

# Teacher's Guide for ODYSSEY

September 2012: How Time Flies!

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## **Teacher's Note:**

This guide contains project ideas, short answer, extended response, fill-in, and true/false with correction. The variation is designed to have the students think critically, as well as to test their comprehension. An answer key to the short answer sections can be found at the end of the guide.

## **Extended Response: Comprehension & Critical Thinking**

The questions below can be used as written, simply answered in complete sentences or easily transformed into longer essay (ELA) style questions, or even research topics. In any case, have the students support their answers with details from the text or use critical thinking skills to create a thorough and interesting answer. The questions, essays and projects have been aligned with the **Common Core Standards**. Consider the level of your students when deciding how to use the questions.

## **"It's True! Time Flies When You're Having Fun" p. 6-11**

1. What is Dr. Eagleman studying in the neuroscience field?
2. Explain the 'time wait' in the brain as it refers to how we get our information.
3. Why does time appear to slow down in life threatening situations?
4. What is a chronometer and how did it help Dr. Eagleman gather data about time perception?
5. How can our perception of the length of time that an event lasts be distorted?
6. What is the 'oddball' effect and what information does it give us about the brain and time passage?
7. Why is there a difference between how time is perceived as it unfolds in the present, and how it is perceived later after the time has already passed?
8. How does Dr. Eagleman hope to use his neuroscientific research to help with brain illnesses?
9. What advice does Dr. Eagleman give to students who may be interested in pursuing science?

**Essay:** *Dr. Eagleman states in his article that there are more than five senses. Explain what he means by that statement, and take a position in favor or against this philosophy. Be sure that you provide details to support your position.*

## **"Timing is Everything!" p. 12-16**

*Read the article in its entirety and then fill in the blanks. Refer back to the text if necessary.*

1. A concept that describes the daily behavioral and physical changes of an organism is called \_\_\_\_\_.
2. On Earth, the circadian rhythm is typically synchronized to a \_\_\_\_\_ period.
3. In mammals, the 'master clock' of our circadian rhythm is located in the \_\_\_\_\_ lobe of the brain in the suprachiasmatic nucleus.

4. The SCN is located in the optic chiasma, the part of the brain that funnels information from your \_\_\_\_\_ to the brain.
5. When it is dark outside, the SCN sends information to your brain's pineal gland, which then secretes a hormone called \_\_\_\_\_, which helps us sleep.
6. Cryptochromes are protein \_\_\_\_\_ receptors found in the SCN that mediate light responses in mammals and insects.
7. The unique combination of circadian rhythm and cryptochromes help the monarch butterfly complete its epic \_\_\_\_\_.
8. Unlike bird migration, monarch migration is \_\_\_\_\_.
9. While a genetic program tells the young monarch that it's time to migrate south, an internal \_\_\_\_\_ compass guides the butterfly on its incredible journey.
10. Circadian rhythms not only help animals maintain daily day functions, but they also help form behavior that is \_\_\_\_\_ with the surrounding environment.
11. \_\_\_\_\_ animals are active during the day; \_\_\_\_\_ animals are active at night.
12. \_\_\_\_\_ animals, like a moose, are most active at dawn and dusk.
13. The modern horse sleeps \_\_\_\_\_ hours per day, spread out in 15-minute intervals over a 24-hour period, thanks to its ancient ancestors.
14. The \_\_\_\_\_ cycle is defined as the moon traveling around the Earth, as they together, travel around the Sun. The combined gravitational forces cause the world's oceans to rise and fall, resulting in the tides.

### **"Tick, Tock, The DNA Clock" p. 17-19**

1. What is the cell nucleus?
2. Explain why DNA is such an important molecule.
3. Why is it important that cells be synchronized?
4. What is a zeitgeber and why do scientists study them?
5. Define insulin and describe its importance to the body systems.
6. Where is the 'master' clock in animals usually located?
7. How is diabetes developed?

### **"Keeping Time" p. 20-23**

1. What were the first two basic timekeeping devices?
2. What instruments did ancient cultures use to keep time?
3. How did the early mechanical clocks of the 13th century differ from modern clocks?
4. Who and what began the timekeeping revolution?
5. What is a pendulum?
6. Explain how technical advances changes the ability to keep time. Use examples.
7. How did the Industrial Revolution result in a need for accuracy of timekeeping in society?

8. Explain how 'time became money'.
9. What surpassed the accuracy of pendulum clocks in the 1970's?
10. Explain why it is increasingly important that time is kept as accurately as possible in today's world.

### **"Really Fast, Really Slow...And Horses That Fly!" p. 28-31**

1. What is meant by the term 'scientific time'?
2. What is quantum mechanics and how does it relate to keeping time?
3. Why was Dr. Harold Edgerton's rapatron camera so important to science?
4. How do atomic clocks work?
5. What is the shortest time currently detectable? Do you think that will change in the near future? Why or why not?
6. Why are atomic clocks vital for the workings of GPS?
7. How did Stonehenge and the pyramids track time over the millenia?
8. How does W. Daniel Hillis' "Clock of the Long Now" anticipate the changes necessary to keep accurate time?
9. How does nature provide ways to measure long periods of time?

### **"Time Wizard" p. 32-35**

1. What is Dr. Atance's particular expertise in child psychology?
2. Give a few examples of 'mental time travel' that you utilize during an average day.
3. Why is it a great benefit to have the capacity for future thinking?
4. What did Dr. Atance's "Bert and Ernie Rooms" test help her to discover about children's ability to mental time-travel?
5. How does Dr. Atance believe that mental time-travel can be taught? Write an opinion stating whether or not you agree with her theory.
6. How does preschooler's ability to think about the future affect their behavior?

### **"Time: It's All Relative" p. 36-38**

1. Explain the effect known as "The Twin's Paradox".
2. How did Einstein's Theory of Special Relativity change what most of the world believed about time?
3. Why is it critical to understand the concepts of "frames of reference" and "time dilation" when understanding Einstein's theory?
4. What has to happen in order for the effects of relativity to be noticeable?
5. Why do physicists believe that there is a possibility of time being able to go 'backwards'?

### **"Good Morning! Really?" p. 42-42**

*Mark the following statements TRUE or FALSE. Provide the correct answer if false.*

\_\_\_\_\_ 1. The science world refers to people who function best in the morning as "doves" after the early rising birds.

\_\_\_\_\_ 2. "Owls" are those of us who function best in the evening.

\_\_\_\_\_ 3. Patterns of wakefulness and sleepiness are part of the circadian rhythm that is embedded in our body.

\_\_\_\_\_ 4. In general, high-school-aged humans function best on 7 hours of sleep.

\_\_\_\_\_ 5. Many high-schoolers may be sleep-deprived simply because of their district's school hours.

\_\_\_\_\_ 6. Later start times of school seem to be correlated with higher grades, fewer sleep-related car accidents, better attentiveness, and less depression.

\_\_\_\_\_ 7. According to researchers, owlism diminishes in our late thirties.

**ANSWER KEY:**

**"Timing is Everything"**

- |                             |                               |
|-----------------------------|-------------------------------|
| 1. <i>Circadian rhythm</i>  | 10. <i>synchronized</i>       |
| 2. <i>24-hour</i>           | 11. <i>diurnal, nocturnal</i> |
| 3. <i>frontal</i>           | 12. <i>crepuscular</i>        |
| 4. <i>eyes</i>              | 13. <i>3</i>                  |
| 5. <i>melatonin</i>         | 14. <i>lunar</i>              |
| 6. <i>light</i>             |                               |
| 7. <i>migration</i>         |                               |
| 8. <i>intergenerational</i> |                               |
| 9. <i>sun</i>               |                               |

**"Good Morning! Really?"**

1. *False, larks*
2. *True*
3. *True*
4. *False, 9 hours*
5. *True*
6. *True*
7. *False, late twenties*