

(MS) Science Bee Round 3

Regulation Tossups

(1) According to the Milwaukee Protocol, treatments of this disease involve placing an infected person into an induced coma through the use of anesthesia made of midazolam and ketamine. The virus causing this disease, uncommonly referred to as "hydrophobia", emerges from protein aggregates in the brain called Negri bodies. Foaming at the mouth is notable symptom of, for the point, what viral disease, caused by the genus Lyssavirus, that is spread through animal bites?

ANSWER: **Rabies** (accept **Rabies** Encephalitis; accept **Hydrophobia** before mentioned; accept **Lyssa** before "Lyssavirus" is mentioned)

(2) These particles, first proposed by George Zweig and Murray Gell-Mann, are believed to be among the essential building blocks of matter and are considered a fundamental secondary group of elementary particles. These particles come in six forms, and they partner with other elementary particles to form protons and neutrons. For the point, name these charged particles with flavors such as top, charm, and strange.

ANSWER: **Quarks** (accept **Quark** Model; accept Up **Quarks**; accept Down **Quarks**; accept Charm **Quarks**; or Strange **Quarks**; accept Top **Quarks**; accept Bottom **Quarks**)

(3) The Bajau people of Southeast Asia have enlarged forms of this organ as an adaptation for diving. Parts of this organ branch into arteries surrounded by PALS tissue. Damage to this organ can result in overwhelming sepsis from encapsulated organisms. Sickle cell anemia can sequester this organ that contains white and red pulp. For the point, name this abdominal organ that destroys old red blood cells.

ANSWER: **Spleen**

(4) C compilers turn source code into code named after these entities. All classes in Java are a subclass of a class named for these entities. Creating these entities typically involves calling a constructor or using the keyword "new," and a central programming paradigm involves these entities, which are instances of classes. For the point, name these things, whose importance in programming leads languages like Java to be termed "[these things]-oriented."

ANSWER: **Objects** (accept **Object** code; accept **Object**-oriented programming)

(5) These bodies can be found in the inner cell mass, and they divide in gastrulation to form germ layers. The depletion of the functional mesenchymal [[meh-zen-KYE-muhl]] type of these bodies in bone correlates to the increase in adiposity. The hematopoietic type of these bodies, from which blood cells ultimately derive, is found in bone marrow and can be transplanted to treat leukemia. Sometimes sourced from embryos, these are, for the point, what undifferentiated cells which can multiply indefinitely and generate various other types of cells?

ANSWER: **Stem** Cells (accept Mesenchymal **Stem** Cells; accept Hematopoietic **Stem** Cells; accept Embryonic **Stem** Cells or other specific types)

(6) Animals exhibiting this behavior only do so during a specific time span in what is termed as the “critical stage,” which was determined by Konrad Lorenz as 32 hours after hatching. Lorenz, who coined the term for this behavior, observed it during an experiment after hatching graylag geese eggs from an incubator. A group of baby ducks following their mother displays the filial form of, for the point, what instinctive behavior exhibited when animals form an attachment to their first visual target?

ANSWER: **Imprinting** (accept Filial **Imprinting** before mentioned; accept Limbic **Imprinting**; accept Sexual **Imprinting**)

(7) In the ELISA assay, the primary and secondary varieties of these molecules can be used to detect the target protein of interest. These molecules, which are made up of four polypeptide chains, are divided into two Fab fragments and one Fc fragment, and vaccines stimulate the production of these molecules in order to provide immunity against diseases. Immunoglobulin is another name for, for the point, what Y-shaped proteins that regulate the immune response by binding to an antigen?

ANSWER: **Antibody** (or **Antibodies**; accept **Immunoglobulins** before mentioned)

(8) Of the three components of this quantity’s operator in quantum mechanics, only one can be measured with certainty due to the Heisenberg uncertainty principle. This quantity is constant in precession where there is no torque. The conservation of this quantity implies Kepler’s second law, and its time derivative is torque. For the point, name this rotational analogue of linear momentum.

ANSWER: **Angular momentum** (prompt on “momentum”, do not accept or prompt on “linear momentum”)

(9) This region’s existence was first documented by Sir Joseph Norman Lockyer, and the density of this region renders it invisible to the naked eye, except in times of a solar eclipse. This region features dynamic jets of plasma called spicules, which emerge from its homogenous layer. For the point, name this middle layer of the Sun’s atmosphere, sitting between the solar transition region and the photosphere.

ANSWER: **Chromosphere**

(10) Brunhes and Matuyama name an event in which this entity last underwent a radical change. The origin of this entity can be explained by the dynamo effect, and reversals in this entity correspond to stripes on the ocean floor. The interaction of charged particles with this entity creates the aurora borealis, or the "Northern Lights." For the point, name this entity which causes compasses on the Blue Planet to align with the poles.

ANSWER: **Earth's Magnetic Field** (or **Geomagnetic Field**; accept **Earth's Magnetic Poles**; prompt on partial answers)

(11) He's not Newton, but this man postulated that visual rays proceed from the eyes onto objects in his book *Optics*. A "space" named after this man is the fundamental space of geometry. This man proved that there are infinitely many primes by constructing their product plus one. The parallel postulate is found in one set of writings by this man. For the point, name this mathematician from Alexandria who wrote the landmark math treatise *Elements*.

ANSWER: **Euclid** of Alexandria (accept **Euclidean Space**)

(12) This object was called Stella Maris in the medieval period, and this object was preceded in its role by Kochab and Pherkad. This object's southern counterpart is called Sigma Octantis, and in Lakota this celestial object is known as "The Star that Sits Still." For the point, name this brightest star of Ursa Minor, or the "Little Dipper," often called the "North Star."

ANSWER: **Polaris** (accept **Alpha Ursae Minoris** until mentioned; prompt on "North Star" or "Pole Star" until mentioned)

(13) This function can be estimated via the Babylonian method, and its graph makes up half a parabola with a vertical directrix. Applications of this function include determining the length of vectors and the geometric mean. This function appears above 5 in the numerator of the Golden Ratio and can be expressed as the one-half power in exponential notation. For the point, name this function, which when applied to negative one is i and when applied to 9 is 3.

ANSWER: **square root**

(14) It's not palladium, but this hetero-atom is found in an organo-metallic species in the Suzuki reaction. This second-row element is used to yield an alcohol in an anti-Markovnikov reaction from an alkene. This element usually only forms three bonds to other elements, resulting in an empty p-orbital. The lightest metalloid is, for the point, what element with atomic symbolized B?

ANSWER: **Boron** (accept **B** before mentioned)

(15) This quantity can be replaced with Hammett's function in very concentrated solutions. The value of this quantity is low for systems containing an abundance of hydronium ions. The isoelectric point of a molecule is this quantity when the net charge is zero. When this quantity is low for a solution, litmus paper turns red, and blood usually has a value of about 7.4 for this quantity. For the point, name this measure of the acidity of a solution.

ANSWER: **pH** (accept **Power** of **hydrogen**)

(16) Climates in this biome are categorized under ET in the Koppen climate classification. Soil in this biome often contains large amounts of biomass stored as methane under layers of permafrost. This biome can be found in mostly arctic, alpine, and Antarctic variants. For the point, name this biome characterized by little tree growth, low rain and snowfall, and extensive moss and lichen growth.

ANSWER: **Tundra**

(17) While the "complacent" type of these features show little variation, "sensitive" types allow for easier cross-dating to assign dates to when they were formed. These things, which are compared on skeleton plots, are "crowded" during periods of drought. Dendrochronology is the process of dating these things, which are affected by amounts of rainfall and are found in the cambium. For the point, name these circular patterns found in wood.

ANSWER: **Tree Rings** (accept **Growth Rings**)

(18) Cleveland Abbe was nicknamed "Old Probability" for his reliability in this task. J.M. Stagg performed this task in preparation for D-Day. Edward Lorenz believed that the long-term performance of this task was impossible due to the butterfly effect. Remote sensing and radiosondes [["radio"-sahndz]] are used in this task, which is performed pseudo-scientifically on February 2nd with a groundhog. For the point, name this task commonly performed by a meteorologist, who might state that rain is likely tomorrow.

ANSWER: **Weather forecasting** (accept answers indicating **Forecasting** the **weather**; or **Predicting** the **weather** or **Modeling** the **weather**; prompt on partial answers; accept **meteorology** before "meteorologist")

(19) The predecessors of these rocks undergo diagenesis. Arkose is a feldspar-rich variant of one example of these rocks, while another example of these rocks is primarily composed of calcite and aragonite. Sandstone and limestone are examples of these rocks. For the point, name these rocks that are formed from cementation of particles and are contrasted with igneous and metamorphic rocks.

ANSWER: **Sedimentary** rocks (prompt on "sandstone" or "limestone" before mentioned)

(20) An equation named for this scientist is solved by the Hartree-Fock and WKB approximations. The time-independent form of an equation named for this man is written as " $H\psi = E\psi$ ". This man critiqued the Copenhagen interpretation by proposing a situation in which a radioactive source causes a hammer to break open a flask of poison. A thought experiment about a cat that is simultaneously alive and dead was proposed by, for the point, what Austrian physicist?

ANSWER: Erwin **Schrödinger** (accept **Schrödinger**'s cat; accept **Schrödinger** equation)

(21) KGB intervention may have caused the death of this man and instructor Vladimir Seryogin during a routine flight in 1968. Nazi occupation forced this man and his family to live in a three-meter by three-meter mud hut for years, and this man shouted "Poyekhali!" or, "Off we go," shortly before departing from Baikonur Cosmodrome on Vostok One. For the point, name this Soviet Cosmonaut, the first man in space.

ANSWER: Yuri **Gagarin**

(22) Hilbert's paradox of the Grand Hotel is a thought experiment that illustrates the counterintuitivity of sets with this property. Georg Cantor denoted a "countable" variety of this property aleph-null. Euclid proved that there are this many prime numbers, while irrational numbers have this many digits after the decimal point. For the point, name this mathematical property denoting a number that is uncountably large.

ANSWER: **Infinity** (accept countable **infinity**)

(23) The 1902 poem "The Story of Fidgety Philip" made an early reference to these disorders, one of which was referred to by a German neurologist as "word blindness." Dyscalculia is one of these disorders affecting numerical reasoning, and dyslexia is another disorder of this type affecting literacy. Ritalin and Adderall are used to treat, for the point, what disorders in school-aged children?

ANSWER: **Learning** Disorders (or **Learning** Disabilities; accept Neuro**developmental** Disorders; ask for less specific information on answers such as "ADHD", "Dyslexia", or other learning disorders)

(24) In order to correct for the Signor-Lipps effect, the location of where these objects end up are assumed to be in random order. Coprolites [[KAH-pruh-lites]] are an example of the "trace" type of these objects, and geologic relationships can be determined using their "index" type. The Burgess Shale is a source of, for the point, what preserved objects that a paleontologist might find at a dig site?

ANSWER: **Fossils** (accept Trace **Fossils** or Index **Fossils** or **Fossilized** Remains; prompt on "Bone" or "Skeleton" or "Remains")

(25) This body was systematically observed by the Babylonians during ancient times and was visited by the *Pioneer* and *Voyager* probes. Features of this celestial body include depressions known as "tiger stripes" and periodic storms like the Great White Spot. The Cassini division can be found within a feature of this planet, which is orbited by the moons Rhea and Titan. An extensive ring system belongs to, for the point, what sixth planet from the Sun?

ANSWER: **Saturn**

(26) The no-hair theorem states that these entities can be characterized by just their mass, charge, and angular momentum. These objects are bound by the Schwarzschild radius, and thermal radiation can be emitted by these entities in a mechanism proposed by Steven Hawking. The surface boundary of these objects is their event horizon, past which nothing can be observed. For the point, name these regions of spacetime with gravity so strong, even light cannot escape it.

ANSWER: **Black holes**

(27) Heinrich Gerber is best known for a component used to make these structures, which he invented. One type of these structures can be built using cantilevers and hinges. Elementary forced resonance is given as the reason for why two of these structures named for Tacoma Narrows collapsed in 1940. For the point, name these structures built over bodies of water, famous ones of which include London and Golden Gate.

ANSWER: **Bridges** (accept Tacoma Narrows **Bridge**; accept London **Bridge**; accept Golden Gate **Bridge**)

(28) This country's Hamelin Pool hosts the most abundant examples of living stromatolites in the world. The extremely rare ant genus *Nothomyrmecia* lives in the south of this country, and the devil facial tumor disease has affected a carnivorous marsupial, *Sarcophilus harrisii*, from this country. Animals such as the kookaburra and wallaby are native to, for the point, what country, whose researchers often study the Tasmanian devil?

ANSWER: **Australia** (or Commonwealth of **Australia**)

(29) A transversal line that crosses the sides of this shape creates segments related by Menelaus's theorem. The Minkowski inequality is a generalization of a statement named for this shape. The area of this shape can be found by multiplying the semiperimeter and inradius, or it can be calculated using Heron's formula. For the point, name this geometric shape that comes in "obtuse" and "acute" varieties and has three sides.

ANSWER: **Triangle** (accept obtuse **triangle**; accept acute **triangle**)

(30) Pinnules [[PIN-yoolz]] are found on these structures in beard worms, and the nose of the star-nosed mole is surrounded by 22 of these structures. Anthozoans [[AN-thuh-ZOH-inz]] have cnidocytes [[NY-doh-"sites"]] on these structures, and some ctenophores [[TEH-nuh-FORZ]] have retractable these structures that feature sticky colloblasts. A squid has eight arms and two of these structures, which are used for seizing prey. For the point, name these appendages that are covered with stinging cells in jellyfish.

ANSWER: **Tentacles** (prompt on "Limb" or "Leg" or "Ray"; prompt on "Arm" before "arms" is mentioned; prompt on "Appendage" before "appendages" is mentioned)

Extra Questions

(1) A substance referred to as "virga" can be released from these objects that can be divided into roll and shelf types. Human activity can form instances of these entities known as contrails, while nacreous varieties of these entities form above the stratosphere. The appearance of halos from these objects form via the passage of sun light through crystals of ice in the cirrus varieties of these objects. Cumulonimbus is one variety of, for the point, what fluffy white objects in the sky?

ANSWER: **Clouds** (accept Roll **Clouds**; accept Shelf **Clouds**; accept Nacreous **Clouds**; accept Cirrus **Clouds**; accept Anvil **Clouds**; accept Cumulonimbus **Clouds**)

(2) One condition that affects this body part is called stenosis, in which bone spurs appear due to the narrowing of the canal found in this body part. Another condition that affects this body part is spondylosis, while in another condition, curvatures resembling the letters "C" or "S" is used to diagnose scoliosis, an abnormal curvature of this body part. The cervical, thoracic, and lumbar are groups of vertebrae in, for the point, what part of the body, also called the backbone?

ANSWER: **Spine** (accept **Backbone** before mentioned)