

# IT'S ABOUT TIME

Name \_\_\_\_\_

Date \_\_\_\_\_

Grade  9  10  11  12

I am trying out for  Math-2 (TIME/ASTR)  Math-3 (TIME/WIDI)

I did this event last year

<b>Scoring</b>	/11	/20	/21	/25	TOTAL	/77
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Answer all questions as completely as possible. No half-points will be awarded, but no points will be deducted for incorrect answers. Include units for all measurements; any numbers without units will be marked as wrong. Point values are listed to the right of each question.

**What concept is discussed in the following quote, and who is quoted?** [2]

*"... in its own nature, without regard to anything external, remains always similar and immovable"*

Absolute time and space

Sir Isaac Newton

**Explain the circular nature of time, and give an operation definition for time.** [3]

Circularity: Time cannot be defined without using time in the definition.

Operational Definition: Accept any reasonable answers that are not circular (e.g. use period as a unit to measure time by counting the number of repetitions of a free-swinging pendulum; the apparent motion of the sun across the sky; phases of the moon; beat of a heart)

*1 point for "circularity," 2 points for operational definition*

**What is the international unit of time and how is it defined?** [2]

Second

Defined in terms of radiation emitted by Cesium atoms

**What common idiom gives time economic value?** [1]

Time is money

**What is the science of the measurement of time or timekeeping called?** [1]

Chronometry

**What is horology?** [1]

Study of devices used to measure time

**How many days did the earliest calendars have?** [1]

354 or 384 days in a lunar calendar

**Why has the number 13, in relation to timekeeping, become important in many cultures?** [2]

Number of months in early lunar calendars

**Who introduced the Roman world to the solar calendar?** [1]

Julius Caesar

**What was the motivation behind introducing the Gregorian calendar? Specifically, what were the changes in the Gregorian calendar?** [4]

Keep date of Easter on the spring equinox

Changed mean length of calendar year from 365.25 days (365 days 6 hours) to 365.2425 days (365 days 5 hours 49 minutes 12 seconds)

*2 points for motivation, 2 points for specific changes*

**What is unique about the unit attosecond?** [1]

It is the shortest duration now measurable (not the shortest duration possible)

**How many days are a sennight?** [1]

7 days

**What does the Plank time unit measure, and how many seconds is it?** [2]

Duration light takes to travel one Plank length ( $1.616 \times 10^{-35}$  meters)

$10^{-43}$  seconds

**What unit of time is used by legislatures?** [1]

Biennium

**How long is a galactic year, and how is it defined? What event happened about 61 galactic years ago?** [3]

230 million years

Duration it takes the solar system to orbit the center of the Milky Way Galaxy one time

Big Bang

**What is a motivation behind daylight saving time (DST)? What are two criticisms of the practice?** [5]

Motivations: Advancing clocks during summer months makes people get up earlier and experience more daylight in the evening; reduce evening use of incandescent lighting

Criticisms: Two reasonable answers, such as it affects activities tied to the sun (e.g. farming) or darkness (e.g. fireworks), affects evening entertainment

*1 point for motivation, 2 points for each criticism*

**Would 2600 C.E. be a leap year? Why?**

[2]

No, not divisible by both 100 and 400

1 point for 'no', 1 point for reason (not awarded if 'yes')

**A fast-moving object would be seen as slower in time from a stationary observer's point of view. What is this effect called?**

[1]

Time dilation

**Describe two common problems with anchor escapement.**

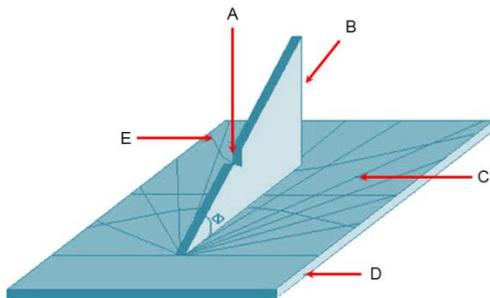
[6]

Explanation of how friction (small changes in force like dampening can alter period and accuracy, lack of isochronism) or recoil (damages timekeeping components through backlash) have negative impacts on time keeping

1 point for each problem, 2 points for each explanation

**Label the diagram of a sundial using correct terminology.**

[5]



- a. nodus
- b. gnomon
- c. hour line
- d. base
- e. furniture

**How do clocks use the piezoelectric effect? What makes it possible for a quartz crystal to be used?**

[3]

Quartz clocks employ quartz crystal that oscillates when a current is sent through the crystal (piezoelectricity) to generate a regularly timed series of electrical pulses.

The quartz crystal has a precisely defined natural frequency.

2 points for complete explanation of piezoelectric effect, 1 point for natural frequency

**A horizontal massless spring with spring constant 10.0 N/m is attached to a mass of 3.00 kg. What is the period? What is the period if the spring is vertical?**

[4]

3.44 seconds

3.44 seconds (no change)

1 point for each correct answer, 1 point for complete work shown for each part

**Design and document a timekeeping device that can measure time intervals between 10 and 300 seconds to the nearest 0.1 second. You must explain how your device is used to measure time and how it is superior to other designs you may have considered. Any diagrams must be labeled and drawn somewhat to scale, and all materials used must be permitted by the rules.**

*10 points for labeled diagram (5 points for listing all materials, 3 points for all parts of device drawn, 2 points for drawing somewhat to scale; -1 point for each material used that is not allowed by rules, -1 point for any parts of device not drawn)*

*8 points for describing how the device works (graded on completeness)*

*7 points for explaining how the device is superior to other designs (graded on strength of design)*