

Science Bee 1 - Round 3

Round 3 tossups

(1) Organisms in this kingdom have cell walls made of chitin [[KAI-tin]]. Algae and these organisms form a symbiotic relationship in lichen, and the death cap is a highly poisonous organism in this kingdom. These organisms have hyphae which make up their mycelium, and examples of these organisms include molds and yeasts. For the point, name this kingdom of organisms which are primarily decomposers, like mushrooms.

ANSWER: **fungi** (or **funguses**)

(2) On the periodic table, this quantity tends to increase when moving from the bottom left to the top right, excluding the noble gases. Cesium has the lowest value of this quantity, and fluorine has the highest value for this quantity of any element. This quantity is measured on the Pauling scale. For the point, name this measurement of an atom's ability to attract electrons.

ANSWER: **electronegativity**

(3) On Saturn, one of these phenomena formed a hexagon shape at the north pole. On Earth, these phenomena typically contain the polar vortices. The subtropical variety of these weather phenomena forms along Hadley Cells. Flights from East Asia to North America can reduce fuel usage by utilizing these phenomena. For the point, name these rapidly moving bands of air located in the upper atmosphere.

ANSWER: **jet stream** (prompt on "wind, "air movement," and similar answers)

(4) This scientist compiled selections from five classical texts of physics and astronomy in his book *On the Shoulders of Giants*. This scientist lends his name to the radiation that slowly decays black holes. This scientist wrote the pop-science books *The Theory of Everything* and *A Brief History of Time*. For the point, name this British astrophysicist, who was confined to a wheelchair due to ALS.

ANSWER: Stephen **Hawking**

(5) Observing double beta decay without emission of these particles would prove that they are their own antiparticles. Observatories built to detect these particles include Super-Kamiokande and one called IceCube which is found underground at the South Pole. Flavor oscillation allows these fermions [[FERM-EYE-ONS]] to switch between their tau, muon, and electron subtypes. For the point, name these nearly massless particles with no charge which rarely interact with matter.

ANSWER: **neutrinos** (accept tau **neutrino**; accept muon **neutrinos**; accept electron **neutrinos**; prompt on "fermions" before mentioned; do not accept or prompt on "neutrons")

(6) At all input values with this property, the Dirichlet [[dee-ree-SHLAY]] function equals zero. All infinite continued fractions represent numbers with this property. The roots of a polynomial with leading coefficient one must be either integers or have this property, which is possessed by numbers whose decimal expansions do not repeat or terminate. The golden ratio and pi have, for the point, what property of numbers that cannot be represented as the quotient of two integers?

ANSWER: **irrational** numbers (do not accept or prompt on "rational")

(7) Examples of an aggressive form of this phenomenon include the angler fish's light organ and the alligator snapping turtle's tongue. The Müllerian [[myoo-LEHR-ee-an]] form of this phenomenon works through strengthening conditioned responses. The Batesian form of this phenomenon involves harmless creatures appearing harmful. For the point, name this phenomenon in which one creature evolves to take on the appearance of another.

ANSWER: **mimicry** (accept **mimicking**; prompt on descriptive answers involving creatures taking on the appearance of another)

(8) With copper, this element forms Gilman reagents. When combined with aluminum hydride, this element forms a powerful reducing agent used in organic synthesis. As does strontium, this element burns crimson during flame tests. This element is the base of a common bipolar medication, and ions of this element are frequently used in rechargeable batteries. For the point, name this lightest alkali metal with atomic number 3.

ANSWER: **lithium**

(9) The "dark" type of these entities blocks light from their "emission" and "reflection" types. The Hubble space telescope photographed the "Pillars of Creation," which are located in one of these entities. Messier 1 is one of these objects which corresponds with a supernova seen by Chinese astronomers in 1054. For the point, name these astronomical star-forming regions, examples of which include the "eagle" and "crab."

ANSWER: **nebulae** (or **nebulas**)

(10) The residual strong force prevents the breakdown of these structures by overcoming electromagnetic repulsion. These structures were proven to exist in an experiment in which alpha particles were fired at a gold foil. The existence of these structures was proven by Ernst Rutherford. For the point, name this collection of neutrons and protons at the center of an atom.

ANSWER: atomic **nucleus**

(11) Inventors in this country developed an earthquake detector which featured dragons dropping metal balls into the mouths of frogs. This country was home to the first rockets, which were used to propel arrows. Historical inventions from this country include the compass, paper, and gunpowder. For the point, name this country whose military technological developments occurred during dynasties such as the Han and Ming.

ANSWER: **China** (or **Zhongguo**)

(12) This quantity for a matrix's column space is known as its "rank." The cardinality, or number of vectors in the basis of a vector space, equals this quantity, which is also represented by the variable "n" in a topological n-manifold. A tesseract has a value of four for this quantity, which is the minimum number of coordinates required to specify a point in space. For the point, name this quantity which equals three for a cube and one for a line.

ANSWER: number of **dimensions**

(13) The nucleolus is known for its synthesis of these organelles. Mitochondria have their own versions of these organelles which have an A, P, and E site. A nucleic acid with a clover leaf structure brings amino acids to this organelle, and the rough endoplasmic reticulum has these organelles attached to it. tRNA and mRNA are involved in translation, a process that happens in, for the point, what organelles which manufacture cellular proteins?

ANSWER: **ribosomes**

(14) A supercritical fluid made of this compound can be used to decaffeinate coffee. Ocean acidification is primarily a result of this compound being dissolved into water. Along with water vapor, this compound is produced as the result of a complete combustion reaction. As a solid, this compound is known as dry ice. For the point, name this greenhouse gas which is released by the burning of fossil fuels.

ANSWER: **carbon dioxide** (or **CO2**)

(15) A "threshold" value for this quantity controls carrier concentration in a MOSFET. A conductor's impedance can be used to calculate the namesake "drop" in this quantity between the source and load. Kirchoff's [[KEERCH-hoffs]] loop rule states that the sum of this quantity around any closed loop is zero. This quantity is the product of current and resistance according to Ohm's law. Batteries are used as a source of, for the point, what measure of electrical potential?

ANSWER: **voltage** (or **EMF**; or **electromotive force**; accept electric **potential** before mentioned; accept scalar **potential** before mentioned; accept **voltage** drop)

(16) This scientist collected his ideas in the books *The Two Chief Sciences* and *Dialogue Concerning the Two Chief World Systems*. This scientist proved that bodies can orbit objects besides the Earth by observing his namesake moons of Jupiter. This scientist tested the universal acceleration of gravity by dropping different weights from the Leaning Tower of Pisa. For the point, name this Italian scientist who was condemned by the Inquisition for supporting heliocentrism.

ANSWER: **Galileo** Galilei (accept **Galilei**)

(17) This island is home to the world's smallest known reptile, the nano-chameleon. This island's largest native predator is the fossa [[FOO-sah]]. This island was once home to the world's largest known bird, the elephant bird. This island's native primates include the silky sifaka and the aye aye. This island is also home to the majority of the world's baobab trees. For the point, name this African island nation.

ANSWER: Republic of **Madagascar**

(18) This quantity is defined as the negative logarithm of a solution's proton concentration. Mixing compounds with a large difference in this value can lead to a neutralization reaction. A solution's value for this quantity can be estimated with an indicator, and changes in this quantity are modulated by buffer solutions. For the point, name this scale which ranges from one to fourteen with low values for acids and high values for bases?

ANSWER: **pH** scale

(19) If this rock undergoes metamorphosis, it becomes marble. Compressed plankton can be formed into a type of this rock called chalk. This rock can be created through the deposition of mollusk shells. Because this rock is easily dissolved in acidic water, most caves are found in bedrock made of this rock. For the point, name this sedimentary rock which is primarily formed from calcium carbonate.

ANSWER: **limestone** (prompt on "calcite"; prompt on "calcium carbonate" before read)

(20) In 1969, the FDA banned one of these substances called cyclamate due to it having caused bladder cancer in lab rats. Consuming these substances has been linked to insulin resistance due to changes in gut bacteria. Common varieties of these substances include aspartame, sucralose, and saccharin. Popular brands selling these substances include Stevia and Splenda. For the point, name these food additives, which replace sugar in diet soda.

ANSWER: **artificial sweeteners** (or **nonnutritive sweetener**; or **low-calorie sweetener**; or **zero-calorie sweetener**; accept **sugar replacements** or **sugar substitutes** before "sugar" is read; prompt on just "sweetener")

(21) An ester linkage of this element makes up the "high-energy" bond of acetyl-CoA [[uh-SEE-til KOH-ay]]. Mitochondrial proteins with clusters of iron and this element transport electrons. Proteins contain namesake "bridges" of this element which are only found in the amino acids methionine and cysteine. The prefixes "mercapto-" and "thio-" refer to this bright yellow element. Rotten eggs release a gas containing, for the point, what element with chemical symbol S?

ANSWER: **sulfur** (accept **S** before mentioned)

(22) *Description acceptable.* Spreiten formations preserve evidence of this behavior which is performed by insects with fossorial legs. The only eusocial mammal lives in homes built by this activity, for which the wombat's backward-facing pouch is an adaptation. Ferrets specialize in hunting prey that hides by this behavior, such as prairie dogs. Badgers and moles engage in, for the point, what behavior of digging underground chambers?

ANSWER: **burrowing** (or **tunneling**; accept **digging** before it is read; accept any answer that describes making passages underground or homes in the soil)

(23) This phenomenon is directly proportional to volume when pressure is held constant, according to Charles's law. This phenomenon is measured in chemical reactions by a calorimeter. Exothermic reactions are characterized by the release of this phenomenon. This type of energy is transferred through convection, conduction, and radiation. For the point, name this type of energy which is measured in degrees Fahrenheit.

ANSWER: **heat** (prompt on "energy" before mentioned)

(24) In an attempt to discredit George Westinghouse, this scientist gave animals electric shocks from alternating and direct current as part of the "War of the Currents." This scientist created an early way to record sounds with his invention called a "phonograph." This inventor and rival of Nikola Tesla was known as the "Wizard of Menlo Park." For the point, name this American inventor, who developed the most popular incandescent light bulb.

ANSWER: Thomas **Edison**

(25) A cycle between muscle and this organ regenerates glucose from lactate through a pyruvate intermediate. In addition to being the site of the Cori cycle, this organ is divided by the falciform ligament. Macrophages in this organ include Kupffer cells. This four-lobed organ has the ability to regenerate, and the hepatic portal vein brings nutrients to this organ. For the point, name this organ which is the site of detoxification.

ANSWER: **liver**

(26) The retention of the structure of these objects at high rotational speeds led to the discovery of dark matter. These objects make up the right end of the "Hubble tuning fork" diagram. These objects are subclassified based on whether or not they are "barred." These objects have greater order than their lenticular, elliptical, or irregular counterparts. For the point, name this type of galaxy which includes the Andromeda and is shaped like a whirlpool.

ANSWER: **spiral** galaxies (or barred **spiral** galaxies; prompt on "galaxies")

(27) This substance is turned into more useable forms through fluid catalytic cracking. The Bakken formation contains this substance's namesake kind of shale. In Alberta, Canada, this substance is extracted in the form of bitumen [[BIT-yoo-men]] from a namesake kind of sand. This substance can be fractionally distilled into substances such as asphalt, kerosene, or gasoline. For the point, name this liquid fossil which is mined by drilling at namesake wells.

ANSWER: Crude **oil** (or **petroleum**; accept **crude**)

(28) In 2019, this company partnered with Worldpay to expand access to their own namesake payment services. This company's cloud computing web services are used by the NFL to create Next Gen Stats. This company's subsidiaries include Twitch, Goodreads, and Audible, and this company's streaming service and complimentary two-day delivery is included in its Prime service. For the point, name this online shopping company, which was formerly headed by Jeff Bezos.

ANSWER: **Amazon**.com, Inc.

(29) These features can be identified by the presence of tektite and a shatter cone. Many examples of these features in the inner solar system were formed during the Late Heavy Bombardment. One of these features located off of the Yucatan peninsula in Mexico is linked to an event that may have caused the dinosaurs to go extinct. For the point, name these geologic features which consist of a depression on the surface of a body created by the impact of a meteor or asteroid.

ANSWER: impact **craters** (accept meteorite **crater** and similar answers; do not accept or prompt on "volcanic crater")

(30) The "HPHT" and "CVD" types of this substance are created in a laboratory. The Vickers test uses a pyramid-shaped piece of this mineral to create indents. Pandanus candelabrum is used to detect this mineral from kimberlite pipes. High-leaded glass and cubic zirconia are common "simulants" for this mineral which has a Mohs hardness of ten. For the point, name this very hard mineral made of carbon.

ANSWER: **diamond**

Extra Question

(1) Inside this body part, calcium carbonate crystals called otoliths float in a viscous fluid within sacs called the utricle and saccule. The ossicles of this organ consist of the malleus, incus, and stapes [[STAY-pees]], which are collectively the smallest bones in the body. Tinnitus can result from damage to this organ's tympanic membrane, which focuses vibrational waves towards the cochlea. For the point, name this organ which perceives sound.

ANSWER: **ear**s (accept inner **ear**; accept middle **ear**)