

(MS) Science Bee Round 6

Regulation Tossups

(1) The kudzu variety of this plant, which is native to Japan, is referred to as the “invasive [this plant] that ate the south” since it prevents the photosynthesis of other grasses and trees by stealing their sunlight. Hormones such as jasmonates and indole-3-acetic acid mediate the coiling action exhibited by tendrils which have adhesive pads that assist this plant in climbing. Grapes grow on, for the point, what long, nonwoody plants that use neighboring plants and structures for support?

ANSWER: **Vines** (accept Kudzu **Vines**; accept Grave**vines**)

(2) Georg Cantor names one of these mathematical objects, which lacks density and contains only boundary points. The intersection of two disjointed forms of these objects yields the empty one of them. These objects, which are “null” when they have no elements, do not include any repeated elements. For the point, name these collections of elements typically written with curly brackets that can be depicted using Venn diagrams.

ANSWER: **Sets** (accept Cantor **Sets**; accept Empty **Sets**; accept Null **Sets**)

(3) This system was developed at the same time as GLONASS, which suffered from incomplete coverage. Lockheed Martin designed objects as part of Block Three, which enable this system to work. The time of transmission and time of arrival are broadcast by this system's satellites. The United States Space Force operates, for the point, what system that allows users to navigate the globe?

ANSWER: **Global Positioning System** (or **GPS**)

(4) This botanist earned his doctorate from the University of Harderwijk [[har-dehr-WEEK]], where he wrote a dissertation hypothesizing that malaria only appeared in areas with clay-rich soils. This scientist established a botanical garden while serving as the Professor of Medicine at Uppsala University in Sweden. For the point, name this “father of modern taxonomy” who formalized binomial nomenclature.

ANSWER: Carolus **Linnaeus** (or Carl von **Linné**)

(5) An outbreak of this condition in Australia resulted in the discovery of congenital cataracts in infants born to mothers diagnosed with this disease. This disease, also known as “three-day measles”, can be prevented through a vaccine whose name is in conjunction with the measles and mumps. Primarily transmitted through airborne droplets from an infected individual, this is, for the point, what contagious infection caused by an eponymous virus that produces a red rash, a condition also known as German measles?

ANSWER: **Rubella** (accept **German Measles** before mentioned, accept **Three-day Measles** before mentioned; do not accept “Measles”)

(6) The preliminary stages of using this device see the administration of either a CQT or a GKT. "General state" and "specific point" are two countermeasures of this device, the latter of which may include physical measures such as pinching one's own skin or biting one's own tongue. A person's skin conductance response, respiration, and heart rate are measured in, for the point, what device, typically used by law enforcement to assess a person's veracity based on their answers to a series of questions?

ANSWER: **Polygraph** Test (or **Lie Detector** Test)

(7) Some animals performing this behavior use the lek system, which is a group performance that is typically displayed by birds. Other birds, such as the bowerbird, express this behavior by forming elaborate structures made up of twigs covered with bones and shells, while the birds of paradise exhibit this behavior by refining a dance inherited from their fathers. For the point, name this behavior animals exhibit when searching for mates.

ANSWER: **Mating** (accept synonymous answers; accept **Reproductive** Tactics; accept **Courtship**; prompt on "Polygyny", "Polygamy", and "Monogamy")

(8) Some fluvial-dominated types of these locations are characterized by homopycnal flows, in which river water mixes with basin water. Hyperpycnal flows characterize these landforms, which are formed by river water depositing sedimentary rock as turbidites. The Tocantins river meets the Amazon at one of these landforms. For the point, name these features that form from deposited sediments in locations where rivers meet another body of water.

ANSWER: River **Delta**

(9) This is the simplest molecule that can undergo pi-pi stacking. The prefixes "ortho", "meta", and "para" describe positions on this molecule in most EAS reactions, including the Friedel-Crafts reaction that adds an alkyl group onto it. A hydroxyl group is added to this molecule to produce phenol. This simplest aromatic molecule is often drawn as a hexagon around a circle. For the point, name this molecule whose formula is C₆H₆.

ANSWER: **benzene** (accept **C₆H₆** before mention)

(10) The Leviathan Patera is a large cryovolcanic system on this celestial body, which was discovered in 1846 by William Lassell. This moon has the lowest average temperature of all known objects in the Solar System. Due to its retrograde orbit, it is believed this moon may have once been a Pluto-like dwarf planet made of mostly frozen nitrogen. For the point, name this largest moon of Neptune.

ANSWER: **Triton**

(11) One of these compounds reacts with a carboxylic acid in the Fischer esterification. In IR spectroscopy, these compounds show a broad peak at 3300 inverse centimeters due to their hydrogen bonding. Permanent blindness can result from consuming the "wood" type of these compounds. For the point, name these compounds with a hydroxyl group, which include ethanol and an isopropyl type used as a disinfectant.

ANSWER: **alcohols**

(12) A hybrid algorithm that performs this task is named after Tim Peters. One algorithm for this task relies on partitioning data around a pivot and then calling itself recursively. The "insertion" and "selection" forms of algorithms for this task typically have the worst runtime. The concept of stability is most often applied to algorithms for this task, which the "quick" form notably lacks. For the point, name this task of putting elements of a list in order.

ANSWER: **Sorting** (accept **Timsort**; accept Insertion **Sort**; accept Selection **Sort**; accept Quick **Sort**)

(13) An early mathematics textbook from this country that discussed bounding fields and proportions is titled *The Nine Chapters on the Mathematical Art*. The first seismometers were developed in this country, as well as the first compasses made of lodestone. Early blast furnaces were developed in this country by Du Shi. For the point, name this country, which produced many technological developments during the Han Dynasty.

ANSWER: **China** (or **Zhōngguó**; accept People's Republic of **China**; or **Zhōnghuá** Rénmín Gònghéguó; or **PRC**; accept Imperial **China**)

(14) This substance's OIP estimation is found by multiplying porosity, saturation, and volume. Catalytic reforming converts an intermediate of this substance called naphtha [[NAF-thuh]] into liquid reformates. This substance, which can be cracked and broken down into petrochemicals, is often extracted alongside brine and natural gas via fracking. For the point, name this liquid fossil fuel which is refined into diesel fuel and gasoline.

ANSWER: **Petroleum** (accept **Crude oil**; prompt on "Oil" or "Petrol" or "Gasoline"; prompt on "Hydrocarbons")

(15) This type of relationship can be characterized by a Pearson correlation coefficient value of one or a negative one. Cramer's rule can be used to find a solution to a system of these types of equations, which can also be solved via Gauss-Jordan elimination or substitution. For the point, name this term that describes polynomials with degree one that have constant slope, examples of which include the line y equals three x plus one.

ANSWER: **linear** (accept **linear** equations)

(16) The Green-Tao Theorem states that one can find arbitrarily long arithmetic sequences of these numbers. According to the Fundamental Theorem of Arithmetic, every positive integer greater than one can be expressed as the unique product of these numbers, which can be computed using the Sieve of Eratosthenes [[ehr-uh-TOSS-thuh-neeZ]]. 2, 3, and 5 are examples of, for the point, what numbers, often contrasted with composite numbers, that are only divisible by 1 and themselves?

ANSWER: **Prime** Numbers

(17) This organelle contains the proteins fibrillarin and nucleophosmin. Proteins are detained and immobilized in this organelle, a process known as its namesake detention. RNA polymerases one and three transcribe ribosomal RNA inside this organelle. The assembly of ribosomes begins in, for the point, what dense structure, the largest spherical component of the nucleus?

ANSWER: **Nucleolus** (accept **Nucleolar** Detention; prompt on "Nucleus")

(18) The properties of this substance control the composition of organisms in edaphic communities. High precipitation can cause eluviation, or leaching, within this substance. Pedogenesis is the process of forming this substance, which is arranged into O, A, B, and C horizons. Decayed organic matter within this substance is called humus. Clay, sand, and silt make up, for the point, what material in which plants grow?

ANSWER: **soil** (accept **dirt**; accept **earth**; accept **topsoil**)

(19) The regions between these geologic features can contain depressed and raised areas known as grabens and horsts. The hanging wall lies above the plane of one of these features in the "normal" type, while the "reverse" type of these features sees the footwall above the plane. Types of these structures include dip-slip and strike-slip. For the point, name these planar fractures in rock, of which a notable one is named after San Andreas.

ANSWER: **Faults** (accept normal **fault**; accept reverse **fault**; accept dip-slip **fault**; accept strike-slip **fault**; accept San Andreas **Fault**)

(20) These objects can be classified as carbonaceous, silicate, or metal-rich. The Late Heavy Bombardment was marked by a large number of collisions involving planets and these objects. In 2014, water vapor was detected on one of these objects named Ceres, while other examples in the same location include Vesta. For the point, name these bodies that exist between Mars and Jupiter in a namesake "belt."

ANSWER: **Asteroids** (accept **Asteroid** Belt)

(21) This quantity is an imaginary number in Tachyonic [[TAK-yon-ick]] Fields. Two different types of this quantity are equated in Einstein's equivalence principle. This quantity is zero for particles such as photons and gluons, and the gravitational force between two bodies is proportional to the product of this quantity for both. For the point, name this quantity measured in kilograms.

ANSWER: **Mass** (accept Imaginary **Mass**; or Gravitational **Mass**; or Inertial **Mass**)

(22) These structures are visualized using G-banding, which uses Giemsa stain to produce a karyotype. Synapsis is the physical pairing of these structures with two arms labeled "p" and "q." Spindle fibers attach to these structures at the kinetochore, which assembles onto the centromere during mitosis. Human diploid cells have 23 pairs of, for the point, what structures containing densely packed DNA?

ANSWER: **Chromosomes** (accept **Chromatids**; prompt on "Centromere" before mentioned)

(23) This quantity for a loop times its area is equal to the magnitude of the magnetic dipole moment of the loop. The total sum of this quantity flowing into a node must equal the total sum of this quantity flowing out of it, according to Kirchhoff's junction rule. Electrical power is the product of voltage and this quantity. For the point, name this quantity, equal to voltage over resistance by Ohm's law.

ANSWER: Electric **Current** (prompt on "I")

(24) To estimate this quantity, Clair Patterson used lead-lead dating of objects named for Canyon Diablo. To determine this value, one scientist neglected convection and nuclear processes, leading Thomas Huxley to declare that value was magnitudes too small. Lord Kelvin was the first to devise this quantity, which has been calculated using meteorites and zircon deposits. For the point, name this quantity relating to our planet, which is estimated to be about 4.5 billion years.

ANSWER: **Age** of the **Earth**

(25) Catastrophic examples of this phenomenon created large formations such as Dry Falls and are often named for Missoula. A type of this phenomenon called jökulhlaup [[yo-KOOL-lahp]] results from volcanic subglacial eruptions or geothermal heating. Glacial retreats can result in examples of this phenomenon, including one that carved out the Columbia River Gorge. For the point, name this phenomenon in which ice dams melt, leading to an overflow of water.

ANSWER: **Floods** (accept Glacial **Floods**)

(26) Clumps of rough endoplasmic reticulum in these cells are known as Nissl bodies, and these cells are supported by oligodendrocytes, a type of glial cell. The Law of Dynamic Polarization in these cells was formulated by Santiago Cajal [[kah-HALL]], who advanced the idea that these cells are the functional units of the nervous system. Schwann cells, axons, and dendrites are parts of, for the point, what cells in the body that send and receive electrical and chemical signals?

ANSWER: **Neurons** (or **Nerve Cells**)

(27) The young of these animals are called crias, and their enameled teeth differentiate these vertebrates from the similar vicuña. The ccara and tapada are breeds of this relative of the guanaco with wool of varying thickness. This animal is the largest camelid in the Western Hemisphere. For the point, name these domesticated pack animals of South America, a larger cousin of the alpaca.

ANSWER: **Llama** (accept **Alpaca** before "enameled teeth")

(28) Mergez is a third magnitude star in this entity, and in Malaysia and Indonesia, this constellation is identified as a boat or canoe. A technique involving drawing an imaginary line through this entity's stars of Merak and Dubne is used to find Polaris. For the point, name this pattern of stars that look like a bowl with a handle, comprising seven bright stars of the Ursa Major constellation.

ANSWER: **Big Dipper** (accept the **Plough**; prompt on "Ursa Major" before mentioned; do not accept or prompt on "Little Dipper")

(29) This galaxy is surrounded by a ringlike filament of stars that wraps around it three times. That ring surrounding this galaxy is the Monoceros Ring, which may have been torn off nearby Canis Major Dwarf Galaxy. This galaxy and the Andromeda galaxy are the two main constituents of the Local Group. The Orion Arm is a component of, for the point, what galaxy that contains the solar system?

ANSWER: **Milky Way** Galaxy

(30) Robert Chambers published an anonymous book that shifted public opinion about this general theory. An 1859 work that advanced this theory rejected the conclusions of William Paley's *Natural Theology*. The idea of giraffes stretching their necks to reach high leaves was a faulty explanation of this theory by Jean-Baptiste Lamarck. For the point, name this theory of "descent with modification," which was proposed by Charles Darwin through natural selection.

ANSWER: **Evolution** (accept **Natural selection**; prompt on "survival of the fittest")

Extra Questions

(1) Severo Ochoa won the 1959 Nobel Prize in Medicine for discovering an enzyme that could synthesize this molecule. Recent studies have shown that the "micro" variety of this molecule plays a role in regulating cancer metabolism. Examples of this molecule include its "heterogenous nuclear", "transfer", and "messenger" varieties. Uracil replaces thymine in, for the point, what nucleic acid, that, unlike DNA, is single-stranded and made up of a ribose sugar?

ANSWER: **RNA** (or **ribonucleic acid**; accept micro**RNA**; or mi**RNA**; accept transfer**RNA**; or **tRNA**; accept messenger**RNA**; or m**RNA**; accept heterogenous nuclear **RNA**; or hn**RNA**; prompt on "nucleic acid")

(2) One system that classifies this concept was developed by Charles Warren Thornthwaite in 1931. The earth's movements are described by Milankovitch cycles, which describe the effects its eccentricity and tilt have on this concept. This concept is classified based on five characteristic vegetations, including rainforest, grassland, and desert. For the point, name this concept that describes long-term weather patterns in a particular area.

ANSWER: **Climate** (accept Thornwaite **Climate** Classification system; prompt on "Weather" before mentioned)