

Science Bee 2 - Round 1

Round 1 Tossups

(1) The Wittig [[VIT-izh]] reaction forms a bond between two atoms of this element. One allotrope of this element found in meteorites has a hexagonal structure and is named for Kathleen Lonsdale. Buckyballs and nanotubes are fullerenes formed from this element. Scotch tape is used to isolate a form of this element called graphene. For the point, name this element which is the basis of organic chemistry, symbolized "C."

ANSWER: **Carbon** (accept **C** before mentioned)

(2) The name of this group is taken from the tendency of its members to form salts when reacting with metals. The elements in this group are so highly reactive that they are not found free in nature but instead in compounds or in a diatomic state. The reactivity of this group is due to its seven valence electrons. For the point, what is this seventeenth group of the periodic table which includes chlorine, fluorine, bromine, and iodine?

ANSWER: **Halogens** (accept Group **17** before mentioned; accept Group **7A**)

(3) The Higgs mechanism explains why certain particles possess this quantity, which is mediated by the Higgs boson. Force is equal to this quantity times acceleration, while momentum is equal to this quantity times velocity. Unlike weight, this quantity is unaffected by gravitational force. According to Albert Einstein, energy is equal to this quantity times the speed of light squared. For the point, name this quantity, whose SI unit is the kilogram.

ANSWER: **Mass** (prompt on "M"; prompt on "weight" before "acceleration")

(4) Hagfish release a highly fibrous variety of this substance to help escape from predators. This substance can be expelled from the body with the help of drugs like Guaifenesin [[gwy-FEN-eh-sin]] and other expectorants. People suffering from cystic fibrosis experience a buildup of this substance in the lungs and digestive tract. For the point, name this biological substance which is emitted from namesake membranes in the nose by people with allergies.

ANSWER: **Mucus** (accept **Phlegm**, **Snot**, etc. before "namesake")

(5) Substances in this phase are described using an equation with "a" and "b" correction terms called the van der Waals equation. Chromatography of substances in this phase is often paired with mass spectrometry. Methane and ethane are in this phase at standard temperature and pressure. The "ideal" type of substances in this phase are described by the equation "PV equals nRT." For the point, name this phase contrasted with liquid and solid.

ANSWER: **Gases**

(6) An uncertainty relation exists between this quantity and time. One form of this quantity can be determined with the calculation “one half times mass times velocity squared” and another form of the same quantity can be determined with the calculation “mass times gravity times height.” The first law of thermodynamics states that this property cannot be created or destroyed. For the point, name this “potential” or “kinetic” quantity which is measured in Joules.

ANSWER: **Energy** (accept Kinetic **energy**; accept Potential **energy**)

(7) Friedrich Miescher [[MEE-shuh]] first isolated this material while its components were studied by Albrecht Kossel. Frederick Griffith's experiments suggested this molecule carries genetic information. Photo 51 of this material shows its structure and was taken by Rosalind Franklin. Composed of the nucleotides cytosine, guanine, adenine, and thymine, for the point, what is this biological molecule with a double-helix structure discovered by Watson and Crick?

ANSWER: **DNA** (or **Deoxyribonucleic acid**)

(8) Description acceptable. Because of this potential outcome, the Union of Concerned Scientists officially opposed solar geo-engineering in 2020. This event will mark the end of the Anthropocene epoch, and Stephen Hawking thought it the most likely outcome of an AI takeover. Scenarios for this event include a three degree climate shift, a nuclear winter, and a large asteroid impact. For the point, name this final catastrophe that some scientists now believe will start with a global pandemic.

ANSWER: The **End** of the **World** (accept descriptions like the **Apocalypse**, the **Collapse of civilization**, the **Extinction of humanity**, etc.)

(9) An acne treatment sold under the brand name Accutane is a derivative of this vitamin. The "golden" variety of rice was genetically engineered to treat deficiencies of this vitamin. Chemical sources of this vitamin include retinol and retinal. This vitamin's precursor is beta-carotene. For the point, name this vitamin found in sweet potatoes and carrots, which supports vision health.

ANSWER: Vitamin **A** (accept **Retinol** or **Retinal** before mentioned)

(10) The total sum of this quantity around a closed loop is zero according to Kirchhoff's [[KEER-koffs]] second law. For a point charge, this quantity is calculated using the formula "k times q divided by r." Power is equal to this quantity times current, and this quantity is equal to current times resistance according to Ohm's law. For the point, name this quantity, symbolized V, which is 120 for U.S. wall outlets and measures the electric potential difference.

ANSWER: **Voltage** (accept **Volts**; accept **Potential** before mentioned)

(11) A circle that goes through points derived from these objects is called the "nine point circle." A statement named for these objects can be proved using the Cauchy [[KOH-shee]]-Schwarz inequality. "S squared root three over four" is the area of one type of these shapes. Binomial coefficients are found in an arrangement of these shapes named for Pascal. For the point, name these shapes whose isosceles type has two sides of the same length.

ANSWER: **Triangles** (accept Pascal's **triangle**; accept Equilateral **triangle**; accept **Triangle** inequality)

(12) Convection in this region was thought to be active in the Hadean [[HAY-dee-un]] period. The D double prime layer is the lowermost part of this region, and S waves are absorbed after going through this region. The Mohorovicic [[moh-hoh-roh-VEE-cheek]] discontinuity lies just above this region. The asthenosphere lies within this region, and the lithosphere includes the crust and the upper part of this region. For the point, name this layer of Earth above the outer core.

ANSWER: **Mantle**

(13) Magellanic clouds at the south pole of this entity produce the Magellanic Stream. The 2020 Nobel Prize in Physics was awarded for the discovery of Sagittarius A-Star, a "supermassive" object found at the center of this entity. This entity is part of the Virgo supercluster of galaxies, which also includes its nearest neighbor, Andromeda. For the point, name this galaxy which contains our solar system.

ANSWER: **Milky Way** galaxy

(14) The smallest species of these animals ejects the nucleus from its nerve cells, allowing them to grow to sizes smaller than .15 [[POINT-ONE-FIVE]] millimeters. In addition to the world's smallest insect, the fairyfly, these animals include one that hunts large spiders, the tarantula hawk. Common varieties of these *Hymenopterans* include yellowjackets and hornets. For the point, name these insects which, unlike bees, do not make honey.

ANSWER: **Wasps** (accept **Hornet** before mentioned; accept Fairy **wasps**; accept Spider **wasps**; prompt on "Hymenoptera" before mentioned; do not accept or prompt on "Bees")

(15) Aside from the number of calories, a 2018 study found no difference in the effect of this general category of products versus the DripDrop ORS used during cholera outbreaks. Dr. Robert Cade invented a popular example of these products for the University of Florida's football players, and many claim the high level of sugar in these products offsets the electrolytes they replace. For the point, name this type of beverage, like Powerade and Gatorade, meant to rehydrate athletes.

ANSWER: **Sports drinks** (accept **Electrolyte drink** before "electrolytes" is mentioned; prompt on "Powerade," "Gatorade," or other similar drinks)

(16) This functional group can be protected with trimethylsilyl [[tra-i-meh-thil-SAI-lil]] ethers [[EE-thers]]. In a process named for Emil Fischer, a carboxylic [[kar-box-ILL-ick]] acid and one of these compounds react together to form an ester. Fermentation of corn can form a compound with this functional group which is used as a biofuel. Isopropyl is also known as the rubbing type of compounds with, for the point, what functional group with oxygen and hydrogen which is found in ethanol?

ANSWER: **Alcohols** (accept **Hydroxyls**)

(17) Connate fluids are expelled during a process used to form these rocks called diagenesis. These rocks can be classified as clastic or chemical, and conglomerate and breccia [[BREH-chuh]] are both this type of rock. These rocks are formed from compaction and cementation. For the point, name these rocks, exemplified by sandstone and limestone, which are contrasted with igneous and metamorphic rocks.

ANSWER: **Sedimentary** rocks

(18) This type of material can be naturally occurring or man-made. Because this material is a physical combination, it can retain beneficial properties of both donor materials and take on new properties such as increased strength, durability, or resistance to corrosion. Duralumin, electrum, solder [[SAW-der]], steel, alnico, nichrome [[NIH-krome]], pewter, bronze, and brass are all examples of this solid solution. For the point, what is this mixture of a metal and another substance?

ANSWER: **Alloys**

(19) A fractal called the "Apollonian gasket" starts from three of these objects, which then fill in the space left. A shape that can be inscribed in one of these shapes is quantified using Brahmagupta's formula. In the power of a point, lines intersect or are tangent to these shapes. The area of these shapes is "pi times its radius squared." For the point, name these shapes which consist of points equidistant from a central point.

ANSWER: **Circles**

(20) These animals make up the sister taxon *Deltatheroidea* and are the last living metatherians. These animals include the Macropodidae, which are notably bipedal. Notable carnivorous examples of these animals include the extinct thylacine and the Tasmanian devil. The only example of these animals that is native to North America is the opossum. For the point, name this group of mammals known for their pouches, which includes kangaroos and koalas.

ANSWER: **Marsupials** (or **Marsupialia**)

(21) Description acceptable. *B. subtilis* is used to test the efficacy of these processes, which include the phytosanitary irradiation of produce. Brucellosis is rare thanks to one of these methods, pasteurization, and the use of sodium benzoate for this purpose can greatly extend shelf-life. For the point, canning and refrigeration are modern techniques for this process that reduces spoilage of products like milk and vegetables.

ANSWER: **Food preservation** (accept descriptions like "preventing **food** from going bad", "preventing **food** poisoning", "preventing **food** contamination", or the preservation of specific types of **food**)

(22) Chinooks are an example of the foehn [[FANE]] type of these phenomena, other examples of which are called katabatic when they go downhill. Anemometers are used to measure this phenomenon, and calm examples of these phenomena are found in the horse latitudes. Gales are a strong type of these phenomena given a rating of seven to ten on the Beaufort scale, which characterizes their speed. For the point, name these phenomena in which air moves due to a change in atmospheric pressure.

ANSWER: **Winds** (accept **Breezes**; accept Foehn **winds**; accept Katabatic **winds**)

(23) This planet's slow perihelion precession served as an early confirmation of Einstein's theory of general relativity. This planet was explored by the *Mariner 10* and *Messenger* missions. This planet experiences the widest day-to-night temperature swings of any body in the solar system, ranging from negative 280 to positive 800 degrees fahrenheit. For the point, name this smallest planet, which is also the closest planet to the Sun.

ANSWER: **Mercury**

(24) Adding gold salts and possibly tin to glass turns it this primary color in a technique dating to the Roman Empire. Stars of this color are classified as K or M, during which the helium flash occurs. The flame tests of strontium and lithium are this color, and litmus paper turns this color in acidic solutions. Jupiter has a large storm called the "great [this color] spot." Light with wavelength longer than visible light is called, for the point, "infra" what color?

ANSWER: **Red**

(25) Diagonal scratches in these structures are the primary evidence of right-hand dominance in early human ancestors. Exposing the base of these structures causes a painful condition called abfraction. Damage to these structures can painfully expose the nerve-rich inner pulp, which is normally surrounded by dentin and enamel. For the point, name these oral structures, which are used to chew food.

ANSWER: **Teeth** (accept **Tooth**)

(26) Fourteen configurations in these substances named for Bravais are described by Miller indices. Proteins are turned into this form so they can be studied with X-ray diffraction. These substances, contrasted with amorphous solids, are orderly and have a lattice structure. Smectic is a phase of the "liquid" type of these substances, used in TVs. For the point, name these substances with repeated arrangements of atoms such as diamond.

ANSWER: **Crystals** (accept **Crystalline** solid(s); accept Liquid **Crystal** Diode(s); prompt on "LCD")

(27) Pouchlike protrusions are present in a type of these objects described by William Clement Ley, the "mammatus" type. Some of these objects which resemble hoods are called a "pileus" [[pai-LEE-us]], and contrails from airplanes are an artificial example of these things. "Anvil" types of these objects are "cumulonimbus," and other types of them include cirrus and stratus. For the point, name these objects from which rain falls.

ANSWER: **Clouds** (accept Mammatus **clouds**; accept Scarf **clouds**; accept Cap **clouds**; accept Cumulonimbus **clouds**; accept Cirrus **clouds**; accept Stratus **clouds**)

(28) Name spaces in this system are regulated by ICANN, and it uses dot decimal notation. The first two nodes of this system were at SRI and UCLA, and TCP/IP was standardized in this system for the NSF. This system's predecessor, ARPANET, was created by the Department of Defense which made this system for time sharing. For the point, name this global system of computer networks which allows you to access the World Wide Web.

ANSWER: **Internet** (prompt on "World Wide Web")

(29) These warm-blooded animals are the closest living relatives to crocodilians, and the respiratory tract of these animals flows in a single direction. Some of these animals swallow stones to store in the gizzard which help with breaking down food. Many of these warm-blooded animals possess hollow bones to reduce their body weight. For the point, name these feathered animals, most of which can fly.

ANSWER: **Birds** (or **Aves**)

(30) A CME which originated from this entity caused a powerful event which was recorded in 1859 by British astronomer Richard Carrington. In this structure's core, pressure is sufficient for hydrogen to fuse into helium, providing most of this structure's energy. This structure's atmosphere or "corona" can be seen during times of an eclipse. For the point, name this star found at the center of our solar system.

ANSWER: The **Sun** (or **Sol**)

Extra Question

(1) Unlike most other mammals, monkeys and apes cannot synthesize this nutrient which is the primary cofactor for the formation of collagen. Diets poor in this nutrient can lead to bleeding gums and brown skin spots. That deficiency of this nutrient is known as scurvy. This vitamin is commonly taken in "super doses" to prevent and fight colds. For the point, name this vitamin which is commonly found in citrus fruits.

ANSWER: Vitamin **C** (or **Ascorbic acid**)