

Round 2

Regulation

(Tossup 1) This molecule's metabolism was the focus of Jacques Monod and Francois Jacob's study of its namesake operon. This sugar molecule has a beta 1,4 glycosidic bond between glucose and a similarly named sugar, which is broken down by a namesake enzyme maintained by many people of Scandinavian descent. For the point, name this sugar molecule, found in milk, that a majority of people are "intolerant" to.

ANSWER: lactose (do not accept or prompt on "galactose")

(Tossup 2) Neutral theory symbolizes the rate of these events with the Greek letter mu [mew]. The terms "frameshift" and "point" are two variants of these events. These events are deleterious if the result decreases an organism's fitness. These events introduce new alleles to a population. They can happen to DNA exposed to UV light or nuclear radiation. For the point, name these events that cause alteration in an organism's DNA.

ANSWER: mutations (accept mutation rate; accept point mutation; accept frameshift mutation; accept mutagenesis)

(Tossup 3) Isaac Newton's calculation for this phenomenon's speed was too low due to treating its travel as an isothermal process instead of an adiabatic process. Interference between two waves of this phenomenon is responsible for beats. This phenomenon travels at 343 meters per second and cannot be perceived above 20 kilohertz. For the point, name this phenomenon measured in decibels and created by thunder.

ANSWER: sound waves (accept speed of sound)

(Tossup 4) While studying these events, H.F. Reid of Johns Hopkins coined the term "elastic rebound" to describe the weaker events that follow. The S and P waves from these events propagate from a hypocenter. The magnitude of these events is measured on the Richter scale. For the point, name these seismic events which occur when tectonic plates rapidly slip past each other along faults, which causes the ground to shake.

ANSWER: earthquakes

(Tossup 5) The kinetic isotope effect is studied by replacing this element with deuterium. The donation of the charged form of this element characterize Bronsted-Lowry acids. The proton-proton chain converts this element to helium. The gas form of this element is used in zeppelins. For the point, name this most abundant and lightest element in the universe.

ANSWER: hydrogen (prompt on proton after "Bronsted Lowry"; prompt on H, H+, or H2)

(Tossup 6) Part of this organ is underdeveloped in microtia. In another part of this organ, the organ of Corti sits on top of the basilar membrane, picking up stimulus from hair cells. This organ's outer portion is the pinna, while across the tympanum, it has three of the smallest bones in the human body: the malleus, the incus and the stapes. For the point, name this organ that controls hearing.

ANSWER: ears (accept inner/middle/outer ear; accept pinna before mentioned; prompt on "cochlea")

(Tossup 7) The heavy form of this compound is used in nuclear power plant cooling towers. This compound's density is maximized at 4 degrees Celsius. This compound is known as the universal solvent due to its high polarity. Aqueous solutions are made using this solvent. Along with acetone, the distilled form of this compound is used to clean glassware in labs. For the point, name this compound composed of two hydrogen atoms and one oxygen atom.

ANSWER: water (accept H₂O)

(Tossup 8) First order systems in this mathematical discipline are also known as "predicate" [this word]. Boolean algebra is used to represent truth values in this discipline's propositional form. It's not philosophy, but Aristotle established syllogisms as an early way to derive conclusions from a valid inference in this discipline. For the point, name this 5-letter word for the study of reasoning which gets its name from the Greek word logos.

ANSWER: logic (accept propositional logic; accept formal logic; accept propositional calculus; accept zeroth-order logic; prompt on Boolean algebra before mentioned)

(Tossup 9) A cart and pole serves as an "inverted" one of these devices in control theory. Foucault [foo-KOH] used one of these devices to demonstrate the rotation of the Earth. The balls in Newton's cradle are the bobs of these devices. Christopher Huygens [HOY-guns] was one of the first to use this device as a clock. For the point, name this device consisting of a weight suspended from a pivot which swings back and forth.

ANSWER: pendulums

(Tossup 10) Frontal wedging describes how a less dense, warmer pocket of this substance is forced over a more dense, cooler pocket. Thermals are rising parcels of this substance. This substance is forced from low to high altitude in orographic lifting. This substance is approximately made up of 21% oxygen, and 1% argon. For the point, name this substance whose bulk movement causes winds.

ANSWER: air mass (prompt on "wind" before mentioned; prompt on "gas"es)

(Tossup 11) This quantity is minimized at a mixture's eutectic point. Ethylene glycol lowers this quantity by disrupting hydrogen bonds. Applying salt to roads during winter is one way to lower this quantity for ice. When water reaches this point, it exists in equilibrium as a solid and liquid. This quantity is equal to 0 degrees Celsius for water. For the point, name this temperature where a phase transition from solid to liquid occurs.

ANSWER: melting point (accept freezing point; accept crystallization point; accept "temperature" in place of "point"; prompt on "0 degrees Celsius", "273(.15) Kelvin" or "32 degrees Fahrenheit")

(Tossup 12) One of these statements refers to “the set of all sets that do not contain themselves” and was formulated by Bertrand Russell. Enrico Fermi names one of these statements regarding the lack of contact with extraterrestrial life. The Liar’s one proposes that “This statement is false.” For the point, name this seven-letter word for confusing statements that often contain self-contradictions.

ANSWER: paradoxes (prompt on contradiction before mentioned)

(Tossup 13) A disulfide compound containing this element is known as pyrite or “fool’s gold.” Porphyrins [POR-fur-ins] that contain this element are sometimes called hemes [heems]. This element names the type of permanent magnetism in the standard bar magnet. This element and carbon alloy to form steel. For the point, name this metal that lends its name to ferromagnetism and has atomic symbol Fe.

ANSWER: iron (prompt on Fe)

(Tossup 14) Holes in this structure are referred to as fenestrae in anatomy. Trepanning is a method of relieving internal pressure by putting a “burr hole” into this structure. The bones of this structure are joined together by fibrous sutures. This structure includes the frontal bones, occipital bones, and temporal bones. For the point, name this bone structure made up of eight cranial bones and fourteen facial bones.

ANSWER: skull (accept skulls; accept cranium until “cranial” prompt afterwards)

(Tossup 15) The mass, charge, and angular momentum of these objects completely describes them, according to the no-hair theorem. One of these objects in M87 was the first to be pictured in 2019. These objects can be thought of as singularities in space-time. Hawking radiation occurs at these object’s event horizons. For the point, name these objects which not even light can escape.

ANSWER: black holes

(Tossup 16) This phenomena is related to a field denoted with an uppercase B. The change in the magnitude of this phenomenon can be used to create potential by Faraday’s law. Ampere’s Law describes how current can produce a non-zero value for this phenomenon. This phenomena is typically measured in Teslas. For the point, name this phenomena present in objects with a north and south pole.

ANSWER: magnetism (accept magnetic field; accept magnetic force; accept magnets; bar magnets; accept geomagnetic field; prompt on “B-field”)

(Tossup 17) This planet’s two wide gossamer rings are mainly composed of debris from Amalthea and Thebe. Some scientists have proposed this planet acts like an “asteroid sponge” after observations of Shoemaker-Levy 9’s collision with this planet. Galileo names the four largest moons of this planet, including Ganymede and Io. For the point, name this gas giant with a Great Red Spot, the fifth planet from the Sun.

ANSWER: Jupiter

(Tossup 18) Euler proved that the reciprocals of an infinite amount of these numbers sum to pi squared over six. Numbers with this property are the only positive integers with an odd number of unique factors. Two triangular numbers sum to a number with this property. The first few examples of these numbers are one, four, nine, and sixteen. For the point, name these numbers that are equal to an integer multiplied by itself.

ANSWER: perfect squares (or square numbers; or squared integers; do not accept or prompt on just “integers”)

(Tossup 19) *Theridiidae* [thay-ree-dee-uh-DAY] create the tangle variant of this structure. Other variants of this structure include the funnel and tubular variants, and the substance used to make this structure has the same tensile strength as steel. The large spiral variants of this structure is associated with orb-weavers. This structure is *not* used by tarantulas to capture prey. For the point, name this structure created with sticky silk, used by spiders to capture unlucky insects.

ANSWER: spider webs (or cobweb)

(Tossup 20) This element is found with sulfur in cinnabar. Alloys containing this element are referred to as amalgams. Bromine and this element are the only liquids at room temperature. This element was used in the first thermometers and its use in hat factories led to poisoning from it being called “mad hatter disease.” For the point, name this element with atomic number 80 and symbol Hg.

ANSWER: mercury (prompt on Hg before mention)

(Tossup 21) This man’s military innovations include designs of a heat ray for concentrating the sun’s energy. This man created a screw used for moving water up a hill. According to legend, this man discovered a method for weighing a gold crown after which he jumped out of his bathtub shouting “Eureka!” while running naked through the streets. For the point, name this Greek mathematician of Syracuse who discovered the principle of buoyancy.

ANSWER: Archimedes of Syracuse

(Tossup 22) Pairs of these particles are opposed to these particles similarly named holes. These leptons are less massive than muons and tauons. The positron is the antiparticle of these particles. These particles actually make up a probability distribution and do not cleanly orbit around the atomic nucleus. For the point, name these elementary particles that carry negative charge.

ANSWER: electrons (prompt on e)

(Tossup 23) The cycle of growth of this structure is separated into anagen, telogen and catagen phases. This biological structure is rich in alpha-keratin, whose disulfide bonds explain why it smells bad when burned. This protein structure separates into the bulb and follicle. Sebum supplies oil to this structure that can be stripped with shampoos. For the point, name this feature of mammals that grows on the skin and scalp of humans.

ANSWER: hair follicle (accept hairs; prompt on follicles)

(Tossup 24) The theoretical maximum efficiency of an object using this type of energy is given by the Shockley-Queisser [KAY-ser] limit. Semiconductors can be used to create a p-n junction that harnesses the power of this type of energy from the photovoltaic effect. This non-biological source of energy has a lower percentage of consumption than wind or hydropower. For the point, name this form of energy from the sun.

ANSWER: solar energy (accept energy from a solar cell/panel; prompt on light or photons or sun energy and other equivalents)

(Tossup 25) Wladimir [“Vladimir”] Köppen [KUR-pen] developed a classification scheme for these systems that splits them into five groups. Rising CO2 levels have caused a greenhouse effect which cause a namesake change in these systems, a phenomenon synonymous with “global warming.” For the point, name this seven-letter word that defines the general weather patterns of a particular region.

ANSWER: climate

(Tossup 26) Modern variants of these devices made in the U.S. followed the Teller-Ulam design. These devices work either by chaining collisions of sub-critical material in the “gun method” or using chemically doped explosive lenses. These devices use fissile material such as enriched uranium or plutonium. For the point, name these weapons of mass destruction that can create giant mushroom clouds and radioactive contamination.

ANSWER: nuclear weapons (accept nuke accept nuclear bomb; accept nuclear warhead; accept atomic bombs; or atom bombs; or a-bombs; accept thermonuclear weapons; accept hydrogen bombs; or H-bombs)

(Tossup 27) This radiation range is governed by Bragg’s law in its namesake crystallography. Chandrasekhar [chahn drah say kar] names a telescope that uses this radiation range. This radiation range was used by Rosalind Franklin to take Photo 51, which Watson & Crick used to determine the double helix structure. Wilhelm [vill-HELM] Röntgen [ROOnt gen] discovered this radiation between UV and gamma rays. For the point, name this radiation range that is most commonly known for being used to image bones.

ANSWER: x-rays or x-(ray) radiation (prompt on Röntgen radiation) [Science Bee Regionals 1]

(Tossup 28) Only 10% of nutrients are retained in this biome’s soil, leading farmers to use slash-and-burn techniques. The upper canopy in this biome is home to birds of paradise and toucans. On the floor of this biome, you can find red-eyed tree frogs. This biome is home to the most biodiversity. The Amazon is an example of, for the point, what biome, characterized by tall trees and high precipitation?

ANSWER: rainforest [prompt on “forest”]

(Tossup 29) Raising i to the fourth power gives this number. This is the only natural number with exactly one divisor. X raised to *negative* this number gives x 's reciprocal. Raising a number to this power gives back the same number. Raising a number to zero yields this number. The multiplicative identity states that a real number times this number equals that number. For the point, name this smallest positive integer.

ANSWER: one

(Tossup 30) It's not basalt, but this felsic rock names a composition of igneous rocks that have a *lower* melting point than rocks with andesitic composition. This intrusive rock is coarse-grained, unlike its extrusive equivalent rhyolite. This rock is the major component in the domes it names at Yosemite National Park. For the point, name this rock whose name comes from its grain-like texture.

ANSWER: granite

Extra

(Tossup 31) The premise of these things as a fundamental unit was first proposed by Matthias Schleiden [muh-TIE-us shly-dun] and Theodor Schwann. The theory of miasma prevailed until the discovery of this fundamental unit. Spontaneous generation proposed these fundamental units could form from dead matter. Robert Hooke observed these units in cork and named these things after the rooms monks live in. For the point, name these fundamental building blocks of life.

ANSWER: cells (prompt on germs or microbes until "cork" with "what fundamental unit makes up germs?")