STEM Student Success

A presentation by CAPS Your Learning Center for ∑ EASE Essential Academic Skills Enhancement

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SURVEY

http://goo.gl/4AD3OC
(case sensitive)
vowel counting

How accurate are you?

Count all the vowels in the words on the next slide.

You have 45 seconds.
### Vowel Counting

<table>
<thead>
<tr>
<th>Item</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Dollar Bill</td>
<td>Cat Lives</td>
</tr>
<tr>
<td>Dice</td>
<td>Bowling Pins</td>
</tr>
<tr>
<td>Tricycle</td>
<td>Football Team</td>
</tr>
<tr>
<td>Four-leaf Clover</td>
<td>Dozen Eggs</td>
</tr>
<tr>
<td>Hand</td>
<td>Unlucky Friday</td>
</tr>
<tr>
<td>Six-Pack</td>
<td>Valentine’s Day</td>
</tr>
<tr>
<td>Seven-Up</td>
<td>Quarter Hour</td>
</tr>
<tr>
<td>Octopus</td>
<td></td>
</tr>
</tbody>
</table>
vowel counting

How many vowels do you remember?

Let’s look again…

What words and phrases did you remember? How are they arranged?
# Vowel Counting

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vowel counting

Now how many vowels do you remember?

What were the differences between the two attempts?

1) We knew what the task was
2) We knew how the information was organized
overview

Big Picture: The Learning Cycle

Zooming in: SQ3R Method
Why a learning cycle?

How does learning happen?

Encountering material *over time* and in *different ways*.
The Learning Cycle

Step 1: Prep
Step 2: Connect
Step 3: Organize
Step 4: Review
Step 5: Reflect

This general pattern is applicable to the way that a lot of people learn, but...

One size does not fit all.
The cycle is flexible enough for many learning styles.
The Learning Cycle

Learning Strategies

?  CYCLE

STEP 4

STEP 3

STEP 2

STEP 1

STUDENT SUCCESS

MATH

ENG

TECH

SCIENCE
Think of this step as the foundation.

You’re cueing your brain to take in information, with a special focus on the important information.

Can you think of some examples?

Create a foundation or focus
connect

Step 1

The goal here is to engage with the information so that it stays with you.

Engaging means active (not passive) learning.

What does active learning mean to you?

Engage with the information
organize

Step 1

In this step, you take the information you absorbed and put it into your own words and framework.

Order the information in a way that makes sense to you.

Step 2

What methods have you tried to organize your learning?

Step 3

Give the information structure
Here, your goal is to make your learning more permanent through repetition.

Neuroscience metaphor...

Look over the information again.
reflect

Step 1

Step back and look at the whole experience.

Step 2

What methods worked for you?
What didn’t?

Step 3

How can it be better?

Step 4

Step 5

Look back on your process
What is SQ3R?
Why do I read my textbook?

a) The professor tells me to
b) I want to learn the material
c) It will help me get a good grade
d) Textbooks are my favorite!

Learning happens over time, in different ways.
SQR3R

- Survey
- Question
- Read
- Recite
- Review
Textbooks often have an overview section at the beginning of every chapter.

Skim over the chapter, look for things that will help you create a big picture, like:

- Titles, subtitles and other headings
- The introductory paragraph
- The concluding paragraph
- Bold-terms, equations, laws
Use the information from your SURVEY to ask *surface* and *deep* questions

<table>
<thead>
<tr>
<th><strong>SURFACE</strong></th>
<th><strong>DEEP</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What</strong> does this term mean?</td>
<td><strong>What</strong> connections can I make between this term and others I already know?</td>
</tr>
<tr>
<td><strong>Why</strong> is this equation important?</td>
<td><strong>Why</strong> would this equation be included in this chapter and not the previous one?</td>
</tr>
<tr>
<td><strong>How</strong> does this processes work?</td>
<td><strong>How</strong> does this process relate to examples I see in real life?</td>
</tr>
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The **SURVEY** step gave you context – you have a big picture, so now you can fit in the details.

The **QUESTION** step gave you concrete ideas to keep you focused. Instead of passively reading, you are now actively looking for the answers to your questions.
Repeat things you read back to yourself (or to your goldfish).

Did you find the answer to one of your questions? Repeat it.

Were you surprised by a new idea? Repeat it.

Did you read something that clarified a concept for you? Repeat it.

Afraid you will forget that key term? Repeat it.

Just remember: Always use your own words!
REVIEW

Think back over what you just read.

Remember the answers you repeated (recited) to yourself? Think over them.

Ask yourself what you learned and how it fits into your overall learning goals.

Look over practice problems and examples.
Test yourself on the key points you identified

Do the SURVEY step again to reinforce the big picture.
Contrary to the normal isotope, $^{16}$O becomes less abundant. They observed the $^{18}$O in oxygen gas was produced by the presence of sunlight, but did not require the light to be visible. From these data, it was determined that the light used to produce $^{18}$O from $^{16}$O entered the water cycle and produced oxygen gas from water. This research supported the idea of two photosynthetic processes: one that uses light to produce $^{18}$O and another that uses light to produce $^{16}$O from water.

As research progressed, it was found that the Calvin cycle—initiated by the electron transport chain—requires the presence of light. The light-capturing reactions produce ATP and NADPH, which are used to reduce carbon dioxide and water in the Calvin cycle. The Calvin cycle produces sugar from carbon dioxide and water.

As Figure 10.3 shows, a chloroplast is enclosed by an outer membrane and an inner membrane (see Chapter 7). The inner leaflet is dominated by flattened, sac-like structures called thylakoids, which are involved in the process of photosynthesis. The thylakoids are connected by channels called grana (singular: grana). The space inside a thylakoid is its lumen. All the reactions of the Calvin cycle take place within the chloroplast and the lumen of the thylakoids.

When researchers analyzed the chemical composition of thylakoid membranes, they found numerous pigments. Pigments are molecules that absorb certain wavelengths of light—other wavelengths are reflected or transmitted. Pigments in chloroplasts include chlorophylls, carotenoids, and accessory pigments. Pigments are specific to the species, and they absorb different wavelengths of light.

Before going into the details of how photosynthesis occurs, we should consider just how astonishing the process is. Chemists have synthesized an amazing diversity of compounds from relatively simple starting materials, and their achievements pale in comparison to a cell that can synthesize large molecules from simple sugars, water, and light. If photosynthesis were to fail, the hypothesis that photosynthesis is a vital process would be widely accepted.

### 10.2 How Do Pigments Capture Light Energy?

The light-capturing reactions of photosynthesis begin with the simple act of sunlight striking chlorophyll. To understand the consequences of this event, it's helpful to review the nature of light.

Light is a type of electromagnetic radiation, a form of energy. Photosynthesis converts electromagnetic energy in the form of sunlight into chemical energy in the C–C and C–H bonds of sugars.

Physicists describe light's behavior as both wave-like and particle-like. Light waves can be described as waves, while light particles can be described as photons. Photons are the basic unit of electromagnetic radiation, and they travel at the speed of light. The wavelength of light determines the type of electromagnetic radiation:

- Shorter wavelengths correspond to higher energy light sources, such as X-rays and gamma rays.
- Longer wavelengths correspond to lower energy light sources, such as radio waves.

FIGURE 10.4 The Electromagnetic Spectrum. Electromagnetic energy radiates through space in the form of waves. Humans can see radiation at wavelengths between about 400 nanometers (nm) and 700 nm, which is known as the visible light spectrum. Electromagnetic radiation is classified by wavelength. Shorter wavelengths correspond to higher energy light sources, such as X-rays and gamma rays, while longer wavelengths correspond to lower energy light sources, such as radio waves.

### Photosynthetic Pigments Absorb Light

When a photon strikes an object, the photon may be absorbed, transmitted, or reflected. A pigment molecule absorbs photons of particular wavelengths. Sunlight includes white light, which consists of all wavelengths at the visible portion of the electromagnetic spectrum. If a pigment absorbs all the visible wavelengths, the pigment appears black because no visible wavelength of light is reflected back to your eye. If a pigment absorbs many or most of the wavelengths in the blue and green parts of the spectrum but transmits or reflects longer wavelengths, it appears red.

What wavelengths do various plant pigments absorb? In one approach to answering this question, researchers grind up leaves...
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Physicists describe light's behavior as both wavelike and particle-like. Like water waves or airwaves, electromagnetic radiation is characterized by its wavelength—the distance between two successive wave crests (or wave troughs). The wavelength determines the type of electromagnetic radiation.

**FIGURE 10.4** illustrates the range of wavelengths of electromagnetic radiation—the electromagnetic spectrum. The electromagnetic radiation that humans can see, the visible light, ranges in wavelength from about 400 to about 700 nanometers (nm, or $10^{-9}$ m). Shorter wavelengths of electromagnetic radiation contain more energy than longer wavelengths do. Thus, there is more energy in blue light than in red light.

To emphasize the particle-like nature of light, physicists point out that it exists in discrete packets called photons. Each photon of light has a characteristic wavelength and energy level. Pigment molecules absorb the energy of some of these photons. How?

**Photosynthetic Pigments Absorb Light**

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SURVEY

http://goo.gl/4AD3OC
(case sensitive)
• Call 277-7205
• caps.unm.edu
• Locations
  – Zimmerman, 3rd floor
  – Mesa Vista (AASS, AISS, El Centro)
  – Advisement and Enrichment Center
  – Dorms (Casas del Rio)
  – And more!