

# Science Bee 2 - Round 2

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## Round 2 Tossups

(1) By stopping the release of this mineral from voltage-gated channels, Benzothiazepines [[ben-zoh-THAI-uh-zuh-peens]] can be used to treat high blood pressure. The release of this mineral's 2+ [[TWO-PLUS]] ion is an important trigger for muscle contraction. The amount of this mineral in the blood is regulated by the action of osteoclasts. Diets poor in vitamin D can prevent the absorption of this mineral, leading to rickets. For the point, name this elemental mineral found in milk, which is used to build teeth and bones.

ANSWER: **Calcium** (or **Ca** [[SEE-AY]])

(2) This quantity represents the distance between the ground state and saddle point on a potential energy surface. The related "delta G double dagger" often replaces this quantity, which is divided by negative RT in the formula for the temperature dependence of reaction rates. On a reaction coordinate, this quantity represents the distance between the reactants and transition state. Catalysts speed up reactions by decreasing, for the point, what minimum energy needed for a reaction to take place?

ANSWER: **Activation** energy

(3) To create this statistical tool, order the numbers of a data set from smallest to largest before finding the median. The next step in this tool's creation is to find the median of each half of the data set and thus, the first and third quartiles. Finally, this tool requires finding the minimum and maximum values of the set as well as the median and quartiles, enclosing them in a rectangle. For the point, you have created what analytical graph which shows the distribution of data?

ANSWER: **Box** and whisker plot (accept similar answers for "plot" such as "diagram" or "graph")

(4) This theory explains the Sagnac effect, which is used in ring laser gyroscopes. This theory explains the aberration of light, and the derivation of this theory depends on Minkowski spacetime or Lorentz transformations. Time dilation and length contraction are explained by this theory, from which the mass-energy equivalence can be derived. For the point, name this theory in physics by Albert Einstein which preceded a "General" formulation.

ANSWER: **Special** Theory of **Relativity** (prompt on partial answers; do not accept or prompt on "General Relativity")

(5) This quantity is determined for monatomic gases using the Sackur-Tetrode equation and remains constant in reversible processes. According to the third law of thermodynamics, this quantity for a perfect crystal is zero at absolute zero, and according to the second law, this quantity does not decrease over time. For the point, name this quantity, symbolized  $S$ , which quantifies the amount of disorder in a system.

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

(6) A "tension" named for this scientist is the discrepancy in measuring a value named for him. "A dot over a," in which "a" is the scale factor, is used to calculate a constant named for this scientist. A system devised by this scientist gives designations like SBc to galaxies which are arranged in a "tuning fork" shape. With a namesake constant describing the expansion of the universe, for the point, who was this scientist who names a 1990 space telescope?

ANSWER: Edwin **Hubble** (accept **Hubble's** tension; accept **Hubble's** constant; accept **Hubble's** sequence; accept **Hubble's** tuning fork)

(7) Along with chloroplasts, the existence of these organelles is explained by endosymbiotic theory, which holds that one single-celled organism consumed and incorporated another. These double-membraned organelles are filled with a viscous namesake matrix. These organelles contain a maternally inherited genome consisting of a circular strand of DNA. For the point, name this organelle responsible for ATP synthesis, often called the "powerhouse of the cell."

ANSWER: **Mitochondria** (or **Mitochondrion**)

(8) John Hunter claimed neural fluid caused this disease, which was treated with hemlock juice for Anne of Austria. William Halsted used a radical surgery to treat this disease, and John Warren performed a mastectomy to remove this disease from Nabby Adams. This disease has received greater attention due to the Pink Ribbon and the Komen Race for the Cure. Mammograms can detect, for the point, what cancer which typically develops in the milk ducts.

ANSWER: **Breast** cancer (prompt on "cancer")

(9) The strength of compounds formed in this manner is equivalent to the lattice energy. Structures form in this way as a result of differences greater than 1.7 on the Pauling scale of electronegativity. These bonds typically form between metals and non-metal elements, forming a chemical salt. For the point, name this type of bond formed by atoms exchanging electrons, which can be contrasted with covalent bonds.

ANSWER: **Ionic** bond(s) (prompt on "Chemical bond(s)")

(10) A pre-cancerous condition of this organ that changed stratified squamous epithelium to simple columnar epithelium is named for Norman Barrett. The formation of a Schatzki ring in this organ can lead to dysphagia [[dis-FAY-zhuh]]. The upper part of this organ runs parallel to the trachea, or wind pipe, and this organ can be damaged by the improper release of stomach acid into it, causing heartburn. For the point, name this organ which carries food from the mouth to the stomach.

ANSWER: **Esophagus**

(11) Since 2010, this government agency has funded Innovation Hubs finding alternatives to rare earth magnets. This department's Office of Science oversees the Fermi, Brookhaven, and Oak Ridge National Laboratories. This department monitors both federal hydroelectric projects and radioactive waste disposal. In February 2021, Jennifer Granholm became Secretary of, for the point, what cabinet department which oversees the U.S. supply of power?

ANSWER: United States Department of **Energy** (prompt on "DOE")

(12) These particles consist of one up quark and two down quarks, and stars named for these particles are supported by their namesake degeneracy pressure. Uranium fission is initiated by the absorption of one of these particles, and after fission, more of these particles are released to sustain a chain reaction. For the point, name these uncharged subatomic particles which make up the atomic nucleus with protons.

ANSWER: **Neutrons** (accept **Neutron** star(s))

(13) The cascade causing this process activates several tissue factors, and infants are often given shots of vitamin K to enhance this process. Drugs such as heparin [[HEP-ah-rin]] and warfarin [[WOHR-fuh-rin]] inhibit this process. When this process occurs inside the body it is known as thrombosis. The inability to induce this process characterizes hemophilia. For the point, name this process which stops bleeding using platelets.

ANSWER: Blood **clotting** (or **Coagulation**; or **Coagulating**)

(14) Lucian Smith disputed the patent for this product, for which Henry Rose helped inspire "the Winner" version. John "Bet-a-Million" Gates popularized the use of this material while William Ednborn made a humane version. This material was contested in the Range and Fence Cutting Wars, and Joseph Glidden, who donated land for NIU, helped create this material. Forming obstacles in trench warfare, for the point, what is this type of steel wire with sharp points?

ANSWER: **Barbed** wire (accept **Bobbed** wire)

(15) Notation for fractions developed in this country includes fractional expansions for rational numbers of the form "two divided by n" and provides the solution to the rope-burner timing puzzle. This country used the ancient *hekat* unit of measurement, and the Rhind papyrus shows this country's mathematics using hieroglyphs. For the point, name this country in which the discredited Horus-eye fractions symbol originated.

ANSWER: **Egypt**

(16) A branch of medicine named for this scientist explains the spread of antibiotic resistance among bacteria. This scientist proved seeds could survive long journeys in saltwater, and he noted the anatomical similarities between giant South American fossils and living sloths. Thick beaks for cracking seeds but pointed beaks for catching insects are adaptations this man observed in his namesake Galapagos finches. For the point, name this man who posited the theory of evolution by natural selection.

ANSWER: Charles Robert **Darwin**

(17) This element is most commonly mined from the mineral cinnabar. When bonded to a methyl group, this element forms a biotoxin which commonly accumulates in seafood. Alloys formed with this element are known as amalgams, and atmospheric pressure can be measured in "millimeters of" this element. For the point, name this element, a metal that is liquid at room temperature.

ANSWER: **Mercury** (accept **Hg**; accept **Quicksilver**)

(18) The rank and depth of this substance are correlated in Hilt's Law. Strip mining is done at banded deposits of this substance called its namesake "seams." The Carboniferous [[kar-boh-NIH-fer-us]] period is partially named from the Latin for this substance. Lignite is turned into types of this substance like its "bituminous" [[bih-TOO-mih-nus]] type, or anthracite. For the point, name this black, sedimentary rock formed from plant matter which is burned for energy.

ANSWER: **Coal** (accept Bituminous **coal**; accept Black **coal**)

(19) Description acceptable. Animals involved in this contest included Ham, Enos, and Laika, and one competitor in this contest launched the Vostok program. Major achievements during this contest included the flight of Yuri Gagarin, the landing of Neil Armstrong and Buzz Aldrin on the Moon, and the creation of NASA. For the point, name this competition between two Cold War opponents to achieve superiority in exploring beyond Earth.

ANSWER: **Space Race** (accept answers describing the contest between the Soviet Union and the United States to achieve greater spaceflight capability)

(20) Doppler spectroscopy is a common way to find these objects, the least massive of which is Draugr. Bellerophon [[beh-LEH-roh-fun]] is a prototype for "hot Jupiters," which are examples of these objects. TRAPPIST-1 is a system with several of these objects, and dimming can be observed when looking for these objects using the transit method. Habitable examples of these objects could be present in the Goldilocks zone. For the point, name these objects which orbit stars that are not the sun.

ANSWER: **Exoplanets** (accept **Extrasolar planets**; prompt on "planet(s)"; accept answers indicating **planets** not in the **solar** system)

(21) Bony projections in these organs are used to filter food from them and are known as the "rakers" of these organs. In some animals, fluid flow in these organs induces counter-current gas exchange. Human fetuses possess folds that were once mistaken for this organ but actually become the jaws and ears. In an example of neoteny [[nee-AH-ten-ee]], the axolotl salamander retains these organs into adulthood. For the point, name these organs used by fish to extract oxygen from water.

ANSWER: **Gills** (or **Branchiae**)

(22) Three of these objects meet in a configuration called the triple junction, such as a ridge-ridge-ridge example of these objects in a triangle named for the African region of Afar. The Nazca and Cocos are two of these objects, which are composed of felsic rock. A small example of one of these objects named for Juan de Fuca formed the Cascade Range. For the point, name these objects which are pieces of the Earth's crust and are prone to shifting.

ANSWER: Tectonic **plates** (accept Nazca **plate**; accept Cocos **plate**; accept Juan de Fuca **plate**)

(23) Scientists studying these objects were awarded the 2020 Nobel Prize in Physics, one of whom was Roger Penrose who proposed extracting energy from the ergospheres of these objects. These objects lose mass through Hawking radiation, and a supermassive one of these objects exists at the center of the Milky Way. For the point, name these astronomical bodies which have a gravitational singularity so strong that light cannot escape past their event horizon.

ANSWER: **Black holes**

(24) The first female tourist to this region was the namesake of the Ansari X Prize. The short-lived MirCorp would have brought travelers to this area, to which Dennis Tito became the first paying tourist in 2001. 2021 may finally see customers who paid \$300,000 each to Virgin Galactic fly past the ISS in this area, though most planned trips are suborbital. For the point, Jeff Bezos's Blue Origin will use vertical takeoff to bring tourists to what mostly empty region above Earth's atmosphere?

ANSWER: Outer **Space** (accept International **Space** Station)

(25) Slubice [[swoo-BEE-tseh]], Poland, created a monument to this organization in Frankfurt Square. In 2002, Rambot was used as an automated program that modified this organization's work. All of the pages on this website were blacked out for one day in 2012 to protest the SOPA law. This organization suffers from edit warring and reliability issues. Larry Sanger and Jimmy Wales founded, for the point, what online encyclopedia?

ANSWER: **Wikipedia.org**

(26) Namesake banded formations of this element alternate layers of its oxides with chert and were formed during the Precambrian. Hydrogen peroxide and this element make up a catalyst that cleans wastewater called Fenton's reagent. This element is the input of the Bessemer process, which uses the "pig" type of this element. This element's ores include hematite and magnetite. For the point, name this ferromagnetic element with chemical symbol Fe [[EFF-EE]].

ANSWER: **Iron** (accept **Ferrum** before "Fe")

(27) Alfisols and gelisols [[JEH-lih-sahls]] are examples of this substance, and pedogenesis is the formation of this material. Humus [[HYOO-muss]] is organic material deposited on this substance, which is divided into horizons including O, A, and B. Loam [[LOW-um]] is a type of this substance, and clay, silt, and sand are components of this material, as shown on a texture triangle diagram. Hydroponics does not use, for the point, what substance to which roots anchor plants?

ANSWER: **Soil** (accept reasonable equivalents such as **Dirt**)

(28) For two decades, Bushman was the most famous resident of one of these institutions in Chicago's Lincoln Park. Immersion exhibits at these places help reduce behaviors like pacing and head-bobbing. These sites saved the golden lion tamarin through captive breeding programs, and in 1972, the "National" example accepted two giant pandas from China. Outside Australia, most koalas live in the San Diego example of, for the point, what institutions which display wild animals to the public?

ANSWER: **Zoos** (accept **Zoo**logical Parks; accept **Zoo**logical Gardens; accept Lincoln Park **Zoo**; accept National **Zoo**logical Park; accept San Diego **Zoo**)

(29) Transpiration has the largest effect on weather in this ecosystem, one example of which can be divided zoologically by Wallace's line. The birds of paradise are native to this biome which is also home to many arboreal mammals like orangutans and sloths. Bark gouging to feed on gum is a behavior of marmosets in the canopy of this biome. High temperature and frequent precipitation are key features of, for the point, what equatorial ecosystem which includes the Congo and Amazon?

ANSWER: Tropical **rainforests** (or **jungles**; accept specific rainforests before they are mentioned)

(30) One type of these structures, spread out into large bulb-like lobes on plains, is known as "piedmont." Asymmetric hills that look like half-buried eggs are left behind by these features, as are long, winding ridges called eskers. Lateral and medial moraines are formed from rock transported by these features which can also create fjords, and calving of these structures forms icebergs. For the point, name these slowly moving bodies of ice.

ANSWER: Glaciers (accept Piedmont glaciers)

**Extra Question**

(1) An early conception of this entity was called the telluric helix, and this entity was refined by Julius Lothar Meyer. The only two objects among the nearly 120 organized by this entity which were named after people who were alive at the time of their naming are oganesson and seaborgium. For the point, name this entity whose modern form is attributed to Dmitri Mendeleev, a tabular display of chemical elements.

ANSWER: **Periodic table** of the elements