(E) Science Bee Round 1

Regulation Tossups

(1)   The motion of these devices is described using the small angle approximation of "sine theta equals theta". A system with two of these devices attached end-to-end exhibits chaotic behavior. Foucault [[foo-KOH]] demonstrated the rotation of the Earth using one of these devices, which is also a simple harmonic oscillator. For the point, name these devices that consist of a mass hanging on a string.

ANSWER: **pendulum**s (accept Foucault's **pendulum**; accept double **pendulum**; accept ballistic **pendulum**; prompt on "simple harmonic oscillator" or "SHO")

(2)   This genetic disorder may be caused by mutations in the P gene or the TYR gene, the latter of which contains tyrosinase, an enzyme involved in the production of melanin. Oculocutaneous [[ah-kyoo-loh-KYOO-teh-nee-us]] and ocular are common forms of, for the point, what genetic condition where the body produces little to no melanin, causing a lack of pigment in a person's skin, hair, and eyes?

ANSWER: **Albinism** (accept **Albino**; accept **Achromasia**; accept Oculocutaneous **Albinism** before mentioned; accept Ocular **Albinism** before mentioned)

(3)   The Aleutian [[ah-LOO-shen]] arc was formed by subduction along these types of locations, which were explored by vehicles such as Kaiko and Trieste. The deepest one of these locations is named after a nearby Pacific Island Chain, with its deepest point being Challenger Deep. For the point, name these depressions in the ground caused by tectonic plate movement, some of which include the Marianas.

ANSWER: Oceanic **Trench**es (accept Marianas **Trench**)

(4)   A variety of this mineral, along with iridium, is found at the K-Pg boundary and provides evidence for the hypothesis that an asteroid impact killed the dinosaurs. This mineral is found at the bottom of Bowen's reaction series. The "shocked" variety of this mineral was found at the Chicxulub crater, and its chemical name is silicon dioxide. For the point, name this mineral that is a seven on the Mohs hardness scale.

ANSWER: **Quartz** (accept Shocked **Quartz**)

(5)   Features of this constellation include the Barnard's Loop, which is an emission nebula located in the constellation's molecular cloud complex. The horsehead nebula is in this constellation's most defining feature, and the brightest stars in this constellation include Rigel and Betelgeuse. The stars Alnitak, Alnitam, and Mintaka make up the "belt" of, for the point, what constellation that is named for a hunter in Greek mythology?

ANSWER: **Orion**

(6)   Locations such as Haua Fteah and Atapuerca contained stone tools from this species' Mousterian culture. This species, which interbred with the closely related Denisovan group, became extinct roughly 30,000 years ago. For the point, name these hominids with heavy brows, named for the German valley where their remains were discovered.

ANSWER: **Neanderthals** (accept *Homo sapiens **neanderthal**ensis*)

(7)   In a controversy surrounding this concept, a hash code was sent between the opponents, which, when deciphered, contained the mention of fluxions. The publishing of the work *Nova Methodus pro Maximis et Minimis* furthered one man's claim to invent this subject often described as the "study of infinitesimals." For the point, name this subject that was invented independently by Gottfried Leibnitz and Isaac Newton.

ANSWER: **Calculus** (prompt on "fluxions" before mentioned)

(8)   Many ammonoids and conodonts went extinct during this period's Carnian pluvial episode. During this period, Pangaea began to separate into the continents of Laurasia and Gondwana. This period, which followed the mass extinction of trilobites in the "Great Dying," gave rise to the archosaurs. The Permian era preceded, for the point, what first geologic period in the Mesozoic Era, named for a set of three distinct rock layers?

ANSWER: **Triassic** Period

(9)   The outer portion of this region is determined by the Kármán line. This region is comprised of several layers, including one which absorbs much of the ultraviolet radiation from the Sun. Nitrogen, oxygen, argon, and carbon dioxide are the four predominant gases that make up, for the point, what collective term for the layers of gases surrounding a planet?

ANSWER: (Earth's) **Atmosphere** (prompt on "thermosphere" or "exosphere" before "several layers"; prompt on "air")

(10)   It's not luminosity, but this quantity is commonly calculated using the Faber-Jackson relation. Type 1a supernovae lie near the top of a namesake "ladder" that contains methods for determining this quantity. Standard candles are used to compute this quantity. Large values for this quantity are often expressed in parsecs. For the point, name this quantity, which for the Sun equals one astronomical unit.

ANSWER: **Distance** (from Earth)

(11)   Napoleonic-era surgeon Dominique Jean Larrey mandated that ships use this substance to sterilize when they did not have access to alcohol. The first known ingredients list for this substance can be found in the *Wujing Zongyao* [[WOO-JING ZONG-YOW]] of the Song Dynasty, and this substance was used to light fireworks prior to its military application. For the point, name this substance used to propel bullets in early firearms.

ANSWER: **Gunpowder** (accept **Black Powder**)

(12)   Some of these objects are engineered at the Renton and Everett factories, where parts like the fuselage and stabilizer are fused together with bolts. Bernoulli's principle explains how lift is generated when air passes over a certain part of these objects. It's not a helicopter, but for the point, name these class of vehicles that can fly, examples of which include the Airbus A380 and Boeing 787.

ANSWER: air**plane**s (or aero**plane**; accept **jet**; or jet**plane**)

(13)   The only stand-alone group of Hilbert axioms concerns an axiom about this property, which is equivalent to Playfair's axiom. Two vectors that have a cross product of zero have this property. Euclid's fifth postulate is named for this property and implies that all angles of a rectangle are right angles. Two lines with this property have the same slope. For the point, name this property of two lines in the same plane that will never intersect.

ANSWER: **Parallel** (accept **Parallel** Postulate)

(14)   Kupffer cells break down red blood cells in this organ, and most of the blood supply of this organ is delivered by the portal vein. This organ is the primary site of the urea cycle and gluconeogenesis. Late-stage scarring of this organ is termed cirrhosis, while its inflammation is known as hepatitis. For the point, name this digestive organ that detoxifies blood and produces bile.

ANSWER: **Liver**

(15)   If the polar angle is this quantity, the resulting point will be on the negative side of the x-axis. The Madhava-Leibniz series approaches this number, and it's not *e*, but this was the first number proven to be transcendental. This number times four-thirds times the radius cubed gives the volume of a sphere. For the point, give this term for the ratio between a circle's circumference and its diameter, approximately 3.14.

ANSWER: **Pi** (accept **Archimedes' Constant**; accept **3.14** before mentioned)

(16)   This particle's interaction with other elementary particles can be observed through Raman scattering. In the Standard Model, this hadron is categorized as having electroweak interactions, and this particle is unified with the W and Z gauge bosons. For the point, name these massless elementary particles symbolized by the Greek letter gamma, the quanta of the electromagnetic field, and more specifically light.

ANSWER: **Photon**s

(17)   The malloc function in C and C++ allocates this resource, and Java uses automatic garbage collection to reclaim this resource, which is stored near the main processor in a CPU cache. The non-volatile type of this resource retains data even without a power source. For the point, name this computer resource used to store information that comes in a random access type abbreviated RAM.

ANSWER: **Memory** (accept Random Access **Memory**; accept **RAM**; accept Virtual **Memory**; accept **Storage**; prompt on "data")

(18)   This quantity's phase type is described as the rate at which a wave propagates in a medium. The time derivative of this quantity is acceleration, and the unit of this quantity is usually expressed in meters per second. Displacement divided by time equals, for the point, what vector quantity that consists of both speed and direction, denoted as "v"?

ANSWER: **Velocity** (accept **Phase Velocity**; accept **v** before mentioned; prompt on "Speed")

(19)   A mutation in one species of these animals, the Stickleback, has allowed them to adapt between different habitats. The majority of these animals belong to the class Actinopterygii [[ack-tee-nop-TEH-rih-gee]]. Respiration in these animals occurs through a closed-loop circulatory system and gills. For the point, name these aquatic animals, examples of which include lampreys, sharks, and piranhas.

ANSWER: **Fish** (accept Stickleback **Fish**; accept Cat**fish**; prompt on "Shark" before mentioned)

(20)   This plant commonly grows alongside, and is often mistaken for, the Virginia creeper. This plant contains a resin called urushiol that induces a form of contact dermatitis, and "black-spot" deposits caused by this plant can be treated with topical corticosteroids. The phrase "Leaves of three, let it be" applies to, for the point, what plant of the genus Toxicodendron that is closely related to other species named "oak" and "sumac", whose sap causes an itchy rash?

ANSWER: **Poison Ivy** (accept **Poison Oak**; accept **Poison Sumac**; accept **Toxicodendron radicans**)

(21)   A hyperfine transition in this element leads to a form of radiation called the 21-centimeter line. This element's alpha emission line is dark red as part of its Balmer series. This element makes up 75 percent of the baryonic mass of the universe. This element is fused by main sequence stars to produce helium. For the point, name this lightest and most abundant element in the universe.

ANSWER: **Hydrogen**

(22)   These objects are harvested to make beer by the Quidi Vidi Brewing Company in Newfoundland. The largest current one of these objects was first detected in the Weddell Sea and the largest one on record, B-15, broke off from the Ross Ice Shelf in March, 2000. Mostly found near Greenland and Antarctica is, for the point, what type of floating, frozen object that sunk the RMS *Titanic*?

ANSWER: **Iceberg** (accept **Iceberg** B-15)

(23)   These types of organisms are classified by the U.S. Fish and Wildlife Service, which is also responsible for their protection. The IUCN's Red List lists the status of these creatures, and they're broken down into categories with abbreviations such as VU or CR. The gray wolf and the humpback whale are examples of, for the point, what type of animals that are classified as vulnerable, threatened, and near-extinct?

ANSWER: **Endangered** Species (accept clear knowledge equivalents; accept statuses such as **Vulnerable** or **Threatened** before mentioned)

(24)   Structures on this entity include the smooth Borealis basin. The largest mountain in the solar system, Olympus Mons, is on this planet. A recent expedition to this planet to search for signs of life in 2021 discovered the presence of hidden water in a canyon. The Opportunity and Curiosity rovers landed on, for the point, what planet named for the Roman god of war, the fourth planet from the sun?

ANSWER: **Mars**

(25)   Sulfonylureas [[suhl-fah-neel-LUH-ree-us]] are a class of organic compounds used to treat this disease, which is caused by the loss of beta cells in some patients. One form of this disease involves the inability of cells to respond to insulin, and is often caused by a lack of physical activity or poor diet. For the point, name this disease characterized by high blood sugar levels that can be classified into Type 1 and Type 2 varieties.

ANSWER: **Diabetes** Mellitus (accept Type 1 **Diabetes**; accept Type 2 **Diabetes**)

Extra Questions

(1)   This organ is made up of three layers, with its spaces being filled with vitreous and aqueous humor. Diseases that affect this organ include conjunctivitis and cataracts, and it contains specialized photoreceptor cells called rods and cones. The lens, cornea, and iris are structures that are part of, for the point, what organ of the visual system that is responsible for helping us see?

ANSWER: **eye**s (accept **eye**balls)

(2)   Johann Wolfgang von Goethe [[GUR-tuh]] published a comprehensive book describing this property, wherein he stated this property is formed from the interplay of darkness and light. Thomas Young proposed a trichromatic theory postulating that this property can be replicated by a combination of three lights. For the point, name this visual property derived from the spectrum of light's interaction with the eye.

ANSWER: **Color**