

## TIME AND SPACE

*„ If you know Time as well as I do, I wouldn't talk about wasting it.  
It's him (...). Now, if you only kept on good terms him,  
he'd do almost anything you liked with the clock. For instance,  
suppose it were 9 o'clock in the morning, just time to begin lessons;  
you'd only have to whisper a hint to Time, and around goes the clock  
in a twinkling: Half past one, time for dinner!“*

Lewis Carroll, *Alice in Wonderland*

### I. Discuss the questions below (adapted from: <http://iteslj.org/questions/> )

1. Do you wear a watch?
2. Do you think you can manage your time well, or does time manage you?
3. What is your busiest day of the week? / time of the day?
4. When you have an appointment, do you show up precisely on time, a bit earlier or a little later?
5. Are you a „night owl“ or an „early bird“?
6. Have you ever suffered from a jet-lag?
7. What do you think about the idea of Daylight Saving Time (setting our clocks to a different time in the spring and autumn)?
8. What sign of zodiac are you? Do you believe that the time and place in which you were born influence our lives?
9. If time travel were possible, which period of world history would you like to return to? Why?
10. Would you like to travel to the future? How far into the future would you go then? What would you like to see / do?

### II. Read the text and fill in the gaps with appropriate words and expressions (adapted from [www.wikipedia.org](http://www.wikipedia.org))

#### Philosophy of Space and Time

Time and space are two of few fundamental quantities, which cannot be defined in terms of other quantities. Thus, they are both defined via measurement. Currently, the standard time interval (called „1. \_\_\_\_\_ second“ or simply „second“) is defined as 9,192,631,770 oscillations of a hyperfine transition in the 133 caesium atom. Time can be combined mathematically with the fundamental quantities of space and mass to 2. \_\_\_\_\_ concepts such as velocity, momentum, 3. \_\_\_\_\_ and fields. The space interval, called a standard meter or simply a meter, is defined as the distance travelled by light in a 4. \_\_\_\_\_ during a time interval of  $1/299792458$  of a second. This definition 5. \_\_\_\_\_ the present definition of time makes special relativity theory to be absolutely correct by definition.

In classical physics, space is a three-6. \_\_\_\_\_ Euclidean space where any position can be described using three coordinates. Special and general relativity uses spacetime rather than space, and it is modeled as a four-7. \_\_\_\_\_ space (with the 8. \_\_\_\_\_ being imaginary in special relativity and real in general relativity, and currently there are many theories which use more than 4-dimensional spaces).

Some theories, most notably special and general relativity, 9. \_\_\_\_\_ suitable geometries of spacetime may allow time travel into the past and future. Albert Einstein's special theory of relativity predicts time 10. \_\_\_\_\_ that could be interpreted as time travel. It states that, relative to a 11. \_\_\_\_\_, time appears to pass more slowly for fast-moving bodies. For example, a moving clock will appear to run slow; as the clock approaches the speed of light its hands will appear to nearly stop moving. A second type of travel is 12. \_\_\_\_\_

general relativity. In this type a distant observer sees time passing more slowly for a clock at the bottom of a deep gravity 13. \_\_\_\_\_, and a clock lowered into it and pulled back up will indicate that less time has passed compared to a stationary clock that stayed with the distant observer. These effects are to some degree similar to 14. \_\_\_\_\_, (which slows down the rates of chemical processes in the subject) almost indefinitely suspending their life thus resulting in „time travel“ 15. \_\_\_\_\_, but never backward.

Many in the scientific community believe that time travel is unlikely, because it violates 16. \_\_\_\_\_, i.e. the logic of cause and effect. For example, what happens if you attempt to go back in time and kill yourself at an earlier stage of your life? Stephen Hawking once suggested that the absence of 17. \_\_\_\_\_ constitutes a strong argument 18. \_\_\_\_\_ the existence of time travels.

time axis, hibernation, dimensional x2, tourists from the future, energy, suggest that, permitted by, conventional, stationary observer, toward the future, interval, causality, coupled with, dilation, against, derive, well

**III. Match the terms with the sentences relating to them;**

1. Cartesian coordinate system	9. sidereal day	17. winter solstice
2. great circle	10. Greenwich Mean Time	18. autumnal equinox
3. parallels	11. Coordinated Universal Time	19. vernal equinox
4. meridians	12. International Date Line	20. tropical year
5. latitude	13. Daylight Saving Time	21. sidereal year
6. longitude	14. altitude	22. Gregorian calendar
7. Greenwich (prime) meridian	15. zenith angle	23. precession
8. solar day	16. summer solstice	

- a) circles parallel to the equator
- b) designates beginning of winter
- c) time used to save energy in the past
- d) the zero meridian
- e) occurs on or near March 21
- f) angular measurement in degrees east or west of the prime meridian
- g) complementary angle of altitude
- h) the time of one revolution of the Earth with respect to a star other than the Sun
- i) a rectangular coordinate system
- j) the angle of the Sun above the horizon
- k) elapsed time between two successive crossings of the same meridian by a star other than the Sun
- l) the equator is an example
- m) designates the beginning of summer
- n) time referenced to atomic clocks
- o) angular measurement in degrees north and south of the equator
- p) occurs on or near September 22
- q) when crossed travelling west, the date is advanced
- r) the year of the seasons

- s) half circles that are portions of a great circle
- t) elapsed time between two successive crossings of the same meridian by the Sun
- u) skips 3 leap years every 400 years
- v) the slow rotation of the Earth's axis
- w) Zulu

#### IV. Read the text and try to complete it with relevant information

In 1. \_\_\_\_\_ Einstein published his theory of special relativity, which explored the link between space and time. And Einstein's theory does not define two separate issues. There is just one thing: spacetime, that we all live in. He thought of this new spacetime as a fabric, 2. \_\_\_\_\_ together space and time. In 3. \_\_\_\_\_ Einstein developed his theory of general relativity, which 4. \_\_\_\_\_ special relativity to include gravity in its effects of this fabric of the spacetime. When we roll a ball across the fabric, it seems to be 5. \_\_\_\_\_ to the massive weight at the center.

General theory of relativity was a new theory that told us that gravity works, because the space and time are 6. \_\_\_\_\_ in the presence of matter, and could respond dynamically, space itself could expand and 7. \_\_\_\_\_.

8. \_\_\_\_\_ is a term used to describe the energy and matter that objects contain. The larger it is, the the greater is distortion of the spacetime fabric and the stronger the 9. \_\_\_\_\_, which itself is not really a force. It is a fabric, it is a shape of space and time, and we just move along the 10. \_\_\_\_\_ and the shapes. The act of doing so takes what would otherwise be a 11. \_\_\_\_\_, and bends it in what we now describe as 12. \_\_\_\_\_, as 13. \_\_\_\_\_, as pathways through the cosmos.

Einstein said not even light can escape the effects of gravity. The proof arrived in 14. \_\_\_\_\_ in the form of an astronomically large experiment, based on a 15. \_\_\_\_\_. General relativity said that if you looked at a star on a path of light that goes right past the Sun, you would see a shift because of the gravity of the Sun. So Arthur Eddington went out to test that theory during 16. \_\_\_\_\_ and photograph stars when the Sun was blocked by the 17. \_\_\_\_\_, and see the stars behind them.

The ability to see the objects that were actually behind the Sun proved that objects could 18. \_\_\_\_\_ spacetime. Einstein became a superstar overnight and in 19. \_\_\_\_\_ he received the Nobel prize for physics.

#### V. Complete the following idioms by adding the correct preposition;

1. \_\_\_\_\_ the dot
2. \_\_\_\_\_ the nick of time
3. \_\_\_\_\_ the crack of dawn
4. \_\_\_\_\_ this day and age
5. \_\_\_\_\_ donkeys' years
6. \_\_\_\_\_ due course

now match them with their explanations:

- a) very early in the morning
- b) eventually, at the right time and not before
- c) for a very long time
- d) in modern times
- e) precisely, exactly on time

and use them with the sentences:

1. I expect you to be here at 8 \_\_\_\_\_.
2. For the big number of applicants, your request will be dealt with not earlier than \_\_\_\_\_.
3. It is unbelievable that there are so many people suffering from hunger \_\_\_\_\_.
4. He loves waking up \_\_\_\_\_ and have a cup of coffee in bed and read some papers before everybody else in the house gets up.
5. I'm never early and I'm never late, but I do admit to doing things \_\_\_\_\_.
6. I fully trust him, we've known each other \_\_\_\_\_.