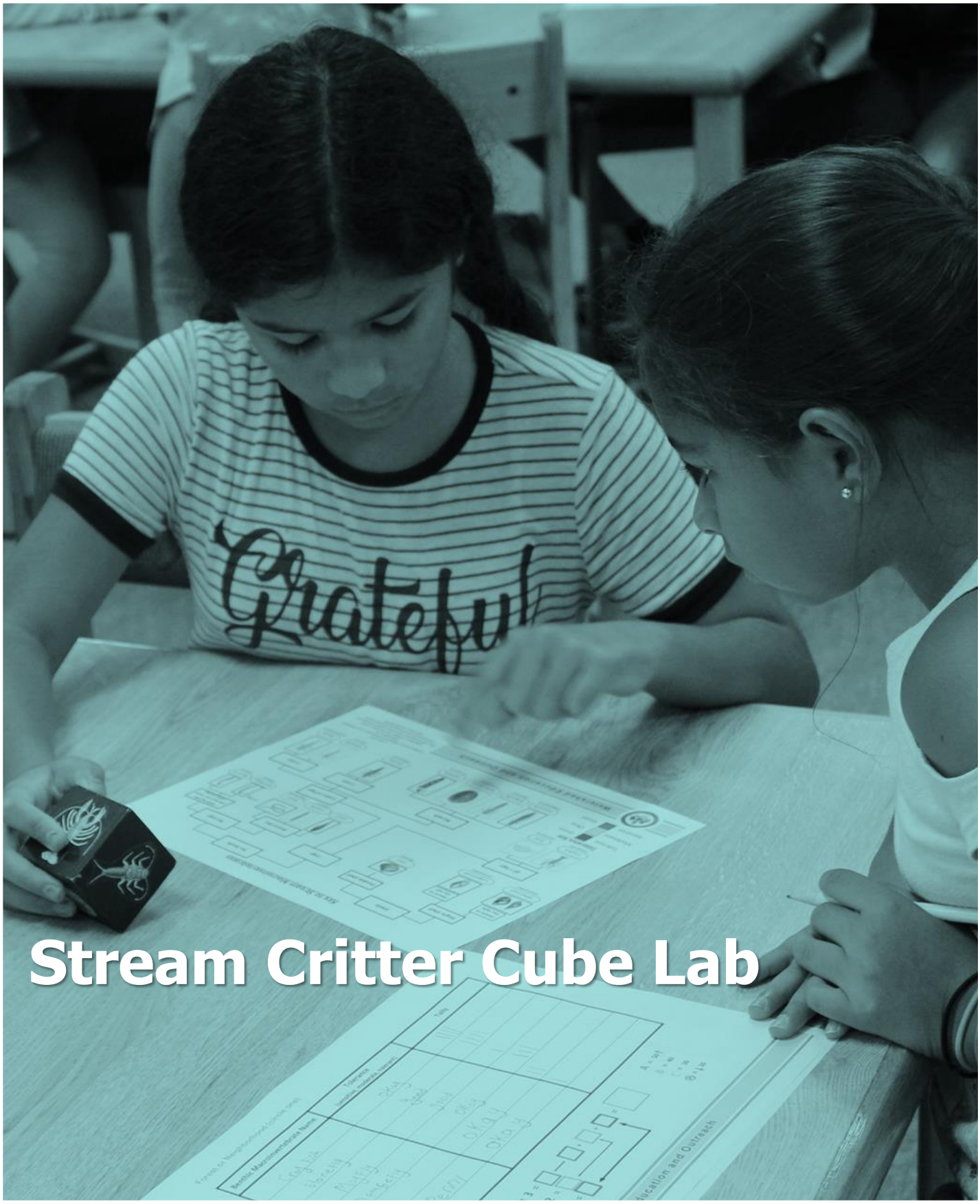

Stream Critter Cube Lab

Department of Public Works and Environmental Services

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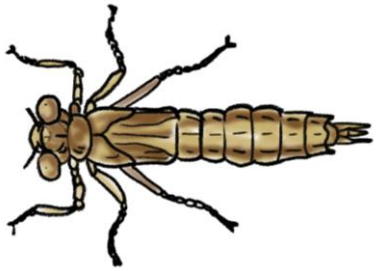
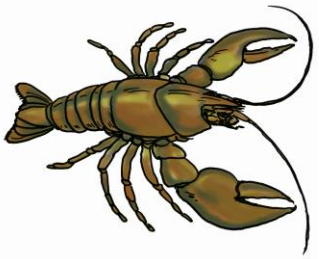



Stream Critter Cube Lab

THIS LAB WILL:

- Explain how scientists use benthic macroinvertebrates to determine stream health.
- Provide you with the templates to make your very own stream critter cubes to "sample" streams from your home!
- Teach you how to "grade" streams based on which benthic macroinvertebrate you find.

EXPAND YOUR LEARNING

Want to build off this lab with other lessons? Some related topics you might want to cover include:

- Life cycles
- Habitats and Ecosystems
- Watersheds
- Properties of Water

The following **Virginia Standards of Learning** can be covered all or in part using this lab or connect to related topics that can be covered in concurrent or follow-up lessons:

Kindergarten: K.1, K.4, K.6, K.7, K.10, K.11
1st Grade: 1.1, 1.5, 1.8 || 2nd Grade: 2.1, 2.4, 2.5, 2.8
3rd Grade: 3.1, 3.5, 3.7, 3.8 || 4th Grade: 4.1, 4.3, 4.8
5th Grade: 5.1, 5.8 || 6th Grade: 6.1, 6.6, 6.8, 6.9

More information about the Virginia Science Standards of Leaning can be found on the Virginia Department of Education website at doe.virginia.gov

Let's Learn About Benthics!

WHAT IS A BENTHIC MACROINVERTEBRATE?

Have you heard the term "**benthic macroinvertebrate**" before? Big word, right? So, let's break it down.

- **Benthic** means lives on the bottom of a stream.
- **Macro**, the opposite of micro, means you can see it with your eyes (no microscope needed).
- **Invertebrate** means no backbone. Like a worm, clam, dragonfly, or crayfish.

We call them ***benthics*** for short. Many aquatic benthics that we are going to discuss in this lab are the nymph or larvae stage (the stage after the egg but before the adult) of common adult insects we see flying around in the summer. For example, all dragonflies start their life off underwater before emerging as winged adults.

Stonefly larvae (above) are sensitive benthics and are only found in clean, healthy streams. Dragonfly larvae (below) are moderately tolerant and are found in most streams as long as they are not really dirty.

WHY DO WE CARE ABOUT BENTHICS?

Different benthics can tolerate, or handle, different levels of pollution. Some are very **tolerant**, others are more **sensitive**, and some are in the middle or **moderately tolerant**. Sensitive benthics can tolerate very little pollution in the water. Therefore, we find them in places where the water is healthy and clean. Tolerant benthics can be found in ALL types of water quality, but we find them more frequently in streams that are not so healthy because the water is too dirty for sensitive benthics to live in. Moderate benthics can tolerate some pollution, but not a lot.

Over the years, scientists have identified which benthics are tolerant, which are moderately tolerant, and which are sensitive. With this information, we can determine the health of a stream by which benthics live there!

Let's Learn About Benthics!

HOW DO WE FIND WHAT LIVES IN OUR STREAMS?

Great question! When scientists need to find out which benthics live in a stream, we use a net called a **D-net** to sample different **habitats** throughout the stream. A habitat is an area that is the natural home for an animal, plant or other organism. Some benthics like fast riffles (think small rapids you see in whitewater rivers), while other benthics like slow pools. We try to sample as many different habitats in a stream as possible to make sure we get all the different benthics living in that stream.

After we have collected benthics from the stream, we put everything into a pan and take out the big leaves, sticks, and rocks to see who we've collected

HOW DO WE FIGURE OUT WHO LIVES IN OUR STREAMS?

Even though we can all see benthics with our eyes, identifying exactly which species we have requires scientists to look at really specific parts of each critter. When scientists identify critters, they use a tool called a **dichotomous key.** A dichotomous key consists of choices that lead the scientist to the correct species they are trying to identify. For benthics, scientists follow a decision-tree of physical features, where they choose whether the critter has a shell, how many legs it has, or how many tails it has, etc. Because of this, we have to take our collected benthics to a lab and use a **microscope** to properly identify them.

Let's Learn About Benthics!

Once we've identified all the benthics, we can "grade" our stream! Each stream is graded based on how many benthics we find and who we find. Remember that each type of benthic has a different tolerance level to pollution. Generally, if we find a lot of sensitive benthics (and tolerant benthics too!), this means we have a healthier stream. If we find only a few benthics and/or only tolerant benthics, then we know that we have a less healthy, more polluted stream.

BIOLOGICAL CLASSIFICATION

Every organism on earth has been classified down to its species. A **species** is defined as a group of organisms that can interbreed and produce fertile offspring in nature.

While scientists normally classify their benthics down to the species level, we are only going to go down to the order level for this lab.

It may be hard to remember the order for biological classification. Try taking the first letter of each group (**KPCOFGS**) and make up a fun saying to help you remember. For example: "**K**ids **P**refer **C**hocolate **O**ver **F**unky **G**reen **S**paghetti." Try it!

Kingdom

Phylum

Class

Order

Family

Genus

Species

How to Run the Lab

LAB TIME!

Now that you know *why* we look at benthics and *how* we look at benthics, it's your turn to grade the streams! For this lab we are only using common names and generally going down to the Order level of biological classification.

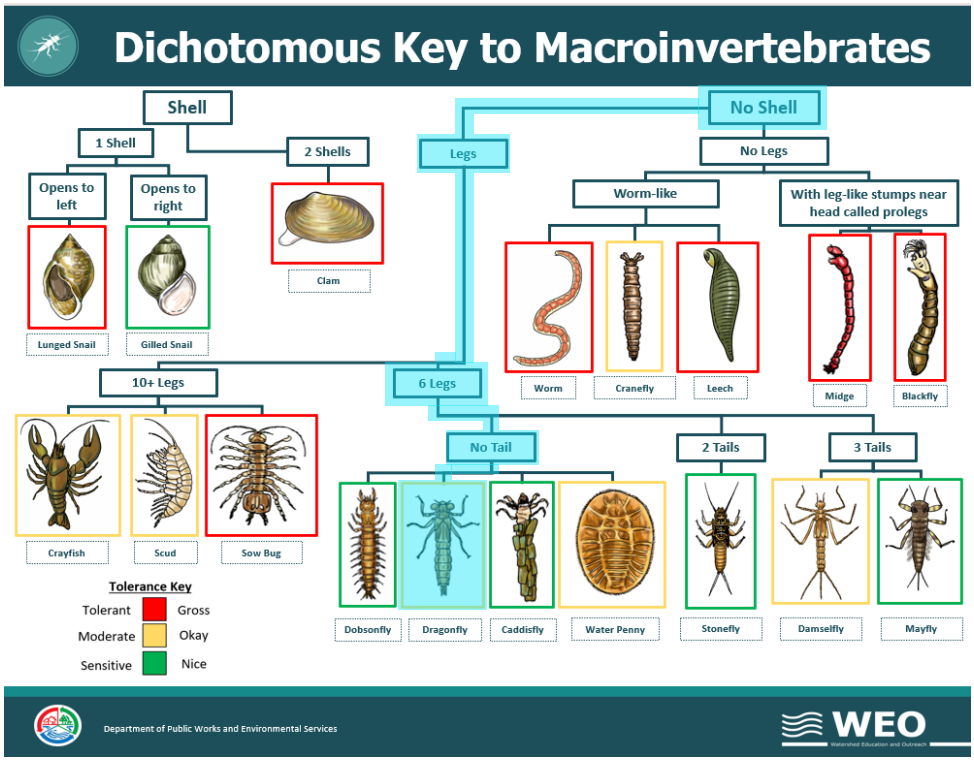
This lab uses "stream critter cubes" to represent a sample of benthics you might find in different streams. Attached to this document are six different critter cubes: A-F. Each stream has six types of critters in it.

STEPS:

1. Put together a critter cube using the attached directions.

2. Roll your critter cube. The critter on the top side of the cube represents a single benthic you "collected" in your stream.

3. Pull out your **dichotomous key** (see attached document) to help you identify what critter the benthic you "collected" is and how tolerant it is.



The image to the left is an example of how you would use the **dichotomous key** to identify what critter you rolled. If you rolled the benthic highlighted in blue, you would start at "no shell," select "legs," "6 legs," and then "no tail." Then you would use the pictures to make your final ID!

How to Run the Lab

STEPS (CONTINUED):

4. After identifying the critter, record its name and tolerance level (sensitive, moderate, tolerant), and add a tally to keep track of the number of times you rolled that same critter on the attached **data sheet**.

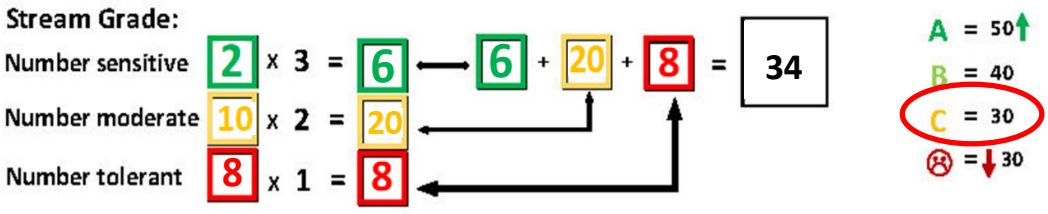
5. Repeat Steps 2-4 until you've rolled your cube a total of 20 times.

Benthic Macroinvertebrate Name	Tolerance (sensitive, moderate, tolerant)	Tally
Dragonfly	Moderate	III
Damselfly	Moderate	IIII
Clam	Tolerant	II
Black Fly	Tolerant	~~IIII~~ I
Crayfish	Moderate	III
Gilled Snail	Sensitive	II

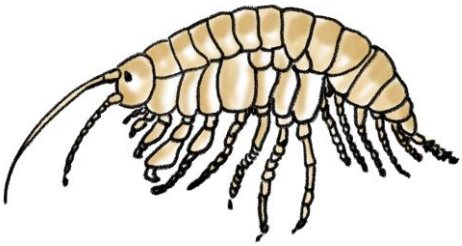
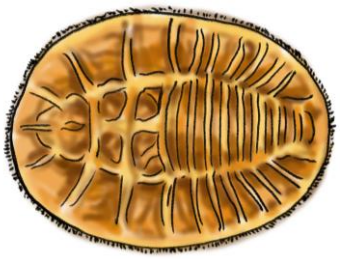
Stream Grade:
Number sensitive ☐ x 3 = ☐ — ☐ + ☐ + ☐ = ☐
Number moderate ☐ x 2 = ☐
Number tolerant ☐ x 1 = ☐

A = 50↑
B = 40
C = 30
☹ = ↓30

6. Next, you can fill in and solve the equations on the bottom of the worksheet to calculate your **stream's grade.**



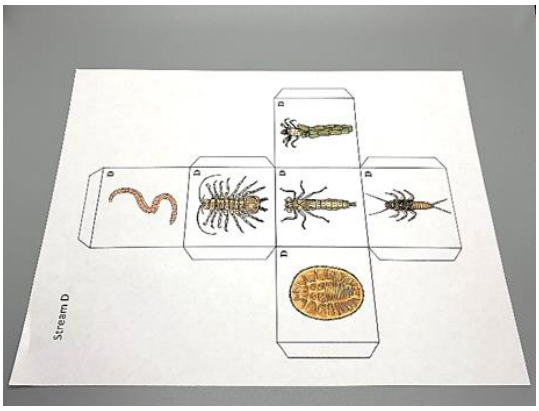
7. Lastly, students will use their results to give their stream a "grade" based on the provided scale. Scientists call this grade the **Index of Biotic Integrity**. The grade tells us how healthy or unhealthy our stream is. A higher number means a healthier stream! A lower number means a dirtier, more polluted stream. How healthy is your stream? Check your answer by looking at the key at the end of this document!

How to Make a Critter Cube

Step 1. Print out your cube template.

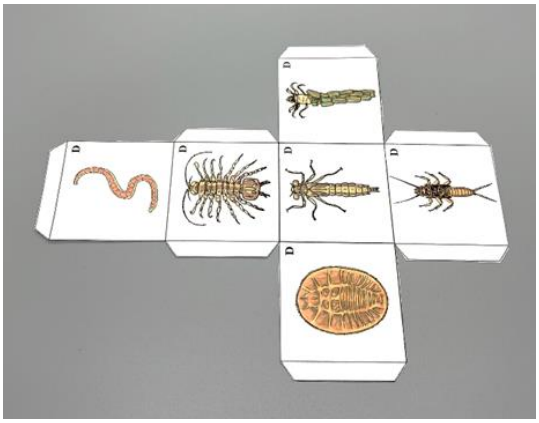
You can print out as many or as few cube templates as you want (just make sure to only print on one side of the paper). There are six total cube templates to choose from and each has a different combination of critters.



Step 2. Cut out your cube template.

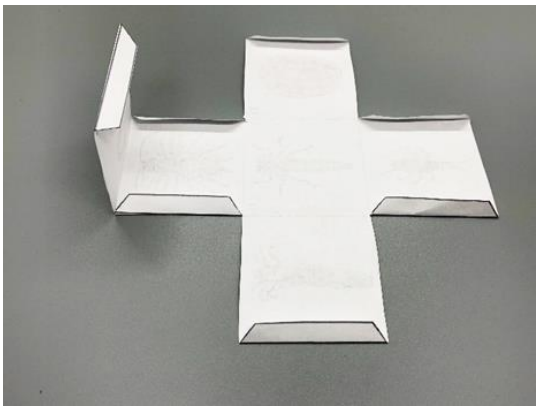
Using a pair of scissors, cut along the outside lines of your template, including the flaps. Don't cut along the lines that divide the boxes from one another, or the lines between the flaps and the boxes.

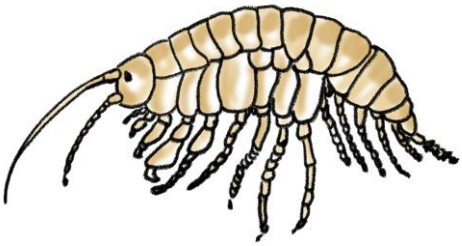
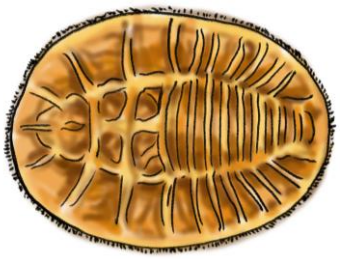
If you mess up, you can tape the template back together or print out a new one. When you're done, your cube should look like the picture to the right.



Step 3. Fold along the lines of your template.

Start by folding each flap inward along the lines that separates it from the square it's connected to. Then, fold the template along the lines separating the squares.

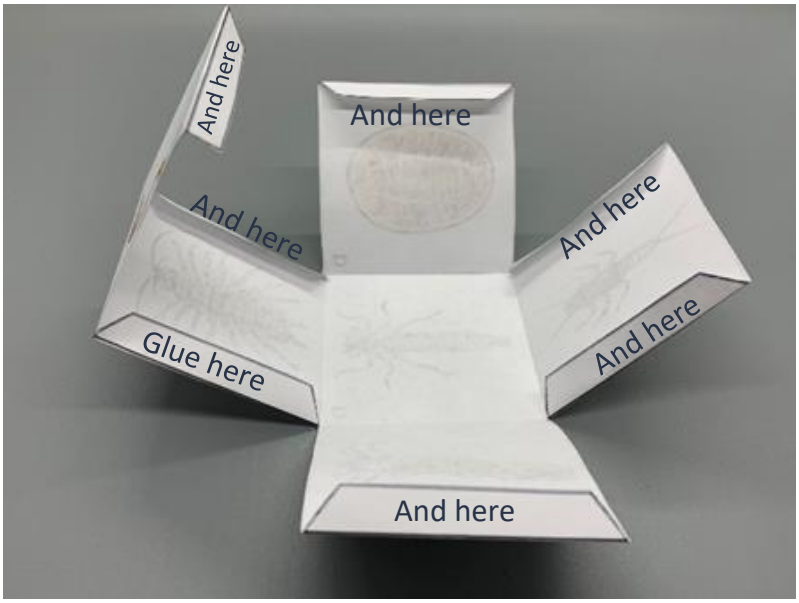


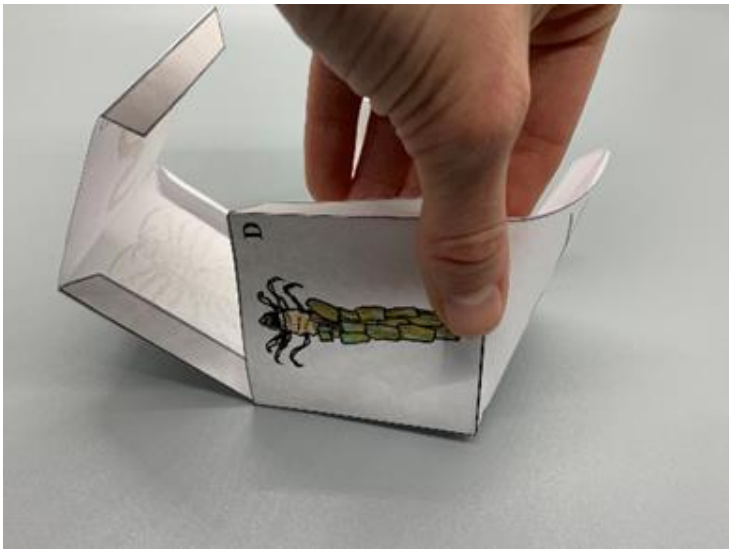




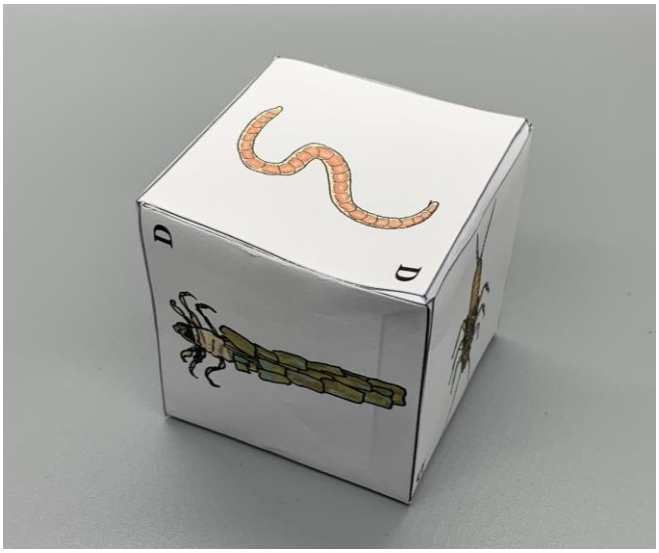
How to Make a Critter Cube

Step 4. Now it's time to glue (or tape, whichever you prefer)!

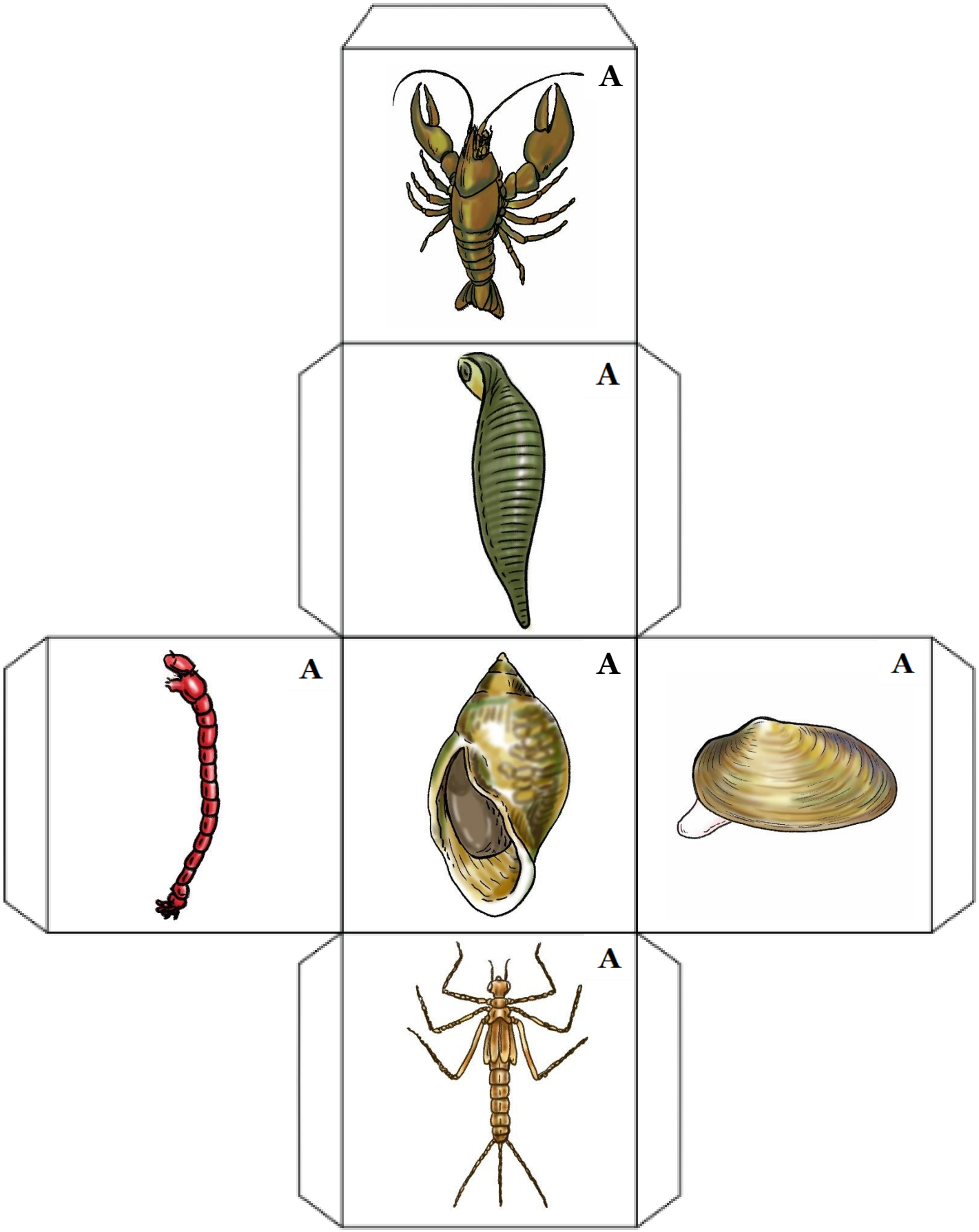
If you're gluing, place glue on one of the flaps and hold it tightly against the corresponding square for a few seconds. Continue doing this with all of your flaps. And, presto, you've made your very own Critter Cube ! Well done!







Stream A



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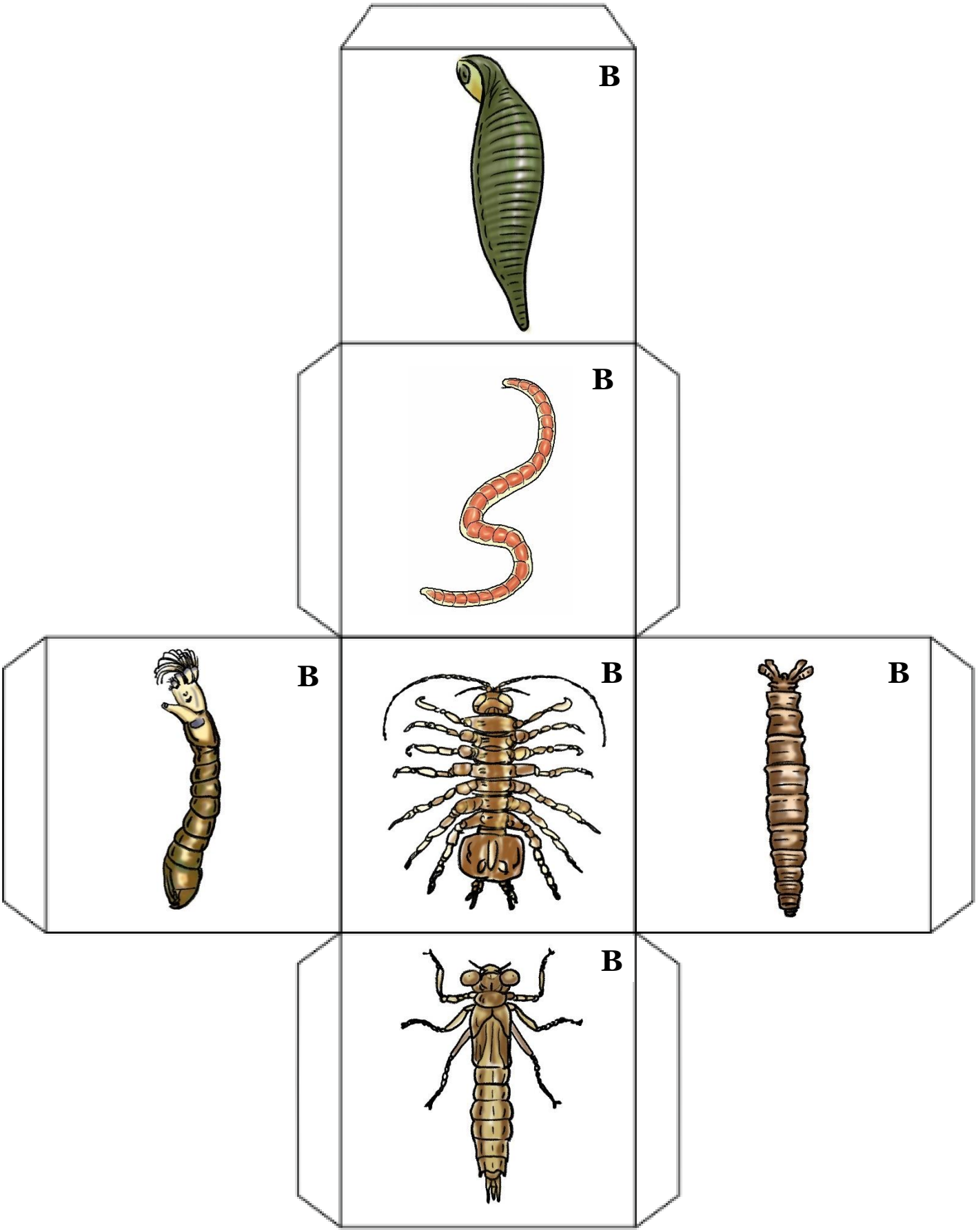
Stream B



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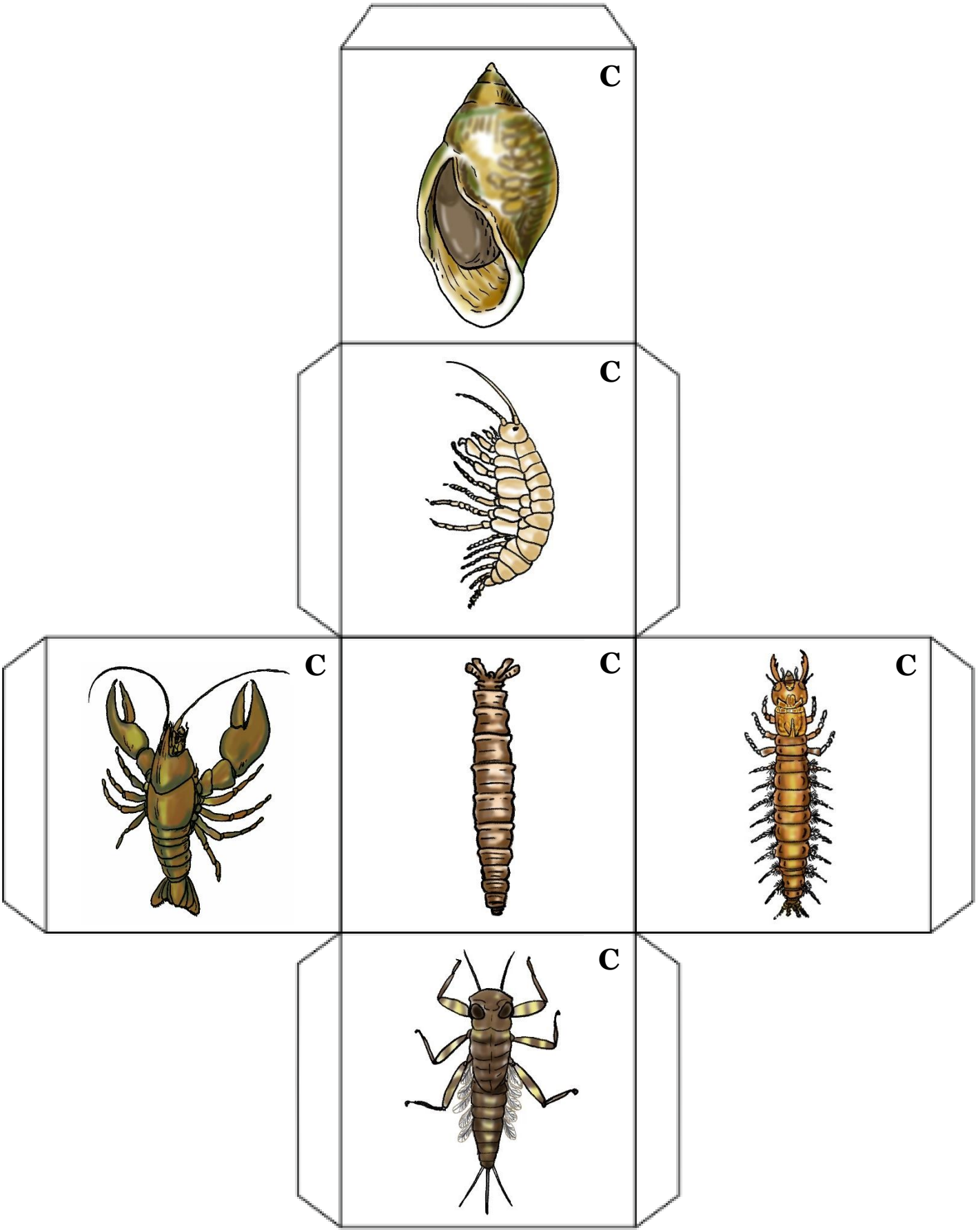
Stream C



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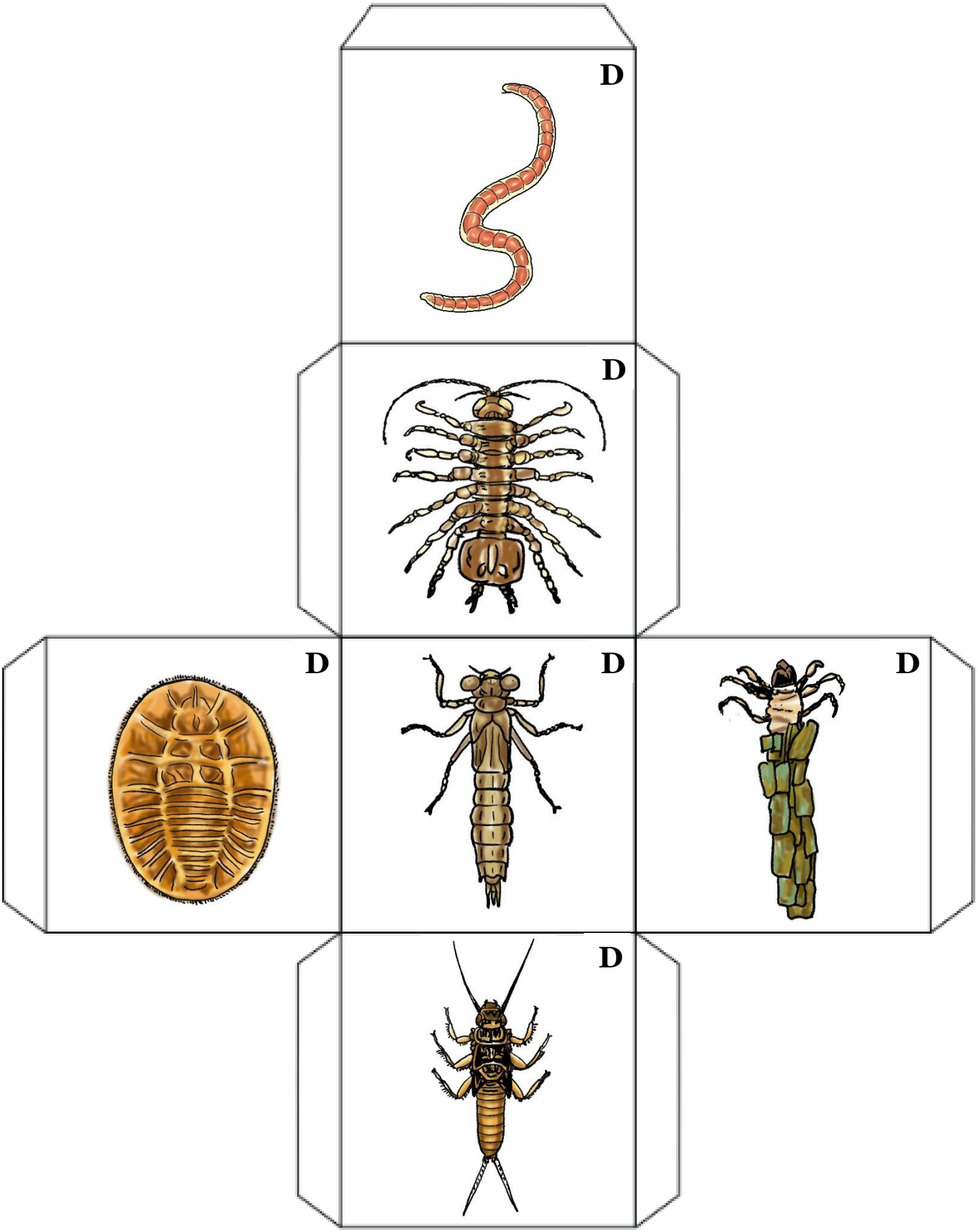
Stream D



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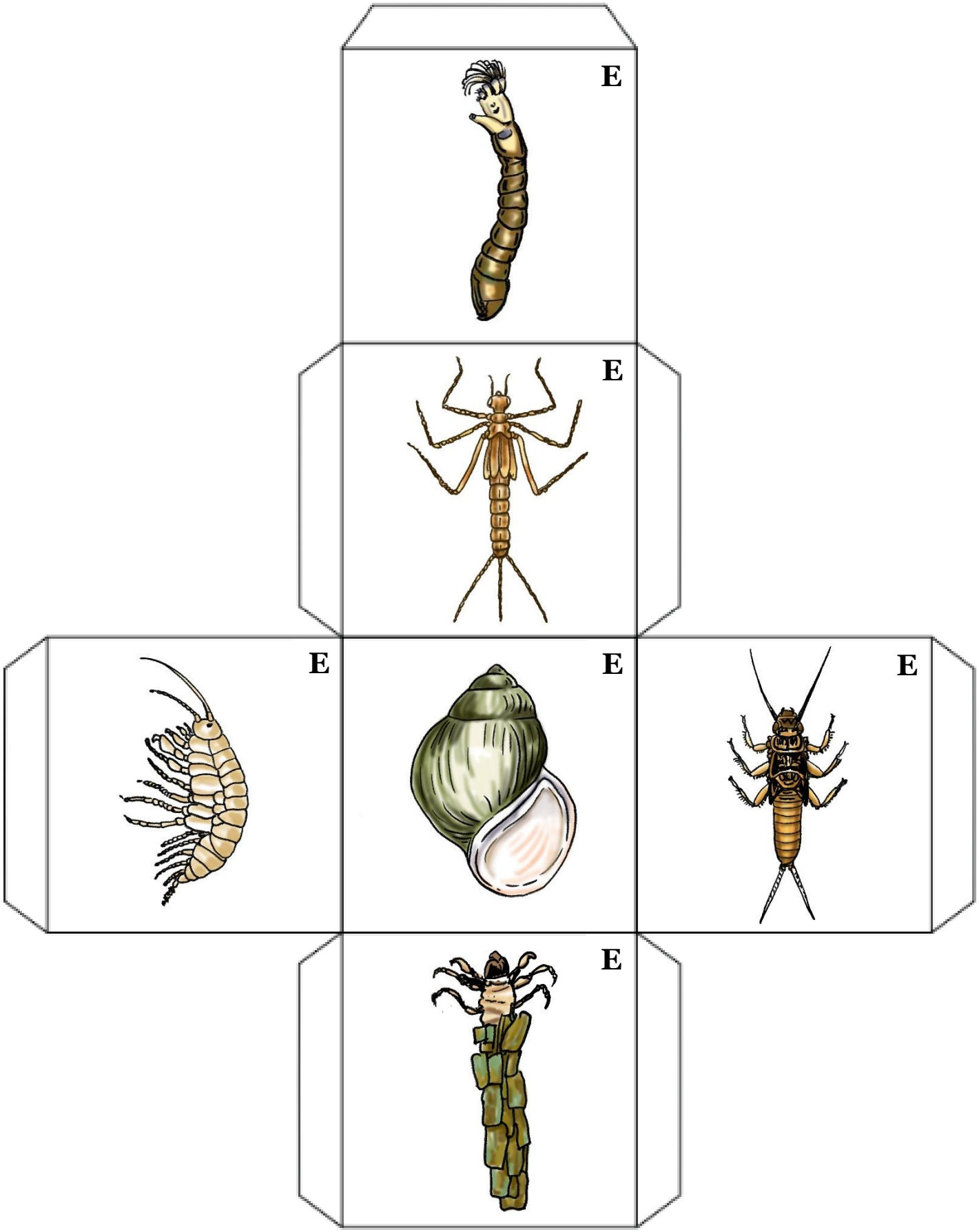
Stream E



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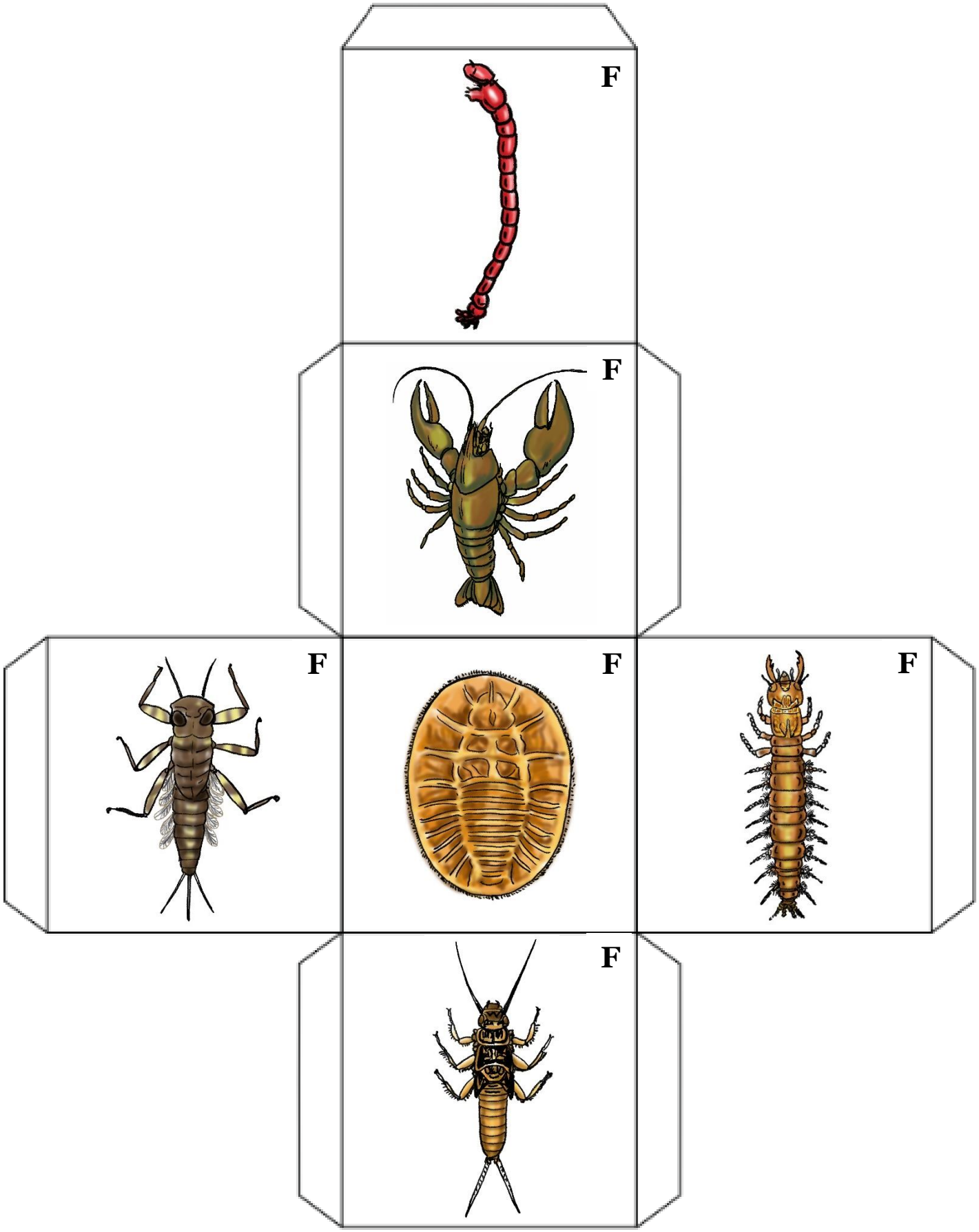
Stream F



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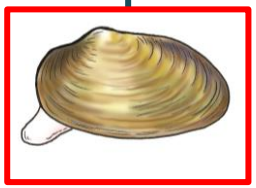
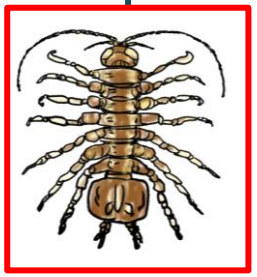
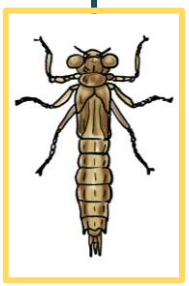
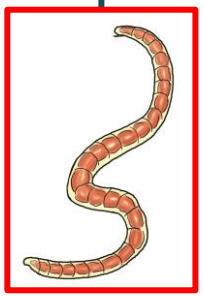
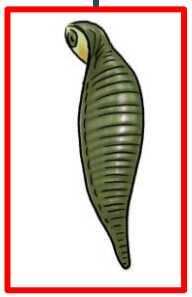
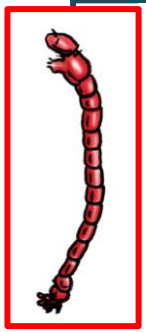
Dichotomous Key to Macroinvertebrates

- **Shell**
  - **1 Shell**
    - **Opens to left**
      - 
      - Lunged Snail
    - **Opens to right**
      - 
      - Gilled Snail
  - **2 Shells**
    - 
    - Clam
- **No Shell**
  - **Legs**
    - **10+ Legs**
      - 
      - Crayfish
      - 
      - Scud
      - 
      - Sow Bug
    - **6 Legs**
      - **No Tail**
        - 
        - Dobsonfly
        - 
        - Dragonfly
        - 
        - Caddisfly
        - 
        - Water Penny
      - **2 Tails**
        - 
        - Stonefly
      - **3 Tails**
        - 
        - Damselfly
        - 
        - Mayfly
  - **No Legs**
    - **Worm-like**
      - 
      - Worm
      - 
      - Cranefly
      - 
      - Leech
    - **With leg-like stumps near head called prolegs**
      - 
      - Midge
      - 
      - Blackfly

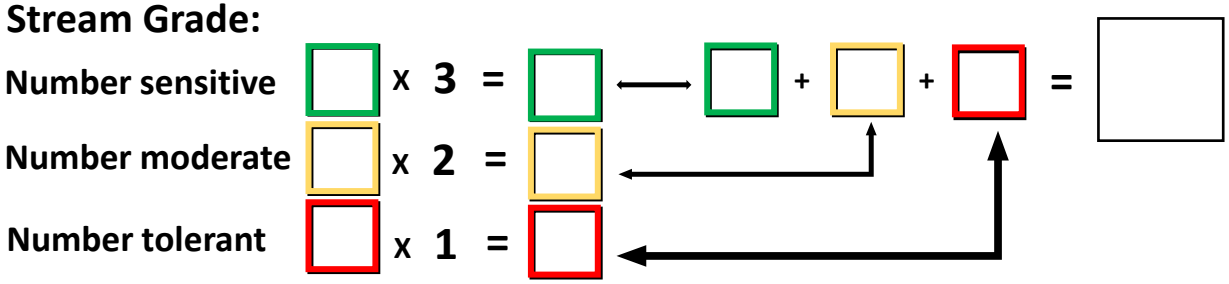
Tolerance Key

Tolerant	Gross
Moderate	Okay
Sensitive	Nice

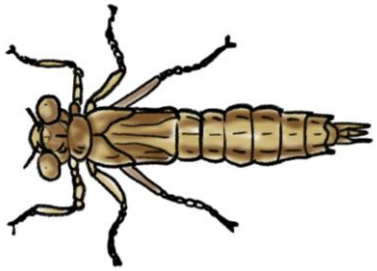
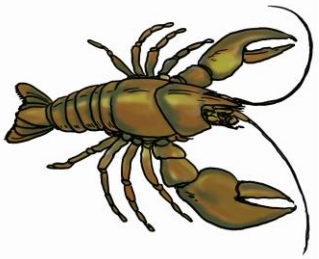
Macroinvertebrate Data Sheet

Benthic Macroinvertebrate Name	Tolerance (sensitive, moderate, tolerant)	Tally

Stream Grade:



A = 50 ↑
B = 40
C = 30
☹ = ↓ 30

Expand Your Learning

STORMWATER RUNOFF

- Look up the term "**stormwater runoff.**"
- Would you expect there to be more or less runoff in a rural or urban area?
- How might runoff make a stream unhealthy? How might the critters differ in a stream with a lot of runoff versus a stream that receives very little runoff?

Hint: The ground soaks up water, but buildings and roads do not!

- How likely do you think you are to find **sensitive** critters in a rural stream? Suburban stream? Urban stream? Why?
- How likely do you think you are to find **tolerant** critters in a rural stream? Suburban stream? Urban stream? Why?

Hint: Remember, finding tolerant critters doesn't automatically mean you have an unhealthy stream. Healthy streams can have sensitive and tolerant benthics.

- Based on what you learned, do you think your stream was from a rural, suburban, or urban location?
- Research what YOU can do to help lessen the effects of stormwater runoff and protect our streams.

ANSWER KEY

A & B – Unhealthy Stream
C & D – Semi-healthy Stream
E & F – Healthy stream

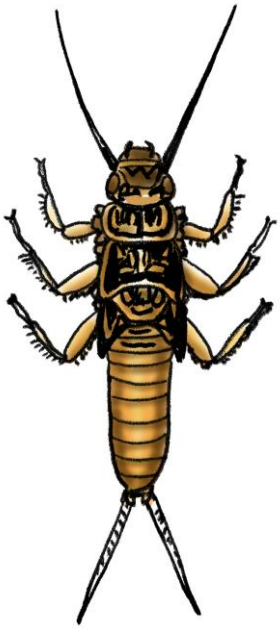
FAIRFAX COUNTY WATERSHED EDUCATION AND OUTREACH

Fairfax County freshwater ecologists provide free, high-quality, innovative educational programs and teaching tools to audiences ranging from K-12.

For more Watershed Education and Outreach activities and materials visit: fairfaxcounty.gov/publicworks/stormwater/watershed-education-and-outreach

Contact Us:

watersheds@fairfaxcounty.gov

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