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STEM Student Success

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

Design by Leslie Woolson

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

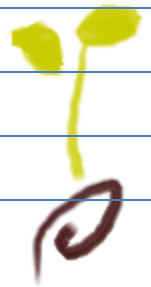
Dollar Bill	Cat Lives
Dice	Bowling Pins
Tricycle	Football Team
Four-leaf Clover	Dozen Eggs
Hand	Unlucky Friday
Six-Pack	Valentine’s Day
Seven-Up	Quarter Hour
Octopus	

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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Tricycle	Football Team
Four-leaf Clover	Dozen Eggs
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vowel counting

Now how many vowels do you remember?

What were the differences between the two attempts?

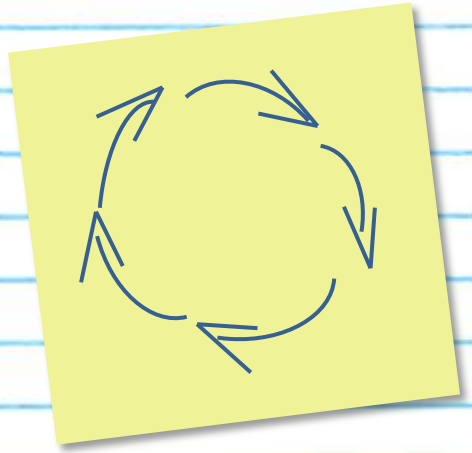
1) We knew what the task was
2) We knew how the information was organized


CYCLE
STUDENT SUCCESS
STEP 1
STEP 2
STEP 3
STEP 4
SCIENCE
TECH
ENG
MATH
LEARNING STRATEGIES
overview
Big Picture: The Learning Cycle
Zooming in: SQ3R Method

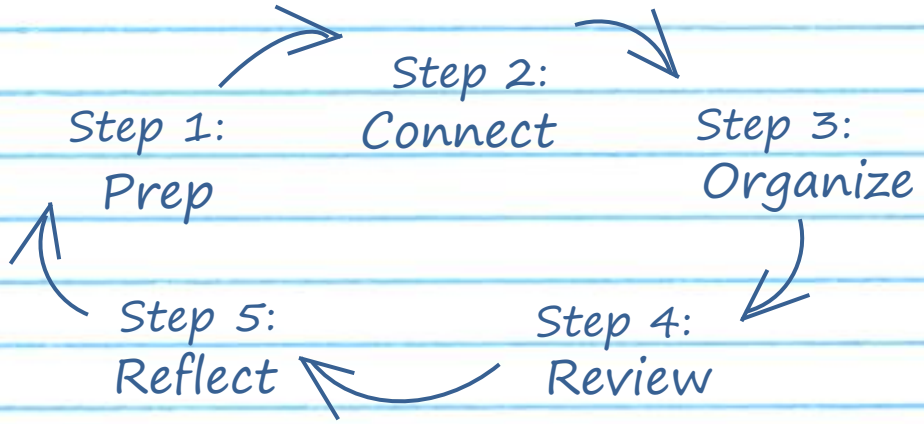
Why a learning **cycle**?

How does learning happen?

Encountering material ***over time*** and in ***different ways***.



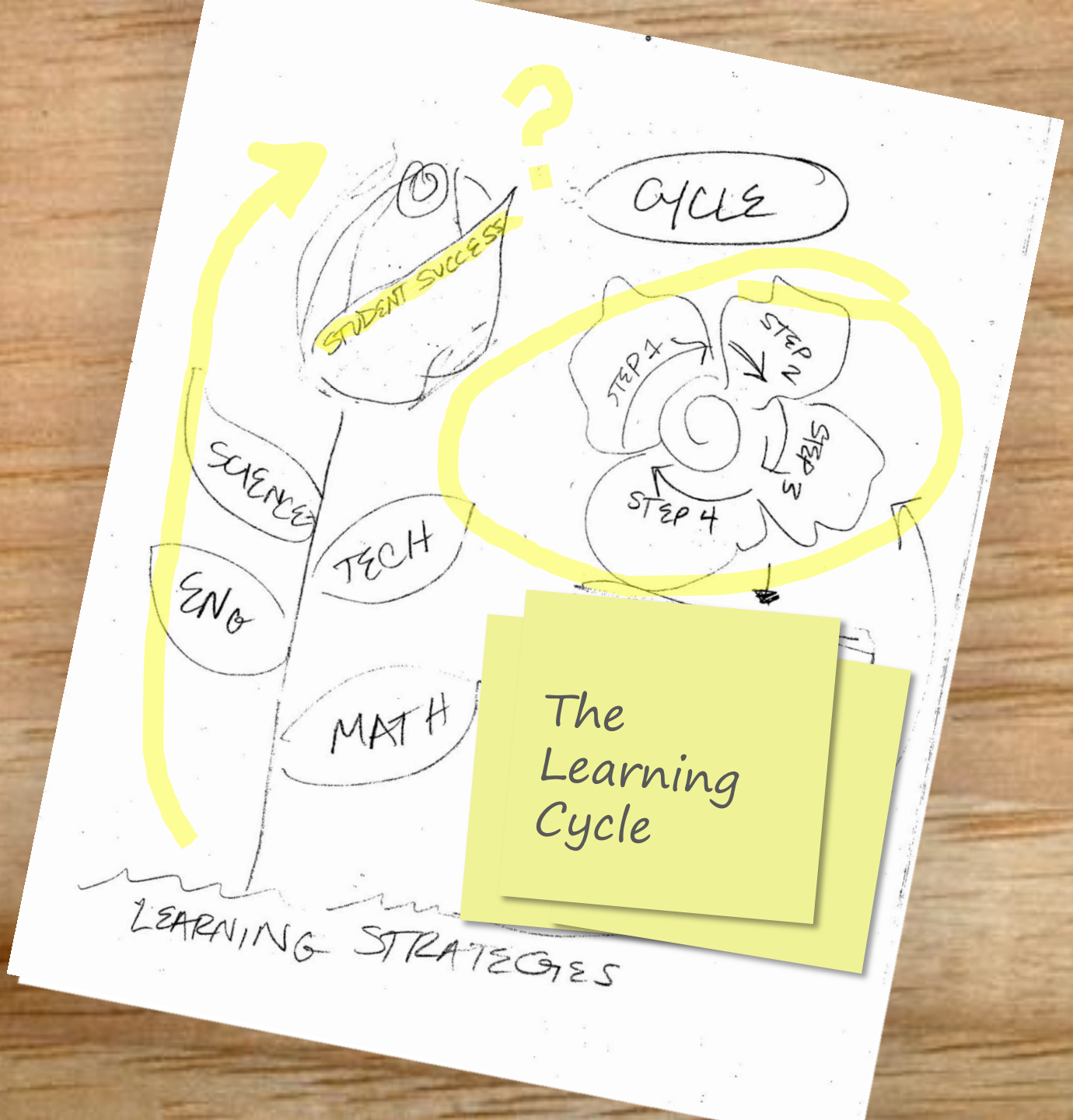
The Learning Cycle



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

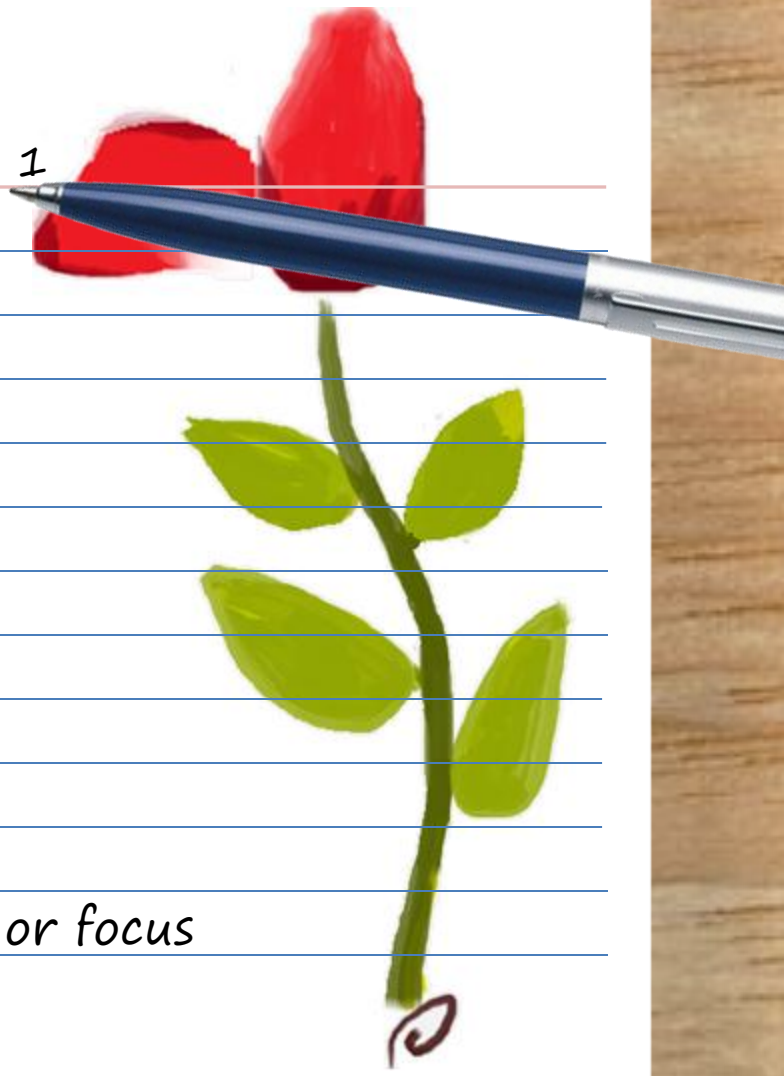
One size does not fit all.

The cycle is flexible enough for many learning styles


CYCLE
STUDENT SUCCESS
STEP 1
STEP 2
STEP 3
STEP 4
SCIENCE
TECH
ENG
MATH
LEARNING STRATEGIES
The Learning Cycle

prep

Step 1



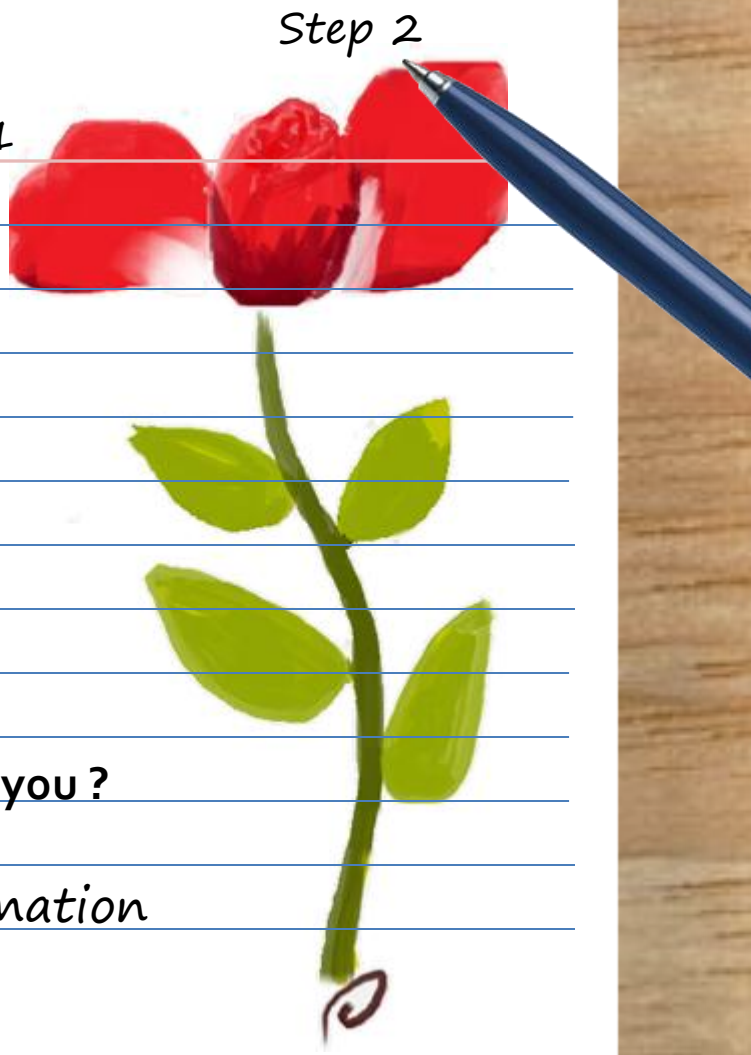
Think of this step as the foundation.

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



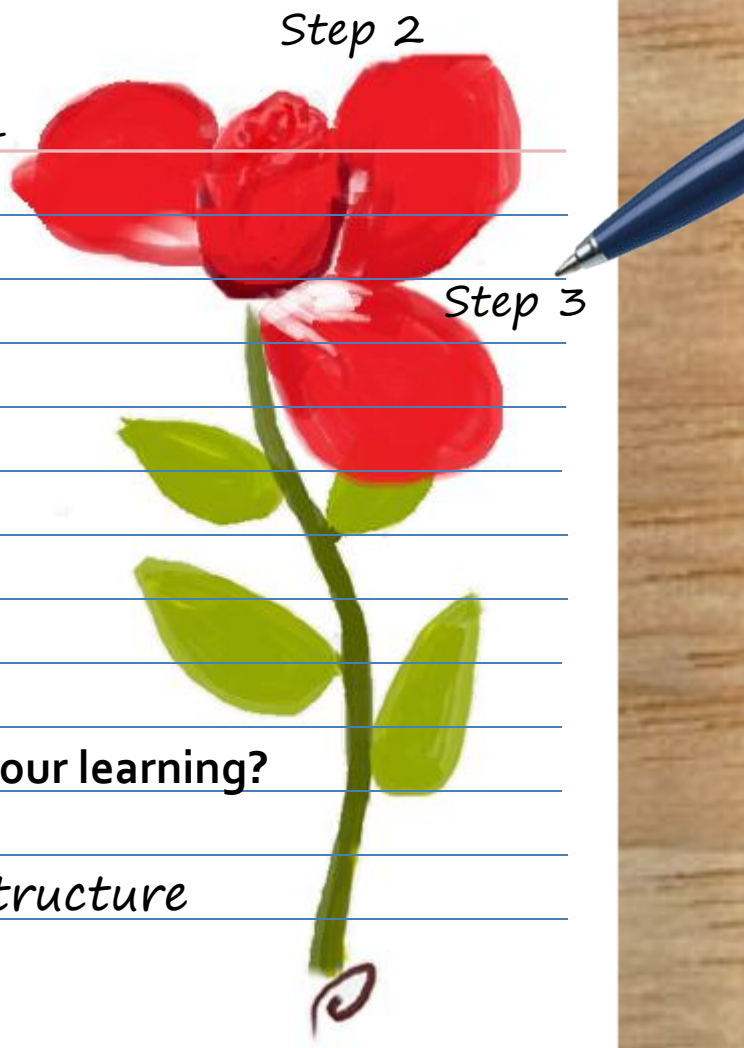
The goal here is to engage with the information so that it stays with you.

Engaging means active (not passive) learning.

What does active learning mean to you ?

Engage with the information

organize



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.

What methods have you tried to organize your learning?

Give the information structure

review

Here, your goal is to make your learning more permanent through repetition.

Neuroscience metaphor…

Look over the information again.

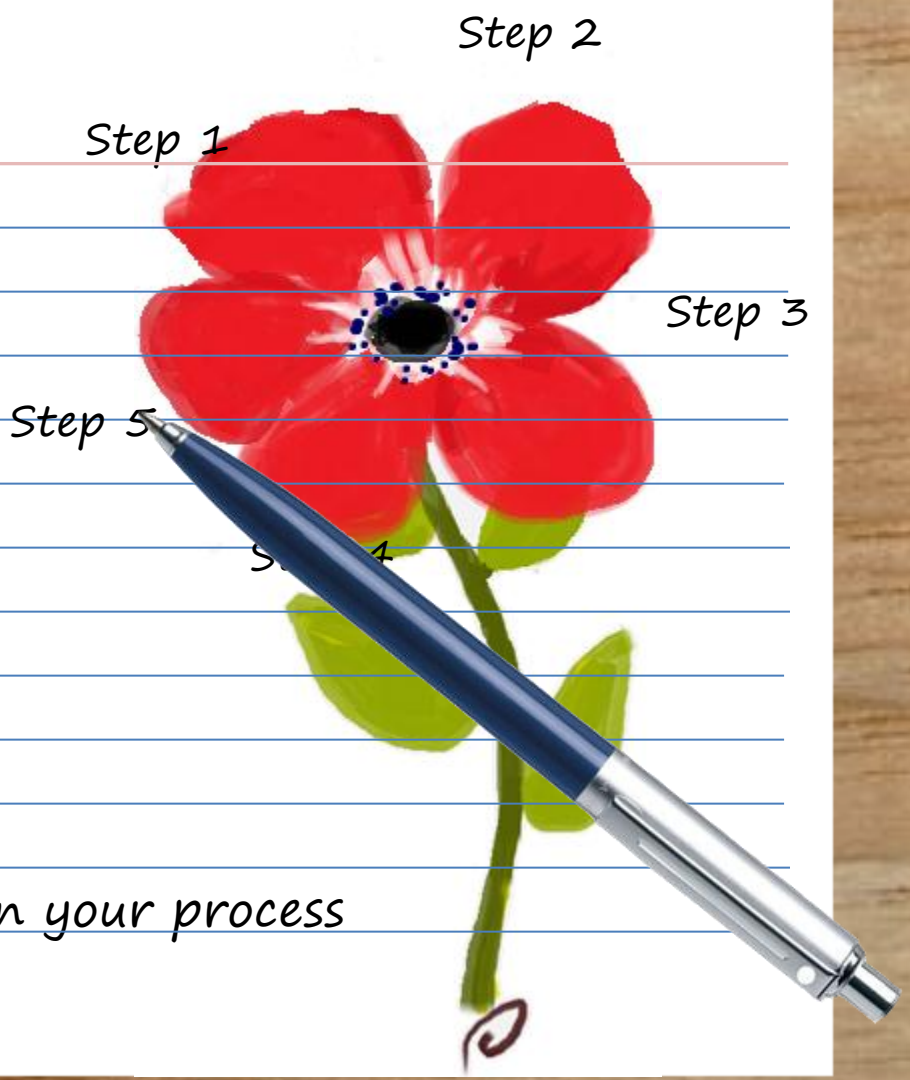
reflect

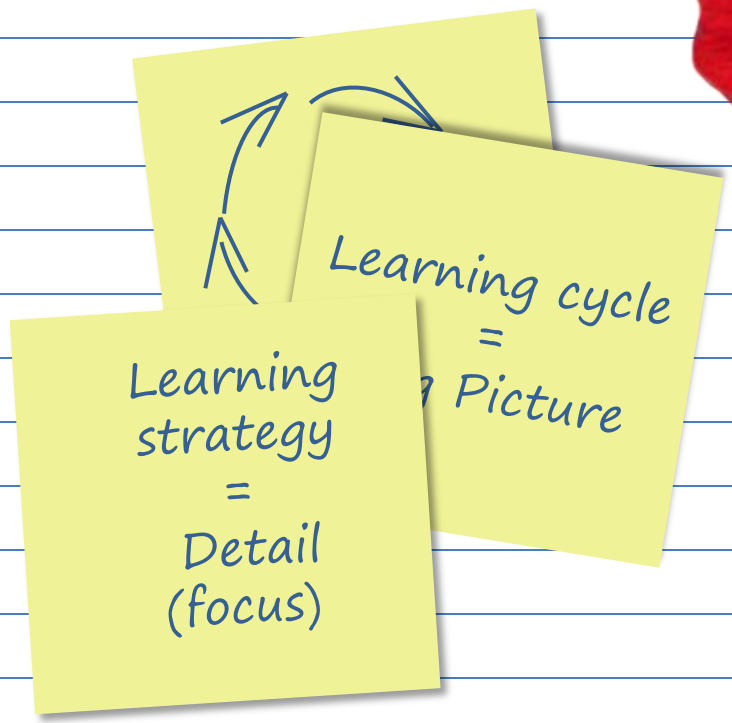
Step back and look at the whole experience.

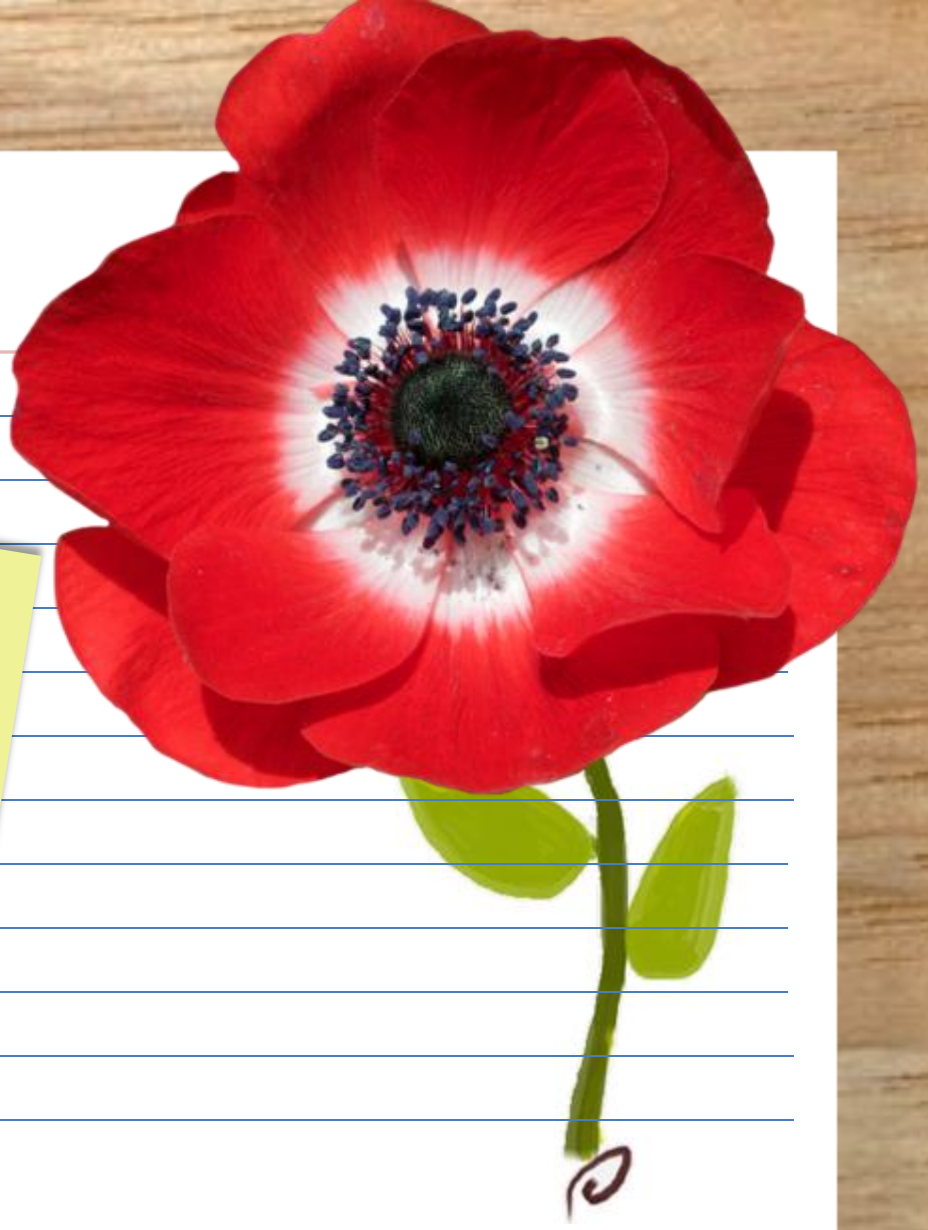
What methods worked for you?
What didn't?

How can it be better?

Look back on your process




Learning strategy
=
Detail
(focus)
Learning cycle
=
Picture




CYCLE
STUDENT SUCCESS
STEP 1
STEP 2
STEP 3
SCIENCE
ENG
MAT
MY
LEARNING STRATEGIES
What is SQ3R?

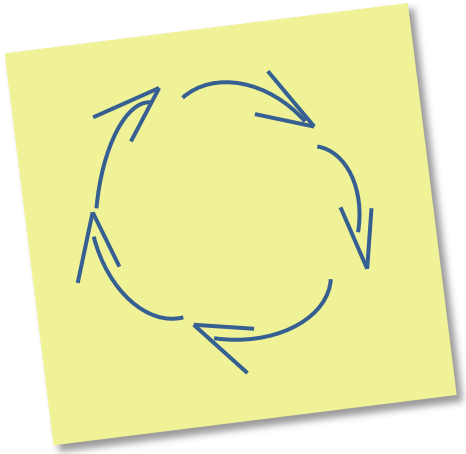
Why do I read my textbook?

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!



SQ3R

- S • SURVEY
- Q • QUESTION
- R • READ
- R • RECITE
- R • REVIEW

SURVEY

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:

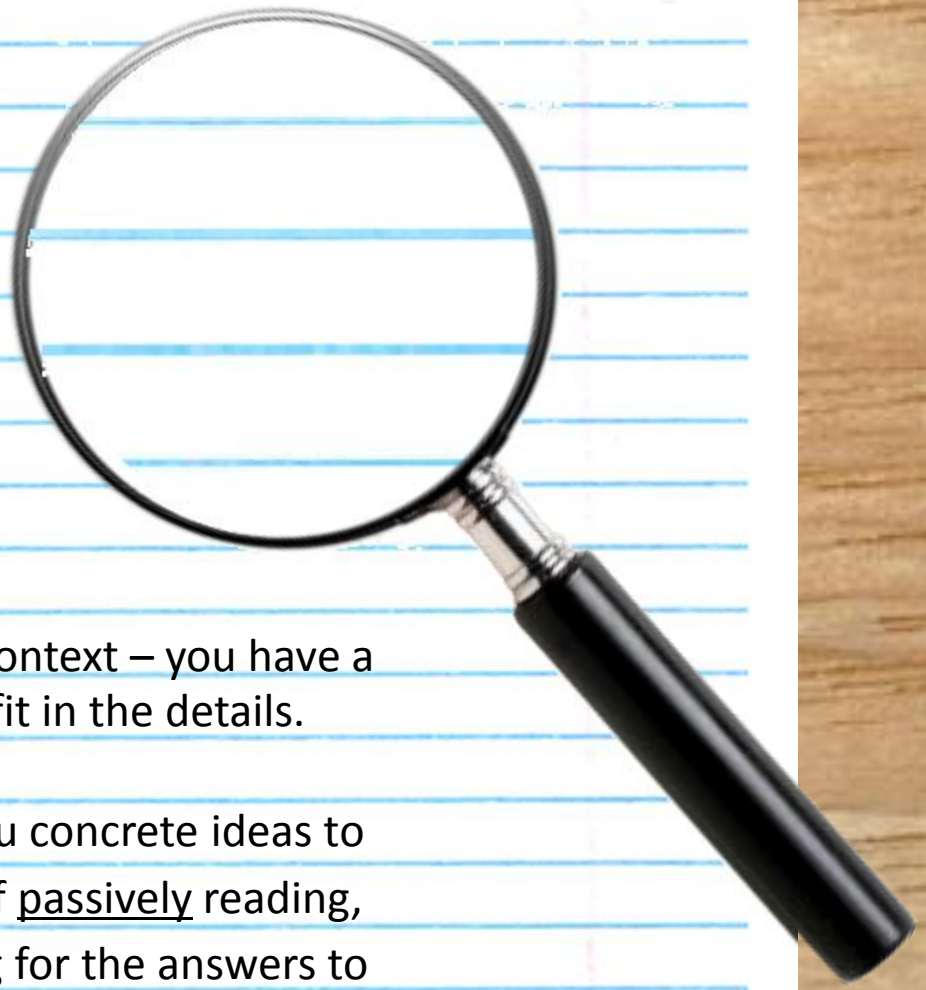
Titles, subtitles and other headings
The introductory paragraph
The concluding paragraph
Bold-terms, equations, laws

QUESTION

Use the information from your SURVEY to ask ***surface*** and ***deep*** questions

SURFACE	*DEEP*
What does this term mean?	**What** connections can I make between this term and others I already know?
Why is this equation important?	**Why** would this equation be included in this chapter and not the previous one?
How does this processes work?	**How** does this process relate to examples I see in real life?

1 READ



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.

2 REPEAT

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!

3R EVIEW

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.

trast to the normal isotope, ^{16}O—became
s. They observed the ^{18}O in oxygen gas
nts were exposed to ^{18}O-labeled H_2O, not

ctions responsible for producing oxygen
e presence of sunlight, but did not require
These data suggested that there were two
s: one that uses light to produce O_2 from
erts CO_2 into sugars.
e of research supported the idea of two
en 1945 and 1955, a team led by Melvin
ing radioactively labeled carbon dioxide
entifying the molecules that subsequently
he radioisotope. These experiments al-
entify the sequence of reactions involved
rs.
d an important role in this research, the
arbon dioxide and produce sugar came
in cycle. Later research showed that the
n only if the light-capturing reactions are

y research showed that photosynthesis
ets of reactions. One set is triggered by
Calvin cycle—requires the products of
ions. The light-capturing reactions pro-
; the Calvin cycle produces sugar from

e linked by electrons that are released
form oxygen gas. During the light-
se electrons are promoted to a high-
d then transferred through a series of
osphorylated version of NAD^+, called
adenine dinucleotide phosphate). This
, which functions as a reducing agent
oduced in cellular respiration. Some of
these redox reactions is also used to
).
cle, the electrons in NADPH and the
re used to reduce CO_2 to carbohydrate.
used in cellular respiration to produce
oxidize sugars in their mitochondria
process, just as animals and other eu-

ivity take place?

urs in Chloroplasts

ablished that photosynthesis takes place
s of plants, biologists focused on the
lled **chloroplasts** ("green-formed ele-
ally contains 40 to 50 chloroplasts, and
averages about 500,000 (**FIGURE 10.3**).
ved from chloroplasts were found to re-
e to sunlight, the hypothesis that chlo-
osynthesis became widely accepted.

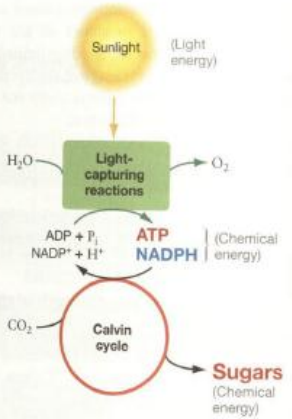


FIGURE 10.2 Photosynthesis Has Two Linked Components. In the light-capturing reactions of photosynthesis, light energy is transformed to chemical energy in the form of ATP and NADPH. During the Calvin cycle, the ATP and NADPH produced in the light-capturing reactions are used to reduce carbon dioxide to carbohydrate.

As Figure 10.3 shows, a chloroplast is enclosed by an outer membrane and an inner membrane (see Chapter 7). The interior is dominated by flattened, sac-like structures called **thylakoids**, which often occur in interconnected stacks called **grana** (singular: **granum**). The space inside a thylakoid is its **lumen.** (Recall that lumen is a general term for the interior of any sac-like structure. Your stomach and intestines have a lumen.) The fluid-filled space between the thylakoids and the inner membrane is the **stroma.**

When researchers analyzed the chemical composition of thylakoid membranes, they found huge quantities of pigments. **Pigments** are molecules that absorb only certain wavelengths of light—other wavelengths are either reflected or transmitted (pass through). Pigments have colors because we see the wavelengths that they do *not* absorb.

The most abundant pigment in the thylakoid membranes turned out to be chlorophyll ("green-leaf"), which reflects or transmits green light. As a result, chlorophyll is responsible for the green color of plants, some algae, and many photosynthetic bacteria.

Before plunging into the details of how photosynthesis occurs, take a moment to consider just how astonishing the process is. Chemists have synthesized an amazing diversity of compounds from relatively simple starting materials, but their achievements pale in comparison to a cell that can synthesize sugar from just carbon dioxide, water, and sunlight. If photosynthesis is not *the* most sophisticated chemistry on Earth, it is certainly a contender.

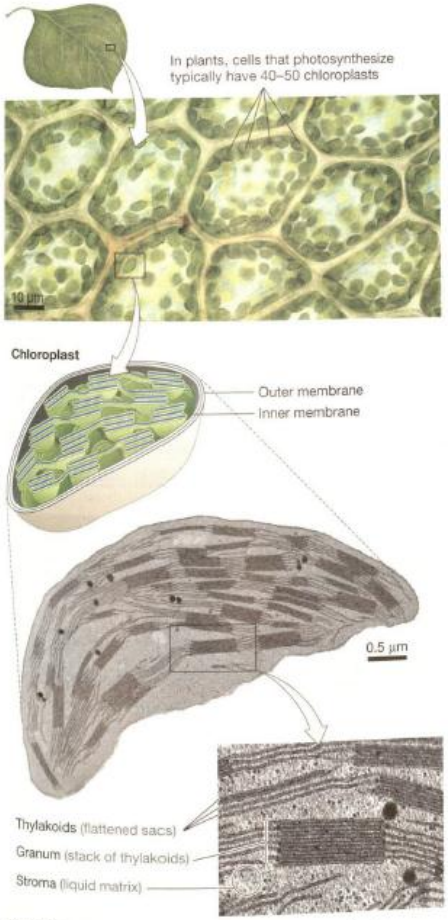


FIGURE 10.3 Photosynthesis Takes Place in Chloroplasts.

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

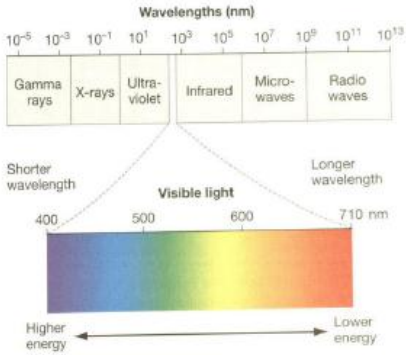


FIGURE 10.4 The Electromagnetic Spectrum. Electromagnetic energy radiates through space in the form of waves. Humans can see radiation at wavelengths between about 400 nanometers (nm) to 710 nm. The shorter the wavelength of electromagnetic radiation, the higher its energy.

sunlight into chemical energy in the C–C and C–H bonds of sugar.

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 710 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.

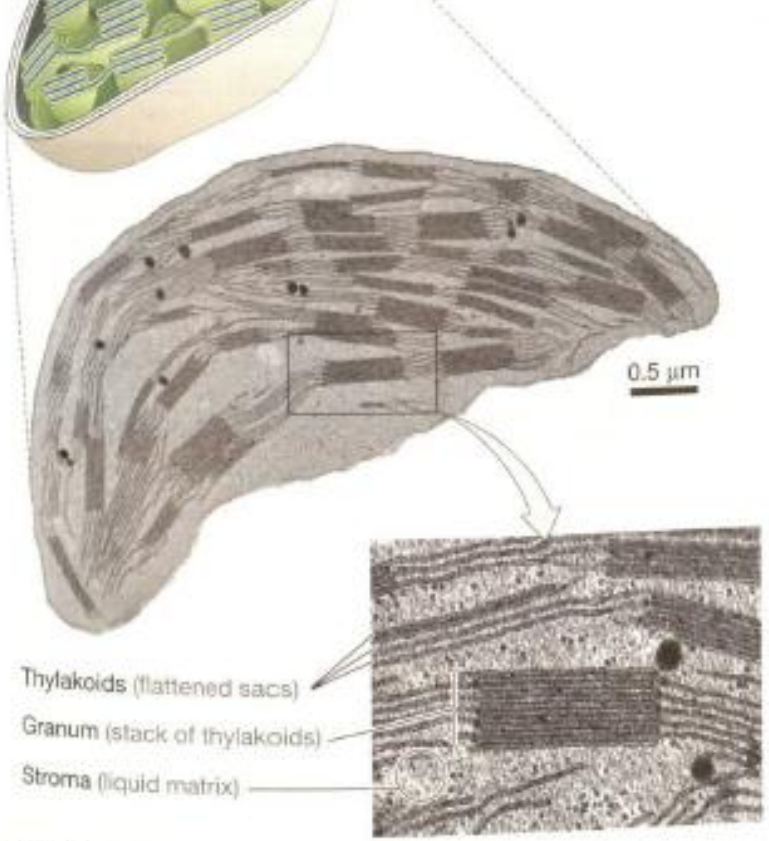
To emphasize the particle-like nature of light, physicists point out that it exists in discrete packets called **photons.** Each photon of light has a characteristic wavelength and energy level. Pigment molecules absorb the energy of some of these photons. How?

Photosynthetic Pigments Absorb Light

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 in the visible portion of the electromagnetic spectrum at once.

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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