

Science Bee 2 - Round 3

Round 3 Tossups

(1) Duffy antigen absence and thalassemia [[thah-lah-SEE-mee-uh]] traits convey partial resistance to this disease. Drug resistant varieties of this disease are treated with artemisinins [[ar-tih-MEE-sih-nins]]. This disease is most commonly spread by members of the genus Anopheles [[uh-NAH-feh-lees]]. Carriers of sickle cell anemia possess a heterozygous [[heh-ter-oh-ZAI-gus]] genetic resistance to this disease. This disease can be treated with the drug quinine. For the point, name this mosquito-borne disease caused by the Plasmodium parasite.

ANSWER: **Malaria**

(2) The destructive type of this process is used for thermal cracking of coal to form coal tar and coke. Refluxing can be used to improve the output of this process. Azeotropes [[AY-zee-oh-tropes]] such as ethanol and water cannot be separated using the fractional form of this technique. Selective condensation is used in, for the point, what technique which separates mixtures based on differences in boiling point?

ANSWER: **Distillation** (accept **Distilling**; accept Destructive **distillation**; accept Fractional **distillation**)

(3) Roughly 300 miles thick, this region lies above a superheated core and a layer that convects heat away from that core, causing it to reach temperatures in excess of 5000 degrees Celsius. That convection contributes to sunspots and solar flares in this layer of the sun - what many would consider the visible "surface." For the point, identify this layer of the sun which takes its name from the Greek word for "light."

ANSWER: **Photosphere**

(4) In Einstein solids, which are composed of quantum harmonic oscillators, this property is defined as the derivative of internal energy with respect to temperature at constant volume. The molar [[MOH-lahr]] type of this property is modeled by the Dulong-Petit [[PET-it]] law. Water has a high value for this property, leading to land and sea breezes. For the point, name this property which gives the heat needed to raise the temperature of a substance by one degree.

ANSWER: Heat **capacity** (or **Specific** heat; accept Molar heat **capacity**)

(5) This mathematician's "orchard" is derived from his algorithm that finds the greatest common divisor. John Playfair names a statement that extends one of this mathematician's axioms which is violated by hyperbolic space. "All right angles are congruent" and "a straight line segment can be drawn joining any two points" are two of five statements this man postulated. For the point, name this Greek mathematician who wrote the *Elements* and is considered the "father of geometry."

ANSWER: **Euclid** (accept **Euclid**'s orchard; accept **Euclid**'s parallel postulate)

(6) The V variant of this substance can be taken orally, while its G variant can only be administered intravenously. This substance was discovered as a result of a crude extract of *P rubens*, which was shown to kill a sample of *staphylococcus aureus*. For the point, name this first commercial antibiotic, derived from a type of mold and accidentally discovered by Alexander Fleming.

ANSWER: **Penicillin** (accept **Penicillin** VK; accept Phenoxymethyl**penicillin**; accept **Penicillin** G; accept Benzyl**penicillin**; prompt on "Benpen"; prompt on "PcV")

(7) These numbers have the form "two to the p minus one times two to the quantity p minus one," leading to their one-to-one correspondence with Mersenne primes. These numbers are neither deficient nor abundant and are only known to be even. Examples of these numbers include six, twenty-eight, and 496. For the point, name these numbers which are the sum of their own prime factors.

ANSWER: **Perfect** numbers

(8) A Pourbaix [[poor-BAY]] diagram plots this quantity on the x-axis and voltage on the y-axis and can be used to evaluate corrosion. Phenolphthalein [[FEE-nahlf-THAY-leen]] turns from colorless to pink as this quantity increases, leading to its use in titrations. Hortensia can be blue or pink depending on this quantity for the soil. Buffers resist changes to, for the point, what quantity which is contrasted with pKa and describes the acidity or basicity of a substance.

ANSWER: **pH** [[PEE-AITCH]] scale

(9) This man studied gardening and beekeeping as a child, but turned his focus to philosophy and physics, studying under Christian Doppler. Unable to pass his oral exams to become a teacher, the financial strain of his education led this man to join the Augustinian abbey in Brno [[BUR-noh]]. Although he was a physics teacher, this man's background in gardening had the greatest impact on his legacy. For the point, name this friar whose work with pea plants established the science of genetics.

ANSWER: Gregor **Mendel**

(10) The first model of this particle was proposed by Murray Gell-Mann and George Zweig. Quantum chromodynamics describes the interaction of the strong force between gluons and this subatomic particle. Hadrons are divided into two types depending on whether they comprise two or three of these particles. Protons and neutrons are composed of "up" and "down" varieties of these particles which come in six "flavors." For the point, name this subatomic particle.

ANSWER: **Quarks** (accept **Quark** model; accept Up **quarks**; accept U **quarks**; accept Down **quarks**; accept D **quarks**)

(11) Morris Ketchum Jesup provided funding for this man's mobile classrooms, called Jesup Wagons. When the U.S. was undercut by imports from China, this man testified to the Ways and Means Committee in 1921. This man studied restoration of nitrogen via crop rotation to improve cotton planting and was called the "Black Leonardo." Teaching at Tuskegee Institute, for the point, who was this African-American agricultural scientist who studied the use of peanuts.

ANSWER: George Washington **Carver**

(12) Unhealthy growth of these organisms on water surfaces can be the result of eutrophication, a process often caused by human waste discharge. Cyanobacteria is often called a blue-green variant of this organism. This type of organism is used to make a gelatinous substance called agar [[AY-gar]], while other types can be eaten as *nori*. For the point, name these photosynthetic protists which include types like the giant kelp.

ANSWER: **Algae** (accept Blue-green **algae**; accept Red **algae**; prompt on "seaweed(s)"; prompt on "kelp")

(13) In one type of these events, a "rebound" and "bounce" can lead to "core collapse." A flood of neutrinos may be the result of one of these events. When a white dwarf exceeds 1.4 solar masses, or the Chandrasekhar [[chahn-drah-SEH-kar]] limit, one type of these events used as a standard candle called "one a" will occur. One of these events seen in 1054 created the Crab Nebula. For the point, name these events in which a star explodes.

ANSWER: **Supernovae** (or **Supernovas** in place of **Supernovae**; accept Type II **supernovae**; accept Type IA **supernovae**; prompt on "SN or "SNe")

(14) S, I, A, and M are classifications of this type of rock devised by Chappell and White. The QAPF classification characterizes the components of these rocks. Yosemite National Park's Half Dome is made of this type of rock, which is similar to diorite. Rhyolite is the extrusive equivalent of this type of rock. For the point, name this type of coarse-grained rock which is the main component of continental crust and is often pink, white, or black when used in countertops.

ANSWER: **Granite**

(15) Under the Georgi-Glashow model, this letter designates bosons responsible for proton decay. A satellite communications spectrum band named for this letter falls between eight and twelve gigahertz. This letter can represent any halogen in organic chemistry reactions, and the genes causing hemophilia and colorblindness are carried on a chromosome of this letter. Wilhelm Röntgen [[RENT-gun]] could view bones using rays labeled with, for the point, what letter which resembles the multiplication sign?

ANSWER: **X** (accept **X** boson(s); accept **X** band; accept **X** chromosome(s); accept **X**-ray(s))

(16) In 2005, the Lasco worm used Symbian OS and this technology to spread. RuBee is touted as a safer alternative to this technology which once competed against the IEEE 802.11 protocol. This technology spread rapidly after the introduction of Secure Simple Pairing, and unlike IR, this tech does not require a line of sight to connect. Developed by Ericsson, for the point, what is this technology for wirelessly networking consumer electronics, named for a 10th century Danish king?

ANSWER: **Bluetooth**

(17) The "fuming" form of this compound is also known as oleum. A vanadium [[vah-NAY-dee-um]] pentoxide catalyst is used in the production of this compound in the contact process, which has largely supplanted the lead chamber process. This compound is used in lead acid batteries, and clouds on Venus have a high percentage of droplets of this compound, which is found with nitric acid in acid rain. For the point, name this strong, diprotic [[dai-PRAH-tik]] acid with chemical formula H₂SO₄.

ANSWER: **Sulfuric acid** (accept **H₂SO₄** before mentioned; accept Fuming **sulfuric acid**; accept **Oil of vitriol**)

(18) 'Narrow-spectrum' types of these substances such as sarecycline target specific biological cells. Prontosil was the first active example of these substances. Carbapenem and cephalosporins are examples of a beta-lactam type of these substances. Bacteria that exhibit an abnormally strong resistance to these substances are called "Superbugs." For the point, name these substances widely used to treat bacterial infections.

ANSWER: **Antibiotics** (accept Narrow-spectrum **antibiotics**; acet Beta-lactam **antibiotics**)

(19) The two main types of these things are surface and deep-water. A riptide is not a tide but one of these things. Thermohaline [[ther-moh-HAY-leen]] circulation drives some of these entities, and rotating systems of these things make up gyres. One of these things first mapped by Timothy Folger and Benjamin Franklin is called the Gulf Stream. For the point, name these moving systems of water in the oceans.

ANSWER: Ocean **currents** (accept Surface **currents**; accept Deep-water **currents**)

(20) A mariachi band played when the final example of these objects was produced in 2003 at a Puebla, Mexico factory. The Cal looker was a modified variant of this object which Béla Barényi engineered. Ivan Hirst helped open a factory for these vehicles which were made under Heinz Nordhoff's leadership. This car was called the "People's Car," and it was born from the ideas of Adolf Hitler and Ferdinand Porsche. For the point, name this distinctively-shaped Volkswagen car.

ANSWER: Volkswagen **Beetle** (accept Volkswagen **Type 1**; accept **Bug** in place of **Beetle**; accept Volkswagen **Käfer**)

(21) One long-running show on this television channel raised controversy by refusing to air an episode on RFID credit card security, while having tripled the available data on bullets shot straight up. This channel replaced narrator David Attenborough with Sigourney Weaver when it aired *Planet Earth*, and its award-winning series *Walking with Dinosaurs* is still the most expensive TV documentary. Shark Week is an annual tradition on, for the point, which cable TV channel, home of the *MythBusters*?

ANSWER: The **Discovery** Channel

(22) Urbain Le Verrier hypothesized this body which Percival Lowell called "Planet X." 11-year old Venetia Burney named this body which Clyde Tombaugh used a blink comparator to find. The IAU launched a debate on whether this body was properly categorized. This body has moons named Styx, Nix, Kerberos, and Charon [[KAY-run]], and *New Horizons* did a flyby of this dwarf planet in the Kuiper Belt. For the point, name this former ninth planet of the solar system.

ANSWER: 134340 **Pluto**

(23) If this mission had failed, Richard Nixon would have read the "Fate Has Ordained..." speech. Michael Collins was selected to remain in the orbiting Command Module during this mission which involved landing the Eagle at Tranquility Base. During this mission, one astronaut stated "that's one small step for man, one giant leap for mankind." For the point, name this NASA mission during which Buzz Aldrin and Neil Armstrong walked on the Moon.

ANSWER: **Apollo 11** (prompt on "Apollo"; prompt on answers mentioning landing on the moon but not giving the specific mission)

(24) Through 2020, more Boy Scout merit badges have been earned for learning this practice than any other. The ABC protocol assesses if a person needs one form of this practice. Applying a tourniquet and performing the Heimlich maneuver are vital skills of this treatment, for which the Red Cross awards certification. Rescue breathing and CPR are components of, for the point, what form of immediate medical assistance which may use the dressings and bandages in a namesake kit?

ANSWER: **First aid** (accept **CPR** before mentioned' anti-prompt on "stopping bleeding," "stopping choking," and similar specific answers)

(25) These animals' livers have enough vitamin A in them to kill over 50 adult humans. These animals' hollow, clear fur and black skin insulates heat so well that they appear invisible on thermal imaging. According to legend, Inuit people learned to hunt seals by watching these animals, which are the largest land carnivores. For the point, name these large, white bears which live in the Arctic.

ANSWER: **Polar** bear(s) (or Ursus **maritimus**)

(26) An increase in pressure can increase the value of this property. An increase in temperature can decrease the value of this property, but the variation is slight for solids and liquids. Also known as specific mass, this property is measured in kilograms per cubic meter and relates to an object's buoyancy. For the point, what is this property which is determined by dividing an object's mass by its volume?

ANSWER: Volumetric mass **density** (accept **Specific mass** before mentioned)

(27) This quantity reaches its highest values in solids, due to the formation of a shear wave. Prandtl–Glauert [[PRAHN-tuhl GLAO-ert]] singularities were previously believed to form when this quantity was exceeded. At normal temperatures, this quantity is approximately 343 meters per second in air. The ratio of an object's velocity to this quantity is known as the Mach number. For the point, a "sonic boom" may be caused when exceeding what quantity?

ANSWER: **Speed** of **sound** (accept **Mach 1** before mentioned; prompt on "sound barrier")

(28) Extinct groups in this family include the Hesperocyoninae [[heh-speh-roh-sai-OH-nih-nay]] and Borophaginae [[boh-roh-FADJ-ih-nay]]. One member of this family from south and southeast Asia is the dhole [[DOHL]]. Another member of this family that is endemic to Japan is the tanuki. Wild members of this family include jackals and dingos. For the point, name this family of mammals which includes foxes, coyotes, and wolves.

ANSWER: **Canidae** (or **Canids**; accept **Canines**; prompt on "Dog(s)")

(29) Fulgurites are glassy structures formed from these phenomena, which may also cause Lichtenberg [[LIK-ten-berg]] figures. The "ball" type of this phenomenon is still unexplained, and St. Elmo's fire may be indicative of one of these phenomena. Benjamin Franklin may have used a kite to determine that these phenomena are electric. For the point, name this electrical phenomenon which often appears as "cloud to ground."

ANSWER: **Lightning** (prompt on "electricity"; accept Ball **lightning**; accept Cloud-to-ground **lightning**; accept CG **lightning**)

(30) Subsurface oceans of this molecule exist on Ganymede, Enceladus [[en-keh-LAH-dus]], and Europa, and it exists in liquid form in the Goldilocks zone. In 2015, NASA confirmed evidence of this molecule in Martian perchlorate salts, and it is found under the carbon dioxide ice cap at Mars's south pole. Along with rocks and dust, the frozen form of this molecule makes up comets. For the point, name this substance thought to be required for alien life since it covers about 70% of the Earth's surface.

ANSWER: **Water** (or **H-2-O**; accept **Water** vapor or **Water** ice)

Extra Question

(1) This phenomenon was the subject of the Cavendish experiment, which was the first to yield an accurate value for a physical constant used in a calculation involving Newton's universal law of this phenomenon. Galileo dropped balls from the Leaning Tower of Pisa, showing that acceleration due to this phenomenon is the same for all objects. For the point, name this force of attraction between masses governed by Einstein's theory of general relativity.

ANSWER: **Gravity** (or **Gravitation**)