

Science Bee 1 - Finals

Finals Tossups

(1) Along with snakes, this is the largest class of animals to use the ZW chromosome sex determination system. This class includes the closest living relatives of crocodiles and alligators. Archaeopteryx was originally identified as the oldest member of this class. Animals in this class are the direct descendants of theropod dinosaurs. Comprised of warm-blooded vertebrates, for the point, what is this class of feathered animals, most of which can fly.

ANSWER: **Aves** (accept [a]avian[a/];s; prompt on "birds")

(2) One type of this technique uses sulfur dioxide and iodine to quantify the presence of water and is named for Karl Fischer. Fast Sulphon Black and EDTA are used in the "complexometric" form of this technique. Bromophenol blue and phenolphthalein are used as color-changing pH indicators in this technique, which uses a burette to add solution to the analyte. For the point, name this technique used to determine the concentration of an unknown solution.

ANSWER: **titration**

(3) These bodies are prevented from collapsing by electron degeneracy pressure. The Chandrasekar [[chan-druh-SEH-kar]] limit is the upper bound to the mass of these bodies. Sirius B is one of these bodies which orbits a larger star. These bodies are the most common endpoint for main-sequence stars. For the point, name these small stellar remnants which are less massive than a neutron star or black hole.

ANSWER: **white dwarfs**

(4) Boundaries between p- and n-type semiconductors act as a simple one of these devices. These devices can change flow when their breakdown voltage is exceeded by their reverse bias. These devices are represented as triangles connecting straight lines on circuit diagrams. These devices typically only allow current to pass under forward bias conditions. For the point, name these devices which allow current to only flow in one direction and include a light-emitting variety.

ANSWER: **diodes**

(5) John Searle refuted this mathematician's namesake test with the Chinese Room thought experiment. That test named for this mathematician is explained with the "imitation game." This mathematician's namesake theoretical machine consists of a computer that manipulates symbols on an infinite tape. For the point, name this English mathematician, who names a test which can determine if a computer possesses strong artificial intelligence.

ANSWER: Alan **Turing**

(6) This statement is an equivalent for one named for Proclus. This statement can be replaced by an "at most" statement called Playfair's axiom. Lobachevsky and Bolyai name a system in which this statement does not hold known as hyperbolic geometry. For the point, name this fifth of Euclid's postulates which states that there is a unique line through a point that does not intersect with another line.

ANSWER: **parallel** postulate (accept **Euclid's fifth** postulate before mentioned)

(7) The cuckoo is known as a "brood" type of these organisms, and *Plasmodium* is a protist which is also one of these organisms. A tropical fungus that acts as one of these organisms can alter the behavior of ants. It's not mutualism or commensalism, since organisms in a symbiotic relationship with these organisms are harmed. For the point, name these organisms which target hosts to gain benefits, examples of which include tapeworms and leeches.

ANSWER: **Parasites**

(8) Synthesis reactions of these molecules are described as "living" if they cannot terminate or have a low polydispersity index. The size of these molecules is often reported as a molecular weight. A free radical initiator can begin synthesis of these molecules through a chain-growth mechanism, which forms examples of them like PVC and Nylon. For the point, what long molecules are made of repeating subunits called monomers?

ANSWER: **polymers**

(9) This body contains the Tombaugh Region, which resembles a large, white heart. A large, dark region on this body is known as Cthulhu Macula [[kuh-THOO-loo MAK-yoo-luh]]. Minor moons orbiting this body include Nix, Kerberos, and Hydra. This body is the largest object in the Kuiper [[KIGH-per]] belt. This body is sometimes considered to be a double planet with its largest moon, Charon [[KAIR-on]]. For the point, name this dwarf planet, which was formerly classified as the ninth planet from the sun.

ANSWER: **Pluto**

(10) Telescopes based on this process were created to fix the problem of chromatic aberration. The angle where polarized light does not undergo this process is named after David Brewster and comes in specular and diffuse forms. At the critical angle, the "total internal" type of this process occurs, which is used in fiber-optic cables. The angle of incidence equals the angle of, for the point, what process in which light bounces off of surfaces like mirrors?

ANSWER: **reflection** (accept word forms; do not accept "refraction")

(11) Venezuela created one of these resources based on the value of oil which was called El Petro. The most prominent of these resources was developed by the pseudonymous Satoshi Nakamoto. These resources are mined through solving hash functions and typically employ blockchain to form a distributed ledger. For the point, name these digital currencies which include Ethereum and Bitcoin.

ANSWER: **crypto**currency (prompt on "digital currency" before mentioned)

(12) The "line" and "surface" types of this operation are related by the generalized Stokes theorem. Partial fraction decomposition and u-substitution are used to evaluate this operation, whose "indefinite" form requires adding the constant "plus C." The trapezoidal rule or Riemann sums can be used to approximate this operation. Differentiation is the inverse of, for the point, what calculus operation which finds the area under a curve?

ANSWER: **integration** (or finding the **integral**; accept **antiderivative**; accept **antidifferentiation**)

(13) The reproductive cycles of these entities can be described as lytic or lysogenic. Surrounded by a protein coat called a capsid, examples of these entities that infect bacteria are often called "phages." Infections caused by these pathogens cannot be treated with antibiotics, and thus they are often countered with vaccines. Smallpox and measles are caused by, for the point, which pathogens, examples of which include HIV and influenza?

ANSWER: **viruses**

(14) A strong intermolecular variety of these interactions causes water to have a high boiling point. Carbon is only capable of participating in these interactions when it is bounded to highly electronegative elements. These interactions typically occur with nitrogen, oxygen, or fluorine and their namesake element. For the point, name these atomic dipole interactions named for the first element of the periodic table.

ANSWER: **hydrogen bonds**

(15) The rate of transport of these structures is measured in sverdrup. Examples of these structures located far below the surface are driven by Thermohaline Circulation. When these structures make a complete, rotating loop they form a gyre [[GIRE]]. One of these structures off the west coast of South America is named for Humbolt while one running from North America to Europe is named the Gulf Stream. For the point, name these large directed flows of water found in the ocean.

ANSWER: Ocean **currents**

(16) To carry out the inertial confinement version of this process, deuterium-tritium pellets are rapidly heated and compressed. A theoretical type of this process would occur at room temperature and is known as its "cold" type. Heavier elements are formed from this process via the CNO cycle. This process forms helium via the proton-proton chain in the center of stars. For the point, name this process in which atomic nuclei are combined, often contrasted with fission.

ANSWER: nuclear **fusion**

(17) This country's inland deserts are home to the thorny devil, a small lizard covered in large spikes. One animal from this county possesses a venomous barb on its hind feet. That animal from this country is the only mammal known to have electroreception. This country is home to the vast majority of the world's eucalyptus tree species. For the point, name this country, whose native wildlife includes the platypus, koala, and kangaroo.

ANSWER: Commonwealth of **Australia**

(18) In children, these organs can be impacted by a type of cancer called Wilms' tumor. These organs maintain a concentration gradient using the loop of Henle [[HEN-lee]]. The functional units of these organs are known as nephrons, and these organs are linked to the bladder by the ureters. When these organs fail, patients may be placed on dialysis. For the point, name this pair of organs which filter blood and produce urine.

ANSWER: **kidneys**

(19) When two of these structures symmetrically overlap, they can undergo namesake "twinning." 2-d changes in these structures can form grain boundaries. These structures are composed of several unit cells arranged into a namesake lattice, and disruptions to the long-range order of these structures create their namesake defects. For the point, name this type of solid, composed of regular, repeating ordered units of atoms, exemplified by gemstones such as diamonds.

ANSWER: **crystals**

(20) A standard formula for calculating this quantity is "X of g plus energy." This quantity can be averaged with electron affinity to calculate electronegativity. This quantity, which increases from left to right and from bottom to top, is highest for helium. For the point, name this quantity representing the energy required to remove an electron from an atom.

ANSWER: first **ionization** energy

(21) This specific process was the primary cause for the extinction of the Spix's macaw in the wild. A field called a "swidden" can be created when this process is done during "slash-and-burn" agriculture. Habitat loss due to this process has endangered both the Sumatran orangutan and the pygmy sloth, which lives in red mangroves. Wildfires and logging efforts contribute to, for the point, what ecological problem which has caused the rapid shrinkage of the Amazon jungle?

ANSWER: **deforestation** (or **clearance**; or **clearing**; or **clearcutting**; accept **cutting down trees** or obvious equivalents; accept **removing trees**; accept **forest degradation** or equivalents; accept **logging** before mentioned; prompt on "habitat damage" or "habitat loss" or "habitat destruction"; prompt on "agriculture")

(22) The last people to complete this task were Gene Cernan and Jack Schmitt. China's Chang'e [[CHAHNG-EH]] 3 and 4 missions were the first non-damaging completions of this task since 1976. The Tranquility base was created after the first completion of this task on the first mission to achieve this task, Apollo 11. For the point, name this task, which was first achieved by Buzz Aldrin and Neil Armstrong.

ANSWER: **moon landing** (accept any answer indicating landing a person/ship/probe/rover/etc on the **moon**)

(23) Hemoglobin exists as both an R, or relaxed, form and another form denoted by this letter. The MHC complex binds receptors on cells named for this letter, which mature in the thymus and come in types such as "cytotoxic" or "helper." In RNA, uracil replaces a nucleotide symbolized by this letter, which forms base pairs with adenine in DNA. For the point, name this letter which represents the nucleobase thymine.

ANSWER: **T** (accept **T** cells, accept **taut** or **tense** before "letter")

(24) These structures can be predicted by the appearance of a hook echo on Pulse-Doppler Radar. Powerful types of these structures can be formed by supercells. The strength of these structures is measured with the Fujita [[foo-JEE-tuh]] scale. Unlike hurricanes, these much smaller structures do not need warm water to form. For the point, name these rapidly spinning winds which typically form during severe thunderstorms.

ANSWER: **tornadoes** (prompt on "storms," "thunderstorms," or similar answers)

(25) According to legend, this thinker drowned one of his students for discovering irrational numbers. This thinker provided the earliest account of music of the spheres and discovered the relationship between mathematical ratios and musical intervals. This thinker's namesake theorem is stated as $A^2 + B^2 = C^2$. For the point, name this ancient Greek philosopher who names a theorem in geometry used for finding the length of the hypotenuse of a right triangle.

ANSWER: **Pythagoras** of Samos (prompt on "Pythagorean")

(26) Similar proteins produced by two parts of this structure lead to self-incompatibility, and the largest of these structures, from the genus *Rafflesia*, emit an odor of rotting flesh. In monocots, the parts of this structure are arranged in multiples of three. A calyx protects a developing one of these structures, whose perfect examples contain both stamens and pistils. Pollinators gather nectar from, for the point, which reproductive plant structures with colorful petals?

ANSWER: **flowers** (or **blooms**; or **blossoms**)

(27) As these objects break up, they can make their namesake "seltzer" hiss by releasing trapped CO₂ [[SEE-OH-TWO]]. The two most common shapes for these objects are called tabular and non-tabular. These objects are formed by calving or the breakup of glaciers at the shore. For the point, name these floating objects found in the ocean which are composed of frozen water and can cause shipwrecks such as the *Titanic*.

ANSWER: **iceberg** (prompt on "sea ice")

(28) The reproductive hectocotylus [[hek-toh-COT-ee-luss]] structure was first discovered in one of these animals, which can pass their bodies through any opening large enough to accommodate the rostrum. Possessing the highest brain-to-body mass ratio among invertebrates, this animal's mimic species can imitate sea snakes and stingrays, while its blue-ringed species is deadly to humans. Able to unscrew jars using its suction cups, for the point, what is this cephalopod mollusk with eight arms?

ANSWER: **Octopuses** (accept **Octopi**)

(29) In 2004, the EU-manufactured *Rosetta* spacecraft made the first successful landing on one of these objects. In 1994, one of these objects named Shoemaker-Levy 9 collided with Jupiter, leaving temporary scars on the surface. The dirty-snowball theory describes the composition of these objects, and solar wind makes the namesake tails of these objects always point away from the sun. For the point, name these orbiting icy bodies, which include ones named Halle-Bopp and Halley's.

ANSWER: **comets**

(30) Some isotopes of this element, when cooled below the lambda point, form the only known superfluids. Named for the Greek personification of the sun, this element's nucleus is equivalent to the alpha particle. After hydrogen, this element is the second most abundant and lightest in the universe. For the point, name this lightest noble gas, which is often used to inflate balloons.

ANSWER: **helium**

Extra Question

(1) After being given one of these body parts from a baboon, Baby Fae became the first person to successfully receive a non-human transplant. An EKG measures the electrical activity of this organ, and artificial pacemakers can be implanted to stabilize the rhythm of this organ. Along with the lungs, a defibrillator and CPR are utilized when this organ stops functioning. For the point, name this organ which pumps blood through the body.

ANSWER: **heart**