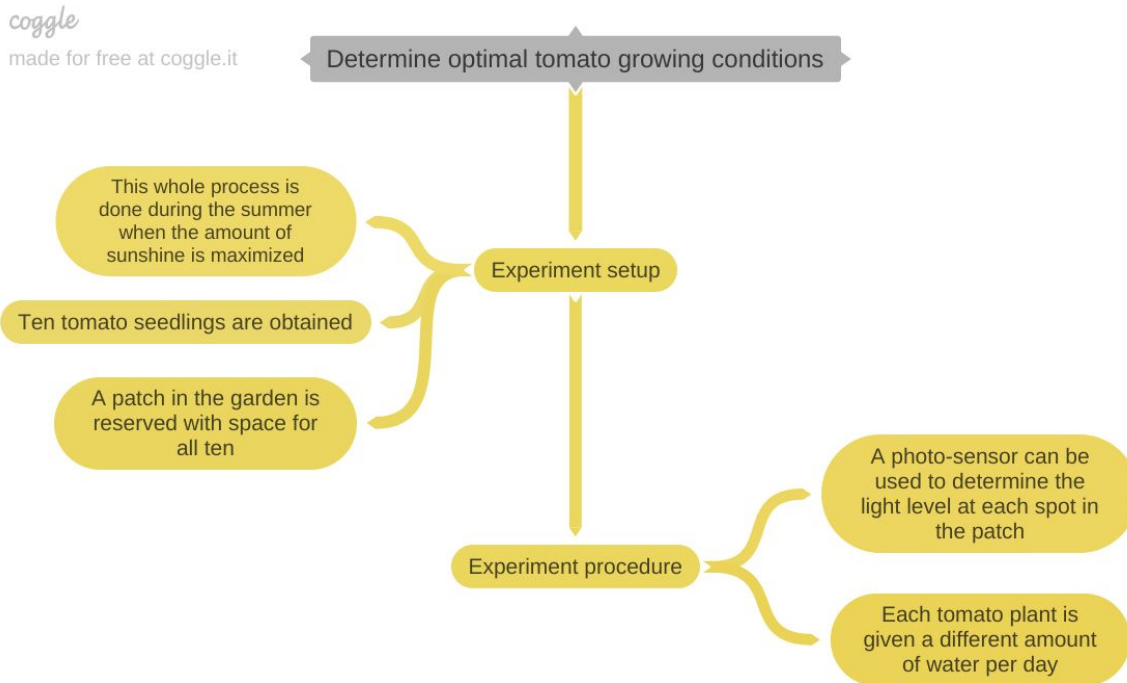


Week 1: Concise Writing 1

1.

- a. Scientists use the orbits of stars to calculate the mass of the object at the center of the galaxy, which is so large that it must be a black hole.
- b. Epidemiologists use the reproduction parameter, R_0 , the number of new infections resulting from one infected person.
- c. According to Newton's Laws of motion, objects with different masses and shapes accelerate at the same rate when dropped.

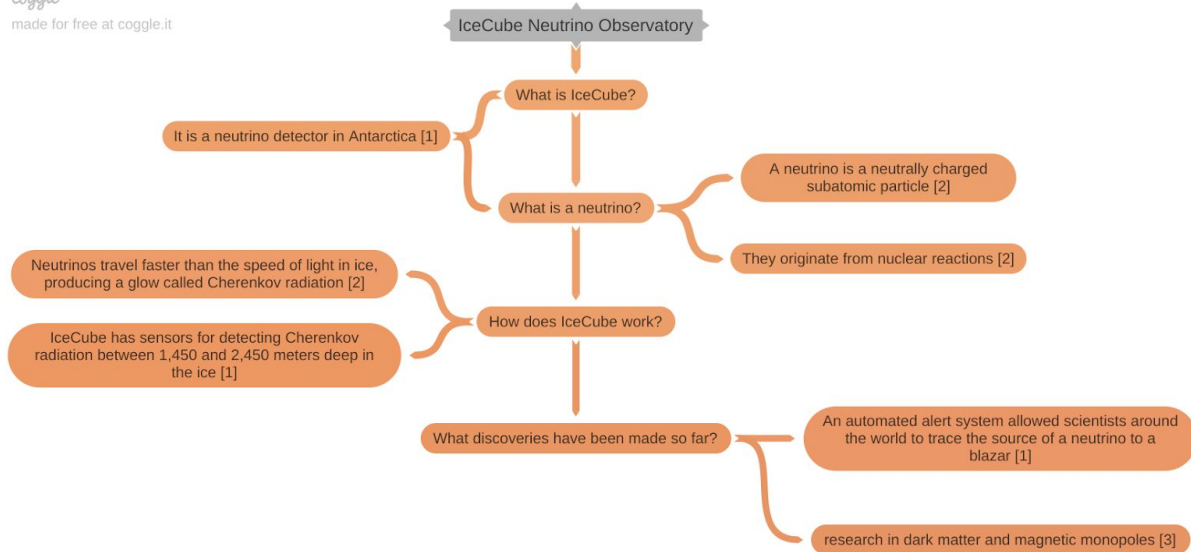
2.



An experiment is done to determine optimal tomato growing conditions. The process takes place during the summer when the amount of sunshine is maximized. Ten tomato seedlings are obtained and a patch in the garden is reserved with space for all ten. Each day, each tomato plant is given a different amount of water and a photo-sensor is used to determine the light level at each spot in the patch. The conditions that yield the plant with the most growth at the end of the experiment are the optimal tomato growing conditions.

Week 2: Concise Writing 2

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The IceCube Neutrino Observatory is a neutrino detector built throughout a cubic kilometer of ice in Antarctica [1]. Neutrinos are neutrally charged subatomic particles formed in nuclear reactions [2]. IceCube's sensors detect neutrinos through a glow the neutrinos produce called Cherenkov radiation [1]. This effect occurs when an object travels faster than the local speed of light [1]. Because light travels about 25% slower in ice, neutrinos travel faster than the speed of light in ice [1]. Data from IceCube has been used to increase understanding of the universe. Detecting an increase of neutrino detections indicates that a supernova will occur, allowing time for researchers to position telescopes before the supernova is visible [2]. IceCube's automated alert system was able to alert scientists around the world within minutes of a neutrino detection called the 170922A event [1]. Because of the speed of the alert, researchers were able to determine the most likely source of the neutrino to be a blazar [1]. This was the first time a neutrino's source was found to be from outside of the Milky Way [1]. Additional research using IceCube's data has been done on black matter and magnetic monopoles [3].

[1] Stephen Crass. **The IceCube Neutrino Detector at the South Pole Hits Paydirt.** *IEEE Spectrum*, 2018.

<https://spectrum.ieee.org/tech-talk/aerospace/astrophysics/the-icecube-neutrino-detector-at-the-south-pole-hits-paydirt>

[2] University of Wisconsin-Madison Department of Astronomy. **Neutrinos!** *Astro.wisc.edu*.

<http://www.astro.wisc.edu/~larson/Webpage/neutrinos.html#:~:text=Neutrinos%20are%20fundamental%20particles%20that,nuclear%20reactions%20here%20on%20earth.>

[3] The IceCube Collaboration. **The IceCube Neutrino Observatory Part IV: Searches for Dark Matter and Exotic Particles.** *33rd International Cosmic Ray Conference, Rio de Janeiro 2013 The Astroparticle Physics Conference, 2013.*

<https://arxiv.org/pdf/1309.7007.pdf>

Week 3: Technical Description 1

1.

- The baby was 8 pounds and 22 inches long at birth.
- The baby grew an inch per month and by the time she was 1 year old, she was 32 inches long.
- Radio transmission took 20 minutes between the Earth and the Moon.
- A hiker walked the 60 km trail in 4 days, making her average speed 15 km per day.

2. Start by opening the refrigerator. On the second to top shelf on the far left is a carton of eggs. Remove the carton and set it on the counter to the right of the stovetop. Next, return to the refrigerator. Behind where the eggs were is a tub of butter. Remove the tub of butter, shut the refrigerator door, and place the butter on the counter next to the eggs. Now stand facing the stove. Turn 90 degrees to the right and now directly ahead is a metal container of utensils. Retrieve a spoon from the bottom left section of the container. Above the utensil container is a row of cabinets. Open the furthest right cabinet and take out a plate from the right hand side. Place the spoon and the plate with the ingredients. Now it is time to cook. On the bottom right hand burner of the stove is sitting a red pan. First, take two spoonfuls of the butter and place them in the pan. Second, light the stove so that the fire is on high. Once the butter is melted, remove two eggs from the carton and crack them into the pan. Place the shells on the counter to the left of the stove. Using the same spoon from before, mix the eggs so that the yolks and whites are blended completely. Push the mixture around the pan so that clumps form. Finally, once no liquid eggs remain, turn off the stove, lift up the pan, and tilt it so that the eggs slide onto the plate.

Week 4: Technical Description 2

1. The acceleration due to Earth's gravity, g , was measured with a pendulum. First, the length of the pendulum was measured to be 20 cm. Second, the pendulum was hung straight down and the bob displaced 5 cm to the right. The pendulum was released and the number of times it returned to the same position as it swung back and forth was recorded for one minute. It was calculated to have returned to its original position every 0.90 seconds. The results were inserted into the formula predicted by Newton's Laws. The result for g was 9.81 m/s^2 .
2. The average horizontal distance bacteria travel after a person sneezes was measured. The trials were conducted in a room with no air conditioning, and therefore no air flow. First, a sample of 20 infected people was gathered. The height of each subject was required to be within 6 inches of 5 feet 6 inches tall. Second, petri dishes were arranged in 0.5 meter intervals out to 10.0 meters on the floor in front of the subject. Third, once each subject felt the urge to sneeze, the subject was required to aim the sneeze down the line without covering their mouth. Fourth, bacterial colonies were allowed to grow in the dishes for one week under ideal conditions. The category of dishes with the largest colonies were the ones corresponding to 8.0 meters. The results show that when a person sneezes, it is possible to spread infection to someone who happens to be 8.0 meters away. These results inform the epidemiology of spreading bacteria.