

Euros Science Bee Round 1 (Varsity/JV)

Regulation Tossups

(1) A system of these features within Nubian Sandstone has been exploited by the Great Man-Made River. Over-harvesting of these features can cause sinking, as seen in the Central Valley. Confining beds can separate layers of these features, which connect to qanats [[kah-NATS]]. For the point, name these underground features, which are bodies of permeable rock bearing water.

ANSWER: **Aquifers**

(2) This woman supervised Raymond Gosling when he took *Photo 51*. Having died of cancer in 1958, this woman was not awarded the 1962 Nobel Prize in Medicine along with Maurice Wilkins, Francis Crick, and James Watson due to the prohibition on awarding posthumous Nobel Prizes. For the point, name this British chemist whose X-ray crystallography led to the discovery of DNA's structure.

ANSWER: Rosalind **Franklin** (or Rosalind Elsie **Franklin**)

(3) The Heck reaction and Suzuki coupling both require catalysts of this element. Ford Motor Company has stockpiled this metal, which costs over \$1100 an ounce, in response to disruptions of Russian exports to ensure it could make catalytic converters. Named after an asteroid that was named after the Greek goddess of wisdom, this is, for the point, what silver-white metal with the symbol Pd?

ANSWER: **Palladium** (accept **Pd** before mentioned)

(4) This disease can be identified by the presence of oligoclonal bands in the cerebrospinal fluid. Patients with involuntary eye movement, speech broken up into syllables, and tremors perpendicular to direction of movement almost certainly have this disease. For the point, name this disease of the central nervous system which disrupts the ability of neurons to send or receive action potentials by destroying the myelin sheaths protecting the nerves, abbreviated MS.

ANSWER: **Multiple Sclerosis** (accept **MS** before it's mentioned)

(5) When these rapidly spinning objects emit radiation toward Earth, they are known as pulsars. The Magnificent Seven is a name referring to a group of these objects, whose mass cannot exceed the TOV limit without becoming a black hole. For the point, name these extremely dense objects composed of their namesake charge-less particles.

ANSWER: **Neutron** Stars (accept **Pulsars** before mentioned)

(6) These compounds can be thermoset by heating them with sulfur in Charles Goodyear's vulcanization process, in which branching is created by the "core first" and "star" methods. In the chain-growth method of synthesizing these compounds, they are only extended by one sub-unit at a time. Teflon, nylon and rayon are examples of, for the point, what macromolecules that are composed of chains of monomers?

ANSWER: **Polymers** (prompt on "macromolecules" before read; prompt on "rubber"; anti-prompt on specific polymers such as "Teflon," "Nylon," and "Rayon")

(7) One checkpoint in this process ensures that kinetochores are attached to spindle fibers. Cytokinesis shortly follows this process, which occurs after the G2 phase and is abbreviated M. The phases of this process include prophase, anaphase, and telophase. For the point, name this asexual division of a cell that produces two identical daughter cells.

ANSWER: **mitosis** (prompt on “cell division”; do NOT accept “meiosis”)

(8) In this programming language, an array or collection can be cycled through using its “enhanced for” loop. This language supported by the JQuery library has a namesake “Virtual Machine” that enables it to run across multiple operating systems. For the point, name this programming language owned by Oracle whose logo is a coffee cup, and takes its name from an Indonesian island.

ANSWER: **Java** (do NOT accept “JavaScript”)

(9) The Lie bracket is an example of a function with the “anti” form of this property. Abelian groups are often named for this property, which is possessed by linear functions but not by the composition of multiple functions. Addition and multiplication possess, while subtraction and division lack, for the point, what mathematical property where changing the order of numbers does not change the result?

ANSWER: **Commutative** Property (or **Commutativity**)

(10) These marine animals were the subject of a series of monographs by Charles Darwin, who then declared that he “hated [these animals] as no man ever did before.” These animals were originally classified as mollusks, although they are actually arthropods that use a cement gland to remain in place. For the point, name these marine invertebrates that often cling to ships or whales.

ANSWER: **Barnacles** (or **Cirripedia**)

(11) A version of this machine named for Felix Wankel makes use of an eccentric rotary design in order to maximize compactness. Components such as spark plugs and crankshafts are used in these machines, which are typically laid out in “boxer,” “V,” or “inline” shapes and can complete a cycle in two or four strokes. For the point, name this type of machine, a heat engine which relies on the burning of fuel, used to power vehicles such as lawnmowers, boats, and cars.

ANSWER: **Internal Combustion** Engines (accept **ICE** or **IC** Engine; prompt on “heat engine” before read; prompt on “Engine”)

(12) This author of the Ninth Bridgewater Treatise extended Wolstenholme's theorem on congruences when taken modulo to a prime number squared. This person worked with C. G. Jarvis to create a device that was programmable via punch cards. This person held Saturday night soirées, at which Harriet Martineau described how guests were more interested in a doll rather than his difference engine. For the point, name this father of computing who worked with Ada Lovelace on the Analytical Engine.

ANSWER: Charles **Babbage**

(13) Harlow Shapley claimed galaxies beyond the Milky Way were in fact these objects in the "Great Debate." The Cat's Eye is an example of these objects, which are often named for their resemblance to animals such as an eagle and a horse's head. For the point, name these often brightly colored objects in the night sky which contain cosmic dust which can clump to form stars.

ANSWER: **Nebulae** (accept Cat's Eye **Nebula**; accept Eagle **Nebula**; accept Horsehead **Nebula**)

(14) A transmembrane receptor for this compound, which is synthesized in the beta cells, belongs to the class of receptor tyrosine kinase. Endogenous production of this compound is reflected in the C-peptide plasma levels, which aids in distinguishing between Type One and Type Two diabetes. For the point, name this hormone produced by the pancreas whose primary role is to regulate glucose metabolism in the body.

ANSWER: **Insulin**

(15) Omeprazole, a heartburn and ulcer drug, is a type of drug known as this particle's "pump inhibitor." The Georgi-Glashow model predicts that this particle has a half-life of 10-to-the-thirty-third-power years, but its decay has never actually been observed. For the point, name this particle in the nucleus represented by a chemical element's atomic number.

ANSWER: **Proton**

(16) Unlike their closest relatives, these animals' males care for their eggs by fanning them to circulate oxygen around the nest. When a female one of these animals dies, the males compete to determine who will transform into a female to replace her in a form of sequential hermaphroditism. These animals, which make up the subfamily Amphiprioninae, exhibit symbiosis with a group of non-mobile cnidarians. For the point, name these striped fish that live within sea anemones [{"ah-NEH-muh-nees"}].

ANSWER: **Clownfish** (accept **Anemonefish** before "anemone" is mentioned; prompt on "Fish")

(17) This quantity names a reference frame that has a special case called the center-of-mass frame. Per Newton's Second Law of Motion, the rate of change of this quantity is equal to the net force on an object, and, like energy, this quantity is conserved in a closed system. Measured in kilograms times meters per second, this is, for the point, what quantity, the product of mass and velocity?

ANSWER: **Momentum** (or **Momenta**; or **Momentums**; accept Linear **Momentum**; accept Translational **Momentum**; reject "angular momentum")

(18) Echinocandins are drugs that block the synthesis of this cellular structure made of chitin in some pathogenic fungi. In bacteria, this cellular structure contains murein, and in plants, this cellular structure can be reinforced with lignin. Absent in the cells of protozoa and animals, this is, for the point, what rigid specialized form of the extracellular matrix, which makes up the outermost layer of a plant cell, found outside the plasma membrane?

ANSWER: Cell **Wall**

(19) One theorem named for these numbers gives their distribution as proportional to “ n divided by $\log n$.” Goldbach's Conjecture states that any even number can be expressed as a sum of two of these numbers, while the fundamental theorem of arithmetic describes the expression of integers as a product of these numbers. Two, three, and five start the beginning sequence of, for the point, what numbers, whose only factors are themselves and one?

ANSWER: **Prime** Numbers (or **Primes**)

(20) The frequency of these phenomena is measured relatively with the Zürich or Wolf number. Gustav Spörer documented an apparent absence of these phenomena during the Maunder Minimum. The frequency of these phenomena varies on an 11-year cycle that is related to stellar magnetic field reversals. For the point, name these areas of lower temperature on the surface of the Sun.

ANSWER: **Sunspots**

(21) Most of this substance was formed during the Pennsylvanian time period in wetlands that are known as this substance's "forests." One of the primary causes of acid rain is the release of sulfur from the bituminous form of this substance. Lignite and anthracite are two forms of, for the point, what fossil fuel, known for being mined in Wales and northern Pennsylvania?

ANSWER: **Coal**

(22) This country's first satellite was launched in 1980 aboard the SLV-3, or Satellite Launch Vehicle. Astronauts from this country are called "vyomanauts". Following the death of a vyomanaut from this country in the Columbia disaster, this country renamed its MetSat-1 to the Kalpana-1. For the point, name this country whose space program is headquartered in Bangalore.

ANSWER: Republic of **India** (or **Bhārat** Gaṇarājya)

(23) It's not the lungs, but Goodpasture syndrome typically affects this organ, with anti-basement membrane antibodies leading to its damage. The juxtaglomerular apparatus present in this organ secretes renin, a key enzyme involved in blood pressure regulation. For the point, name this organ whose primary function is to remove waste products and excess fluid from the body.

ANSWER: **Kidney** (accept **Ren**)

(24) This electromagnetic wave is produced by a cavity magnetron, which was used in early radar devices. This electromagnetic wave occupies a wavelength range of one millimeter to 30 centimeters, hence residing between radio waves and infrared radiation. For the point, name this electromagnetic wave used to heat food in a namesake ovens.

ANSWER: **Microwave** (accept **Microwave** Oven)

(25) A sudden, sharp increase in the speed of this entity is classified as a squall. The direction of this entity is indicated by a weather vane, while the direction and speed of this entity is measured by an anemometer. Planetary, trade, and westerlies are three forms of, for the point, what natural movement of air, which is caused by the uneven heating of the Earth's surface?

ANSWER: **Wind** (accept **Wind** Speed; accept Katabatic **Wind**; accept Planetary **Wind**; accept Trade **Wind**)

(26) Dr. Leonard Lee Baily said his nonbelief in evolution was the reason for choosing one of these organs from a baboon for one experimental procedure instead of from a chimpanzee. The first successful artificial example of this organ was the Jarvik-7 in 1982, and patients with arrhythmia of this organ may have pacemakers installed to provide electrical shocks. Connected to the lungs by the pulmonary arteries, this is, for the point, what vital organ, the main organ of the cardiovascular system?

ANSWER: **Heart**

(27) This force can be calculated by an inverse-square law that was confirmed by Henry Cavendish's torsion balance experiment. By Newton's Second Law, this force can be calculated on Earth using the formula "mass times nine point eight meters per seconds squared." For the point, name this fundamental force that attracts objects with mass.

ANSWER: **Gravity**

(28) These vessels often use air-independent propulsion and are often configured to carry ballistic missiles, such as the Trident. Periscopes are often attached to these vessels, which are related to bathyscaphes and are often powered by nuclear energy. The pressure hull maintains the structural integrity of, for the point, what vessels, which operate underwater?

ANSWER: **Submarines** (do NOT accept or prompt on "Submersible")

(29) These bodies of water may experience thermal stratification, which can be divided into the epilimnion, thermocline, and hypolimnion layers. Tarns are examples of these bodies of water formed in the cirques of mountain regions, and the fluvial type of these bodies of water is formed by running water. For the point, name these bodies of standing water which are completely surrounded by land.

ANSWER: **Lakes** (accept **Ponds**; accept Fluvial **Lakes**)

(30) The Silurian hypothesis paper proposed that unusual deposits of this element could be the primary evidence for a lost advanced civilization, and this element names a period that includes the Mississippian subperiod. Isotope ratios of this element are used to detect ancient climate change, and, along with hydrogen, this element makes up the fossil fuels. For the point, name this element whose 12 and 14 isotopes are used for radiometric dating.

ANSWER: **Carbon** (accept **Carbon**-12; accept **Carbon**-14)

Extra Question

(1) This object contains a depression in Lacus Felicitatus, an irregular *mare* patch named Ina. Swirls on this body have high albedo and may have been created by magnetic anomalies that moved dust. A bistatic radar experiment on the *Clementine* identified that this body could have frozen water under its surface, and this body's dark side was reached by the Chinese Chang'e Four spacecraft. The tides are created by, for the point, what satellite of the Earth?

ANSWER: **Moon**