

(E) Science Bee Round 7

Regulation Tossups

(1) Alkali types of these minerals have lower specific gravity than their plagioclase and orthoclase types. A subclass of these minerals constitutes the continuous branch of Bowen's reaction series, and a subclass of these minerals defines six on the Mohs hardness scale. For the point, name this most abundant class of minerals in Earth's crust.

ANSWER: **Feldspars** (accept Plagioclase **Feldspars**; accept Orthoclase **Feldspars**; accept Alkali **Feldspars**)

(2) Members of this phylum possess a mantle that contains a large cavity for feeding and excretion. Many members of this phylum possess a tongue-like structure called a radula. Cephalopods, gastropods, and bivalves belong to, for the point, what largest marine phylum of invertebrates that includes clams and snails?

ANSWER: **Mollusca** (or **Molluscs**)

(3) Tube framing superseded the steel frame design of these structures, which were pioneered by Fazlur Rahman Khan. These structures often make use of sky lobbies to expand service core via elevators. For the point, name these towering buildings that include the Burj Khalifa.

ANSWER: **Skyscrapers** (accept **Supertalls**; prompt on "High-rises"; prompt on "Buildings")

(4) The first complete map of one of these things for a eukaryote was created for Baker's yeast. James Watson led a project that used high-throughput sequencing to map these things for *Homo sapiens*. For the point, what term refers to the entire genetic sequence of an organism?

ANSWER: **Genome** (accept Human **Genome** Project; accept **Genome**-wide Association Studies; prompt on "genes" or "DNA")

(5) This operation describes the runtime for the fastest known algorithm that solves the traveling salesman problem. This operation is performed on " $\cos(x) + i \sin(x)$ " in De Moivre's $e^{ix} = \cos(x) + i \sin(x)$ formula. This operation's second input is nt in the compound interest formula. When this operation has a base of two, it is the same as doubling. For the point, name this operation that multiplies a number by itself.

ANSWER: **Exponentiation** (or **Exponential**; accept **Power**)

(6) This Wilson prime is also the third Catalan number and the fifth of the Fibonacci numbers. This number appears under the square root in the numerator of the golden number, and this number is also the value of the hypotenuse of the smallest Pythagorean triple. For the point, identify this number, the atomic number of boron, as well as the total sides in a pentagon.

ANSWER: **Five**

(7) Objects from this region are disrupted by a dwarf star every 27 million years, according to the Nemesis hypothesis. The inner part of this location is sometimes called the Hills cloud, and the dwarf planet Sedna is located in this region beyond the Kuiper [[KY-per]] Belt. For the point, name this proposed location for the source of long-period comets, named for a Dutch astronomer.

ANSWER: Öpik-**Oort Cloud**

(8) The transition between minerals rich in sodium and minerals rich in this element make up the continuous branch of Bowen's reaction series. Along with magnesium, this metal is present in dolomite, and it is also found in aragonite and calcite. This element's carbonate makes up the shells of many marine animals. A metal found in limestone, this is, for the point, what element, the main constituent of bone?

ANSWER: **Calcium** (or **Ca**)

(9) In 1954, this scientist won a Nobel Peace Prize for his opposition to weapons of mass destruction. To treat heart disease and prevent colds, this scientist controversially advocated for megadoses of vitamin C. Electronegativity is measured within a range from 0.7 to 4 on a scale named after, for the point, what American chemist who wrote *The Nature of the Chemical Bond*?

ANSWER: Linus **Pauling** (or Linus Carl **Pauling**; accept **Pauling** Scale)

(10) Laura Ingalls Wilder wrote *The Long Winter* detailing her and her family's efforts to survive during one of these events. The Storm of the Century caused one of these natural events to occur in March 1993. The National Weather Service states wind speeds must be greater than or equal to 35 miles per hour in order to be, for the point, what type of severe, prolonged snowstorm?

ANSWER: **Blizzard** (accept Ground **Blizzard**; prompt on "Snow" or "Snowstorm")

(11) A handful of isolated populations of this animal on St. Paul Island and Wrangel Island survived until 4,000 years ago, and a frozen specimen of this animal was discovered at Yukagir. For the point, name this tusked, furry creature that roamed the earth during the last Ice Age.

ANSWER: **Woolly Mammoths** (accept **Mammuthus primigenius**; prompt on partial answers; do not accept or prompt on answers mentioning elephants)

(12) At very low Reynolds numbers, the magnitude of this force on a spherical object is proportional to fluid velocity according to Stokes' law. Gravity balances this upward-acting force when a falling object reaches terminal velocity. For the point, name this force that opposes the motion of an object through a fluid.

ANSWER: **drag** force (accept **air resistance**; or fluid **resistance**; prompt on "friction")

(13) The Dongfanghong I was the first of this kind of object launched by China as part of its "Two Bombs, One [this object]" campaign. Celestial bodies like Europa and Ganymede are considered the "natural" kind of this object and surround Jupiter. Artificial examples of these objects include the Soviet Sputnik 1. For the point, name these objects that orbit larger bodies.

ANSWER: **Satellites** (accept natural **satellites**; or artificial **satellites**)

(14) The Miller-Urey experiment tested whether this phenomenon led to the first organic compounds on earth. St. Elmo's fire can be produced by this phenomenon, whose "ball" variety may be explained by the soliton hypothesis. This phenomenon occurs when the atmospheric field strength exceeds three million volts per meter. For the point, name this phenomenon seen during thunderstorms.

ANSWER: **Lightning** (accept ball **lightning**)

(15) In 2019, this scale was recalibrated around Boltzmann's constant. A constant term of about 273 is used to convert this scale's measures to Celsius, and this scale is named for the title held by physicist William Thompson. For the point, name this temperature scale that starts at absolute zero.

ANSWER: **Kelvin** Scale

(16) In practical experimentation, this effect illustrates that the removal of negatively charged particles from a material surface occurs only when incident rays of light exceed a certain frequency regardless of change in intensity. Albert Einstein used this effect to explain the particle nature of light. For the point, name this phenomenon in which light emits electrons when hitting certain materials.

ANSWER: **Photoelectric** Effect

(17) Arc length can be calculated by multiplying this quantity by theta over 360. The constant tau is equal to the ratio between this quantity and the radius, and this quantity can be estimated by multiplying the diameter by 22 over 7. For the point, give this term for the distance around a circle.

ANSWER: **Circumference**

(18) This scientist coined the terms “dominant” and “recessive” for the expression of traits and developed the laws of segregation and independent assortment. For the point, name this scientist whose experiments on pea plants provided the foundation of genetics.

ANSWER: Gregor **Mendel** (or Gregor Johann **Mendel**)

(19) The scaphoid, pisiform, and hamate are among the eight bones found in this ellipsoid joint, which attaches to both the ulnar and radial collateral ligaments. Repeated compression of the median nerve that passes through this joint causes carpal tunnel syndrome. For the point, name this joint that connects the arm to the hand.

ANSWER: **Wrist** (accept **Radiocarpal** Joint before "carpal" is mentioned)

(20) Solvents in this phase of matter are used to partition solutes in the most common form of extraction. The HPLC type of chromatography uses a pressurized solvent in this phase, which also names the crystalline materials used in TV displays. This phase is bypassed by substances that undergo deposition and sublimation. At room temperature, bromine and mercury exist as, for the point, what state of matter?

ANSWER: **Liquid** (accept **Liquid** Crystals; accept **Liquid**-liquid Extraction)

(21) A system on this planet found between two jet streams was found to move in an anticyclonic manner in time-lapse photos from *Voyager 1*. A massive storm called the Great Red Spot is found on this planet, whose moons include Ganymede and Europa. Most asteroids are found between Mars and, for the point, what largest planet in the Solar System?

ANSWER: **Jupiter**

(22) The Baltimore system is used to classify these entities, which typically replicate using the lytic [[lih-tik]] or lysogenic cycle. Reverse transcriptase is used by the “retro” type of these infectious agents, which require host cells to reproduce. Bacteriophages [[bak-TEE-ree-oh-FAY-juz]] are a type of, for the point, what pathogens that can cause Ebola, chicken pox, and the flu?

ANSWER: **Viruses** (accept **Retroviruses**; accept **Rotaviruses**; accept either Bacteri**phages** or **Phages** before “Bacteriophages” is mentioned)

(23) This scientist found that nothing would grow in nutrient broth unless it was exposed to the air, thereby rejecting the theory of spontaneous generation and providing evidence for germ theory. For the point, name this French chemist and microbiologist, who developed a namesake process of heating certain foods and beverages to destroy pathogens.

ANSWER: Louis **Pasteur** (accept **Pasteur**ization)

(24) “Thermal” and “slow” types of these particles are produced in nuclear reactors. Isotopes of elements are caused by differing amounts of these particles. These baryons are composed of one up quark and two down quarks. For the point, name these particles found with protons in atomic nuclei and which possess no electric charge.

ANSWER: **Neutrons**

(25) The “great” [this phenomenon] is exhibited by wildebeests, and the Sierra Madre Mountains in Mexico is the target destination of monarch butterflies after performing this 3,000-mile phenomenon from Canada. For the point, name this phenomenon animals exhibit when they move to another location in response to a change in their environment.

ANSWER: **Migration** (accept Great **Migration**)

Extra Questions

(1) Some plants in this biome have adapted to utilizing CAM photosynthesis or C4 carbon fixation to minimize the rate of transpiration. Features like ergs and oases can be found in this biome that can be formed by the rain shadow effect or weathering processes. The Gobi and Sahara are examples of, for the point, what type of biome characterized by little precipitation and arid climate?

ANSWER: **deserts**

(2) Simon Baron-Cohen conducted the "Sally-Anne test" on children with this condition and proposed that people with it have "extreme male brain." Researchers have mostly rejected the theory that this condition is caused by "broken" mirror neurons. People with this disorder often struggle to respond to cues for joint attention and can be non-verbal. For the point, name this disorder characterized by difficulty in communication, whose forms include Asperger's.

ANSWER: **Autism** spectrum disorder (accept **ASD**; accept Kanner **Autism**; or Classic **Autism**; prompt on "Asperger's")