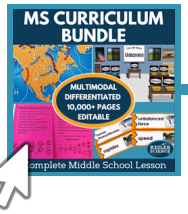
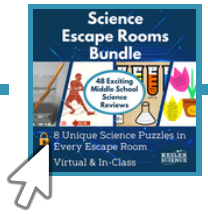
What Can Kesler Science Do for You?

4th - 8th grade science teachers love our Life, Earth, and Physical Science materials! With these easy and engaging materials, teachers can save planning time and put their focus back on the teaching that really matters.



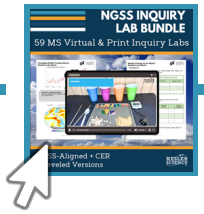
5E LESSONS

Two-week lessons with over 100 topics



ESCAPE ROOMS

Engaging activities for review

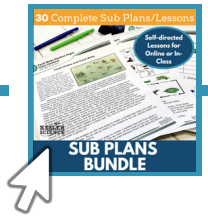


INQUIRY LABS

Three different levels to fit every student

AMAZING ANCHORS

Anchoring phenomenon to book-end your lessons



SUB PLANS

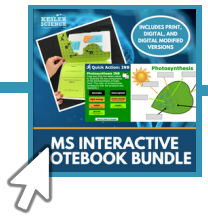
Never worry about planning for a sub again.

WARM-UPS

Bellringers for the entire year

STATION LABS

Student-led exploration

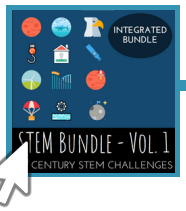


INTERACTIVE NOTEBOOKS

Bring science journals to life.

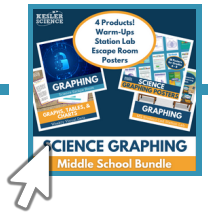
WIKI TICKETS

Quick formative assessments



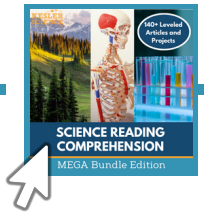
STEM CHALLENGES

Real-world STEM problem-solving



GRAPHING

Table and charts and graphs ... OH MY!

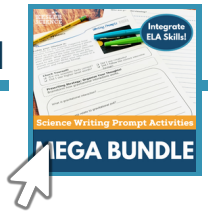


SCIENCE READING COMPREHENSION

Leveled reading passages with mini-activities

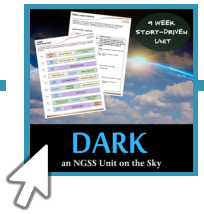
SPANGLER COLLABORATION

Exclusive Steve Spangler lessons and videos



WRITING PROMPTS

Writing activities covering 100+ topics



EXPLORIES

Story-driven units with integrated activities

The Kesler Science Professional Learning Network (PLN) group on Facebook has a huge community of engaged and supportive science teachers - come join us!

KESLER SCIENCE

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Name: _____

Date: _____

Photosynthesizing Sea Slugs

Elysia chlorotica, a tiny sea slug

If you've taken a leisurely stroll by a saltwater marsh near the Atlantic Ocean, chances are pretty good that you've looked right past an incredible marvel of nature. That's because its green body blends perfectly with the plant growth in the marsh, and it only grows to about half the width of your pinky nail. Don't be fooled by its size, though - there is something amazing going on in this tiny critter.

Meet *Elysia chlorotica*, a tiny sea slug with a survival trick that's anything but ordinary. When it hits adulthood, it figures out how to make its own energy... for free. No hunting, no foraging, no stress!

What do I mean? In a food pyramid, producers are the foundation at the bottom because they convert energy from the sun into stored energy that every other organism relies on. Consumers have to get their energy by eating those plants - or by eating another organism that already ate the plants. *E. chlorotica* is a consumer that breaks all the rules by making its own energy directly from the sun - a sea slug that photosynthesizes!

What's weird is that these slugs aren't actually born with the chloroplasts necessary to turn sunlight into sugar. As they grow from the juvenile to adult stage, they start to gorge themselves on algae, which do have chloroplasts.

E. chlorotica has a special mouth part that punctures the outer wall of their favorite algae, sucking out the inside for food. Instead of digesting the chloroplasts, the slug stores them conveniently in the lining of its digestive system, which also turns *E. chlorotica* green as they eat more and more algae. This process of stealing chloroplasts is called **kleptoplasty**, and there are a few small organisms with this special ability.

For the sea slugs, the chloroplasts stay functional for up to several months, making sugar for the slug from sunlight. This brilliant adaptation helps the slugs survive stretches where food choices are slim - sort of a like a hybrid vehicle switching from using gasoline to battery!

There's a lot scientists don't know about kleptoplasty, including how the new host organism can keep the chloroplasts alive and happy inside their bodies. Biologists noticed similarities between the algae DNA and that of the sea slugs that might mean *E. chlorotica* "borrowed" a gene segment from the algae a long time ago that allows the slugs to support the chloroplasts.

Wouldn't it be great if humans could pull this off? No more packed lunches - we could just sit in the sunlight instead!

Well, there are a couple problems with human photosynthesis. First, there's no reason to think that chloroplasts could survive inside our skin cells. Second, photosynthesis is not as efficient at you'd think. Scientists calculate that we'd need 290 hours of midday sun to give us the energy needed to make it through one full day. Bummer. 👎

Available sunlight is not the only factor that impacts photosynthesis. Water and carbon dioxide concentrations are other variables that influence how much glucose those chloroplasts can churn out. The graph (next page) shows how photosynthesis rates are influenced by temperature.

Source: Karen N. Pelletreau et al., CC BY 4.0 <https://creativecommons.org/licenses/by/4.0>, via Wikimedia Commons

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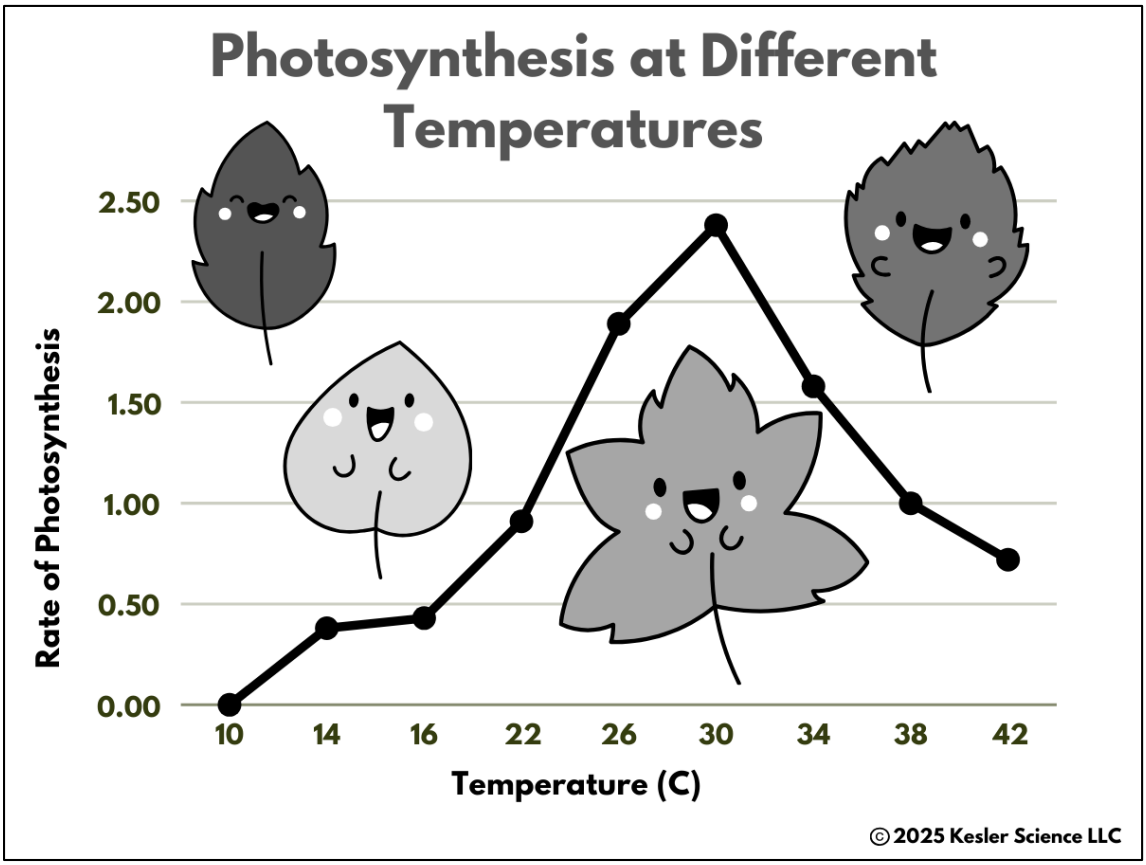

1. What patterns do you see in this graph?

_____

_____

2. At which temperature does the photosynthesis rate on this graph appear to reach its peak?

_____

_____

3. Would you expect that plants in your area complete photosynthesis at the same rate throughout the day or throughout the year?

_____

_____

_____

4. Ocean temperatures range from -2 degrees C near the poles to over 30 degrees C near the equator. How could the habitat of *E. chlorotica* affect its use of "borrowed" chloroplasts?

_____

_____

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Blog Link: https://blog.keslerscience.com/phenomenon-and-graphing/photosynthesizing-sea-slugs

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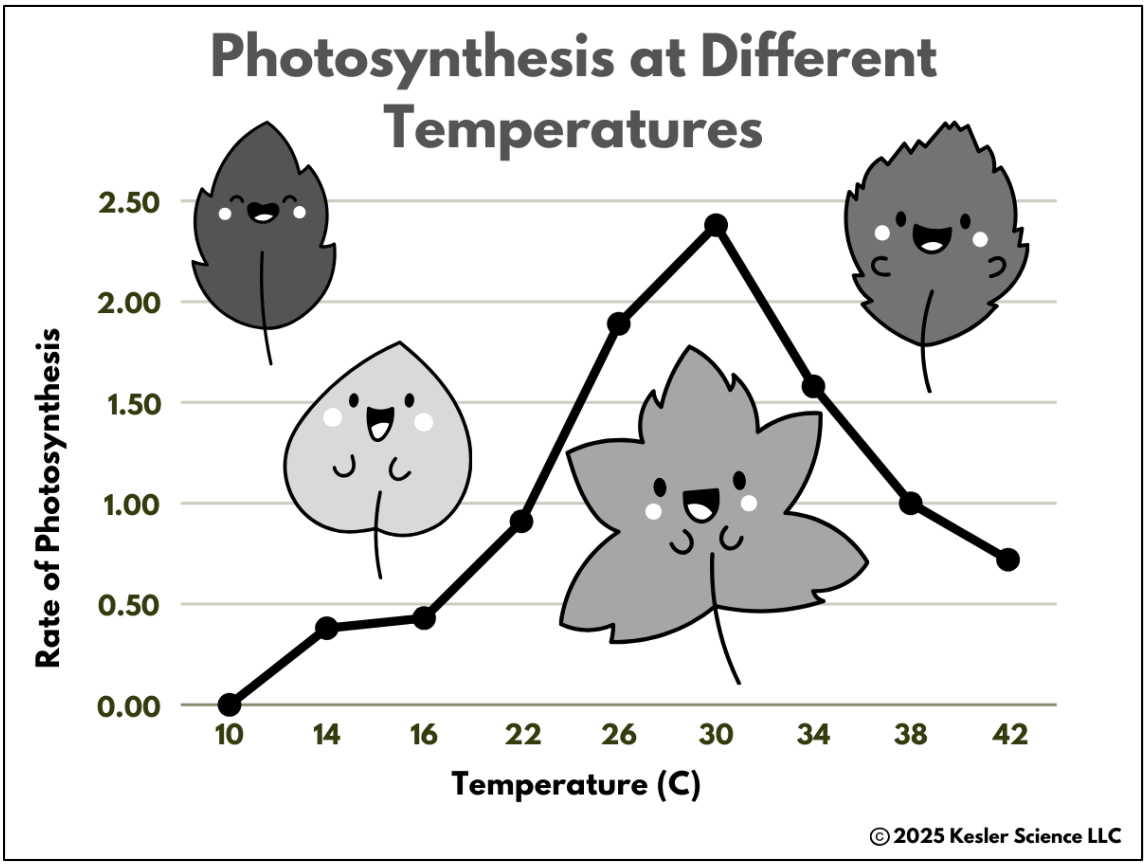

1. What patterns do you see in this graph?

   Answers could vary, but students might notice the photosynthesis rate is less at extreme low and high temperatures.

2. At which temperature does the photosynthesis rate on this graph appear to reach its peak?

   The photosynthesis rate peaks around 30 degrees Celsius.

3. Would you expect that plants in your area complete photosynthesis at the same rate throughout the day or throughout the year?

   The photosynthesis rate drops rapidly if the temperature is colder than 26 degrees C or hotter than 30 degrees C. This means rates will decrease at the night or during the fall or winter, depending on where the students live.

4. Ocean temperatures range from -2 degrees C near the poles to over 30 degrees C near the equator. How could the habitat of *E. chlorotica* affect its use of "borrowed" chloroplasts?

   In very cold or very warm water, the chloroplasts could produce very little energy through photosynthesis.

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