

Name \_\_\_\_\_

## Growth Mindset Article

Success in college physics requires many things: prerequisite knowledge and skills, a tireless work ethic, an understanding of the factors affecting motivation and effort, and efficient study skills. As you progress through physics, you will develop these skills/traits. The student you were ten years ago is not the same student you are now and the student you are now is not be the same student you will be in a couple more years. This assignment is designed to provide you with a chance to reflect on the process of learning and becoming a successful student. Recent research has shown that students who understand how the brain develops new understandings are more successful than students who do not.

### Assignment

1. Read the entire *Growth Mindset* article.
2. Provide a 1-page response to this article. In your response, answer the following questions:
  - a. According to the article, how do people learn? Is it possible to learn without spending significant time with a new concept or skill?
  - b. According to the article, what happens in the brain when you learn new things?
  - c. According to this article, does learning cause permanent physical change or does the brain growth that occurs while learning fade away after a period of time?
  - d. Think of a situation when you learned something that you initially thought was impossible. Describe how you overcame any barriers to learning and how they relate to the reading.
  - e. Do you consider yourself to be a "science person"? What experiences/factors have influenced this view of yourself?

## GROWTH MINDSET

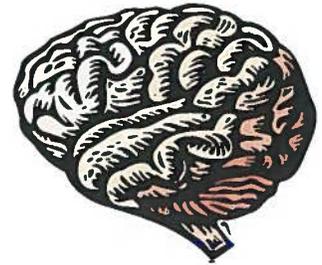
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*"Simply learning about the growth mindset seems to mobilize people for meeting challenges and persevering."*  
Dr. Carol Dweck

### ***You Can Grow Your Intelligence: New Research Shows the Brain Can Be Developed Like a Muscle***

Many people think of the brain as a mystery. They don't know much about intelligence and how it works. When they do think about what intelligence is, many people believe that a person is born either smart, average, or dumb — and stays that way for life.

But new research shows that the brain is more like a muscle — it changes and gets stronger when you use it. And scientists have been able to show just how the brain grows and gets stronger when you learn.

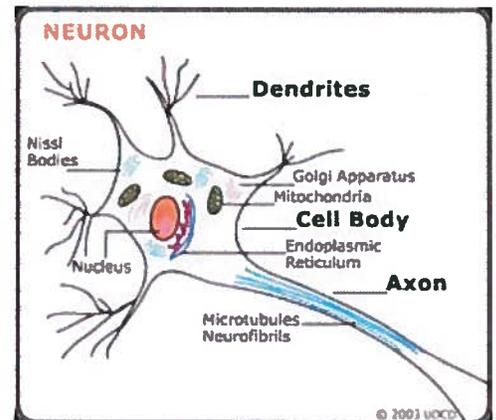


Everyone knows that when you lift weights, your muscles get bigger and you get stronger. A person who can't lift 20 pounds when they start exercising can get strong enough to lift 100 pounds after working out for a long time. That's because the muscles become larger and stronger with exercise. And when you stop exercising, the muscles shrink and you get weaker. That's why people say "Use it or lose it!"

But most people don't know that when they practice and learn new things, parts of their brain change and get larger a lot like muscles do when they exercise.

Inside the cortex of the brain are billions of tiny nerve cells, called neurons. The nerve cells have branches connecting them to other cells in a complicated network. Communication between these brain cells is what allows us to think and solve problems.

When you learn new things, these tiny connections in the brain actually multiply and get stronger. The more that you challenge your mind to learn, the more your brain cells grow. Then, things that you once found very hard or even impossible to do — like speaking a foreign language or doing algebra — seem to become easy. The result is a stronger, smarter brain.



## ***How Do We Know the Brain Can Grow Stronger?***

Scientists started thinking that the human brain could develop and change when they studied animals' brains. They found out that animals that lived in a challenging environment, with other animals and toys to play with, were different from animals that lived alone in bare cages.

While the animals that lived alone just ate and slept all the time, the ones who lived with different toys and other animals were always active. They spent a lot of time figuring out how to use the toys and how get along with the other animals.

These animals had more connections between the nerve cells in their brains. The connections were bigger and stronger, too. In fact, their whole brains were about 10% heavier than the brains of the animals that lived alone without toys.

The animals who were exercising their brains by playing with toys and each other were also "smarter" — they were better at solving problems and learning new things.

Even old animals got smarter and developed more connections in their brains when they got the chance to play with new toys and other animals. When scientists put very old animals in the cages with younger animals and new toys to explore, their brains grew by about 10%!

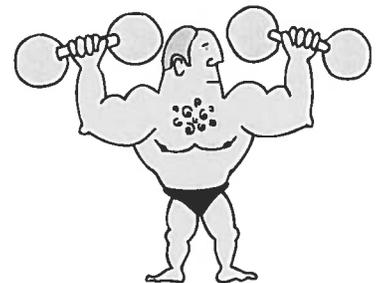
## ***The Key to Growing the Brain: Practice***

From the first day they are born, babies are hearing people around them talk — all day, every day, to them and to each other. They have to try to make sense of these strange sounds and figure out what they mean. In a way, babies are exercising their brains by listening hard.

Later, when they need to tell their parents what they want, they start practicing talking themselves. At first, they just make goo-goo sounds. Then, words start coming. And by the time they are three years old, most can say whole sentences almost perfectly.

Once children learn a language, they don't forget it. The child's brain has changed — it has actually gotten smarter.

This can happen because learning causes permanent changes in the brain. The babies' brain cells get larger and grow new connections between them. These new, stronger connections make the child's brain stronger and smarter, just like a weightlifter's big muscles make them strong.



## ***The Real Truth About "Smart" and "Dumb"***

No one thinks babies are stupid because they can't talk. They just haven't learned how to yet. But some people will call a person dumb if they can't solve math problems, or spell a word right, or read fast — even though all these things are learned with practice.

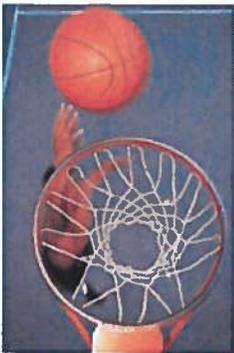
At first, no one can read or solve equations. But with practice, they can learn to do it. And the more a person learns, the easier it gets to learn new things—because their brain "muscles" have gotten stronger!

The students everyone thinks are the "smartest" may not have been born any different from anyone else. But before they started school, they may have started to practice reading. They had already started to build up their "reading muscles." Then, in the classroom, everyone said, "That's the smartest student in the class."

***These students don't realize that any one of them could learn just as well if they had exercised and practiced reading as much.***

Remember, all of those other students learned to speak at least one whole language already — something that grownups find very hard to do. They just need to build up their "reading muscles" too.

## ***What Can You Do to Get Smarter?***



Just like a weightlifter or a basketball player, to be a brain athlete you have to exercise and practice. By practicing you make your brain stronger. You also learn skills that let you use your brain in a smarter way—just like a basketball player learns new moves. But many people miss out on the chance to grow a stronger brain because they think they can't do it, or that it's too hard. It does take work, just like becoming stronger physically or becoming a better ball player does. Sometimes it even hurts! But when you feel yourself get better and stronger, it is worth it!

Name \_\_\_\_\_  
**Growth Mindset Article Reflection**

Earlier in this quarter you completed an assignment called Growth Mindset. The assignment was designed to provide you with a chance to reflect on the process of learning and becoming a successful student. The research presented in the article showed that students who understand how the brain develops new understandings are more successful than students who do not.

### **Assignment**

1. Review the entire *Growth Mindset* article.
2. Provide a 1-page response to this article. In your response, answer the following questions:
  - a. Over this past quarter, we have learned and practiced many skills. List one skill you found difficult to learn this quarter.
  - b. What, in your experience, made this skill more difficult to learn than others?
  - c. How much time did you spend learning this skill?
  - d. How did it feel while you were learning this skill?
  - e. How does your experience learning this skill fit with the article's description of learning?
  - f. Has your view of yourself as being a "science person" changed since the quarter began? What experiences/factors have influenced this?

## GROWTH MINDSET

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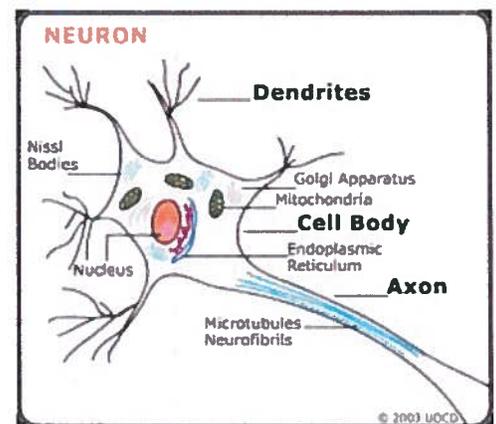
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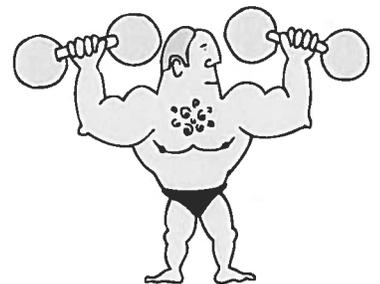
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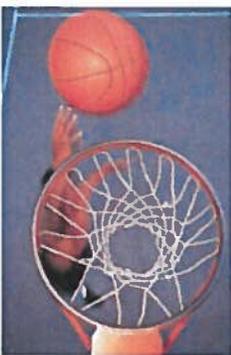
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## Study Tips Article

Success in college physics requires many things: prerequisite knowledge and skills, a tireless work ethic, an understanding of the factors affecting motivation and effort, and efficient study skills. As you progress through physics, you will develop these skills/traits. Think about times when you were successful in school and which study skills contributed to that success. This assignment is designed to provide you with a chance to reflect on the process of learning and becoming a successful student. Recent research has shown that students who are presented with basic study tips are more successful than students who are not.

### Assignment

1. Read the entire *Study Tips For College Students* article.
2. Provide a 1-page response to this article. In your response, answer the following questions:
  - a. Do you consider yourself to have strong study skills?
  - b. According to this article, what is your strongest study skill?
  - c. According to the article, what is your weakest study skill?
  - d. After having read this article, what study habits do you intend to change? How are you going to change them?
  - e. Do you consider yourself to be a "science person"? What experiences/factors have influenced this view of yourself?

## Study Tips For College Students

Since grade school, most students have been taught the "right" way to study: Dedicate yourself. Memorize. Lock yourself in a quiet room and don't leave until you know the material. Recently, however, the *New York Times* reported that many of these habits are scientifically unsound, and that some strategies that seem counterintuitive actually do work. Below are some of the methods the *Times* sheds light on, plus ones that we have found to be tried and true.

### 1) **Study and Homework Groups**

Never underestimate the power of your peers, especially when working through a difficult problem set or reading assignment. Dividing and conquering is an effective way to reduce your workload -- and to make sure you understand the material. You might even make a friend in the process.

### 2) **Make Flash Cards**

Sometimes the best habits are the ones we've used forever. Flash cards are oldies but goodies -- writing notes and definitions more than once will help imprint information in your memory, and the cards are a great way to develop and use mnemonic devices and associative phrases.

### 3) **Take Tests**

As much as we may hate tests, the *New York Times* reports that formal evaluations not only affirm knowledge but enhance it. Consistent testing can help us relearn and recall information, and it pays off when preparing for final exams.

### 4) **Sleep!**

A tired mind is a slow mind. [Get enough sleep and watch your GPA rise.](#)

### 5) **Don't Categorize Yourself**

Students often categorize themselves as visual or auditory learners, or as being left-brained or right-brained thinkers. According to the *New York Times*, research has shown that these distinctions are largely erroneous. It is more important to figure out which study strategies work for you than to worry about where you lie on the learning spectrum.

### 6) **Go To Class**

This one might seem obvious, but large lectures and early start-times often make class feel, shall we say, optional. The best way to prepare for tests is to attend classes and participate. You'll have already begun the process of reviewing and will know what to expect on the exam (especially if you haven't done the reading.)

7) **Don't Immerse Yourself in Subject Material**

In keeping with the age-old proverb that values quality over quantity, scientists have found that immersion is not an effective method of study, the *New York Times* reports. Rather than sticking to one subject and spending hours attempting to master it, you should switch between a few (related) topics. It's less boring -- and you'll learn more.

8) **Manage Your Time**

The only thing worse than having a deadline is missing a deadline. Stay organized, cut down on procrastination and your work load will feel much more manageable.

Name \_\_\_\_\_

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  - c. What is your strongest study skill now?
  - d. What is your weakest study skill now?
  - e. Over the past quarter, what study habits have helped you learn the course material?
  - f. What can you do to keep refining those skills you have found to be helpful?
  - g. Has your view of yourself as being a “science person” changed since the quarter began? What experiences/factors have influenced this?

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