

## Round 2

### Regulation

(Tossup 1) Components of this structure can be moved around more readily with flippases and scramblases. An imbalance of phosphatidyl [phos - fa - tiddle] serine in this structure is an “eat me” signal for macrophages. S.J Singer and G.L Nicolson described this structure as a “two-dimensional liquid” that allows lipid rafts and receptors to move around; that is the fluid mosaic model of this structure. For the point, name this portion of the cell made up of proteins embedded in a phospholipid bilayer, which functions to separate the cell from its environment.

ANSWER: cell membrane (accept plasma membrane; prompt on membrane; prompt on phospholipid bilayer)

(Tossup 2) The Japanese theorem deals with triangulated versions of these objects. Regular types of these objects have apothems whose length can be modeled using the radius of a circle inscribed in one of these objects. The interior angles of a simple one of these mathematical objects add up to the product of  $n$  minus 2 and 180, where  $n$  is the number of sides of one of these objects. The faces of a polyhedron are made up of, for the point, what two-dimensional shapes with straight line edges?

ANSWER: polygons

(Tossup 3) At the interior of many of these structures is a craton, while the edges consist of terranes that are more easily transferred between these structures. As one of these named Farallon has largely disappeared, its remnants include a smaller one of these named Juan de Fuca. The East African Rift lies at a boundary between these two places which is diverging, unlike the subduction occurring at the Andes. For the point, name these mobile sections of the lithosphere whose movements cause earthquakes and volcanic activity.

ANSWER: tectonic plates (prompt on plates; prompt on continents)

(Tossup 4) In 2017, a Harvard University project proposed attaching Stratocruiser modules to these objects in order to spray sulfates into the atmosphere. Leon Teisserenc de Bort used observations from these objects to discover the stratosphere. In 1873, the Montgolfier brothers were the first to pilot one of these objects, which they constructed from taffeta cloth. For the point, in 1824, Michael Faraday invented a rubber version of what objects that use helium or hot air to float?

ANSWER: balloons

(Tossup 5) After observations of stars in this object, Walter Baade [VAL-ter BAH-deh] formulated the idea that stars could be grouped based on their metallicity. The Triangulum galaxy’s largest neighbor is this object which was discovered to contain Cepheid variables by Edwin Hubble, partially resolving the Shapley-Curtis debate. This object is number thirty-one in the Messier catalog and is expected to collide with the Milky Way in 2.5 billion years. For the point, name this spiral galaxy, the closest to the Milky Way.

ANSWER: Andromeda galaxy (prompt on M31)

(Tossup 6) Increases in this quantity were suggested by the H-theorem, but challenged by Josef Loschmidt. Clausius coined the name of this quantity and defined it as “transformational content.” Ludwig Boltzmann’s tombstone is inscribed with a definition of this quantity; that definition sets this quantity as Boltzmann’s constant times the natural log of the microstates. This quantity, symbolized S, is always increasing due to the second law of thermodynamics. For the point, name this measure of disorder in the universe.

ANSWER: entropy

(Tossup 7) Electrons diffract around this group of elements in the Ramsauer-Townsend effect. Neil Bartlett created a hexafluoroplatinate compound made with an element from this group. The only currently living person with an element named after him is Yuri Oganessian, who helped synthesize a member of this group named oganesson. For the point, name this group of elements, such as radon and xenon, that are on the far right of the periodic table and are named for being relatively inert.

ANSWER: noble gases (accept group 18)

(Tossup 8) A “Blue Norther” is one of these phenomena, common in places like Texas, caused by the lack of a boundary that could stop the incursion of polar air. These fronts are the fastest-moving, and they become occluded if they catch up to another type of front. These fronts form where warmer air is lifted by the incursion of denser air, which can cause rain or storms if the lifted air is moist enough. For the point, name this type of weather front often symbolized by a line of blue triangles.

ANSWER: cold fronts (prompt on “fronts” until mentioned)

(Tossup 9) Kurt Vonnegut’s brother Bernard received a patent for this process in 1975, which may have inspired elements of the novel *Cat’s Cradle*. “Make mud, not war” was the slogan for Operation Popeye, which enacted this process over Vietnam. Silver iodide is the most common chemical used during this process, though dry ice and salt can also be effective nuclei. For the point, name this controversial process in which small particles are dropped into the sky to stimulate condensation.

ANSWER: cloud seeding

(Tossup 10) Members of this cultural group underwent enkoimesis when they sought a healing sleep. This group’s practice of “pharmakeia” was regarded as sorcery. One scientist from this culture was the first to propose the four humors theory. A serpent wrapped around a pole is known as the Rod of Asclepius, after a legendary healer from this cultural group who was the father of Hygeia and Panacea. For the point, an oath to abstain from all harm is named for a member of what ancient culture, Hippocrates?

ANSWER: ancient Greeks (accept ancient Greece)

(Tossup 11) One form of this substance contains colostrum, which has many immune benefits. A1 and A2 are variants of a protein found in this substance that differ only by the substitution of one amino acid, but which may lead to differences in digestion. A mutation possibly related to differences in Vitamin D exposure has led to lactase persistence, enabling the consumption of this substance by many adults. The mammary glands produce, for the point, what substance that provides nutrition to young mammals?

ANSWER: milk

(Tossup 12) Duralumin is one of these substances which hardens with age. Based on the method of formation, these substances can be classified as interstitial or substitutional. A valuable, naturally occurring one of these is electrum, while a low-temperature, fusible one is solder. These substances are called amalgams when they include mercury, and one containing mostly tin is called pewter. For the point, identify this type of substance such as brass, bronze, or stainless steel, a mixture of two or more metals.

ANSWER: alloys

(Tossup 13) A paper describing the nucleosynthesis occurring after this event was amusingly credited to scientists Alpher, Bethe [BAY-tuh], and Gamow. The Planck time describes the boundary around this event. Fred Hoyle coined the name for this event even though he supported the steady-state model over it. Alan Guth developed the theory of inflation that followed this event to help explain why the universe is so isotropic. For the point, name this event that occurred 13.7 billion years ago, widely believed to have started the universe.

ANSWER: the Big Bang

(Tossup 14) The Porro variety of this instrument uses four reflecting surfaces. Spectrometers take advantage of this instrument and diffraction gratings when getting spectral signatures of atoms. After passing through the objective lens, light is directed through this instrument before reaching the eyepiece in binoculars. Isaac Newton used this instrument to develop his theory of color. For the point, name this simple optical device, commonly made out of glass, that breaks up white light into its colored components.

ANSWER: prism (accept specific prisms like optical prism; glass prism; triangular prism; plastic prism; dispersive prism)

(Tossup 15) This intrusive rock is equivalent to the extrusive rhyolite. Dykes of aplite can often be seen streaking this rock, which may have formed as this rock cooled from the same mineral composition. That composition for this rock is between 20 and 60 percent quartz and primarily alkali feldspar, per the QAPF diagram. Because this rock often contains trace uranium, basements built into it must be tested often for radon. For the point, name this igneous rock, the most common continental rock, often used for decorative countertops.

ANSWER: granite

(Tossup 16) A book often nicknamed “K&R” contains this single letter in its official title. A programming language similar to Java is named after this letter followed by the musical sharp symbol. The binary number 1100 is represented using this letter in hexadecimal notation. The most common type of style sheet language used online is abbreviated with this letter coming before “SS.” For the point, two plus signs follow what letter in the name of a common programming language?

ANSWER: C

(Tossup 17) 4 Vesta is the only one of these objects visible to the naked eye. These objects can be classified as C-type, M-type, and S-type, based on observations of their mineral composition. They were named by William Herschel for their apparent resemblance to stars. These objects are thought to be the remnants of planetesimals formed in the early solar system that lacked enough mass to become true planets. For the point, name these objects, some of which lie in a namesake “belt” between Mars and Jupiter.

ANSWER: asteroids (accept planetesimals until “William”)

(Tossup 18) The rate of this process in *C. elegans* is regulated by DAF-2. *Turritopsis dohrnii* is known for its ability to reverse this process. A disease that causes this process to accelerate is due to a point mutation in Lamin A and is known as Hutchinson-Gilford progeria. This process is associated with the Hayflick limit, which puts a limit on the number of times a cell can divide due to telomere shortening. As this process occurs, the number of mutations accumulate until mortality. For the point, name this process of growing old.

ANSWER: aging (or senescence)

(Tossup 19) A coefficient of this force is plotted against the bearing number on a Stribeck curve. For a circular pipe, the Reynolds number and relative roughness are plotted on a Moody diagram along with a factor of this force named for Darcy. This force is independent of the area of contact according to Amonton’s second law of it. Under static conditions, the magnitude of this force is equal to the normal force times this force’s static coefficient. A falling object experiences drag, one type of this force. For the point, name this force that resists changes in motion.

ANSWER: friction

(Tossup 20) The first of these events was organized after Senator Gaylord Nelson observed the damage caused by the Santa Barbara Oil Spill. The first March for Science was organized to coincide with the date of this event, and following the one in 2016, the Paris Agreement on Climate Change was signed. The EPA, Clean Water Act, and Endangered Species Act are seen as responses to, for the point, what worldwide event promoting environmentalism that was first celebrated on April 22, 1970?

ANSWER: Earth Day

(Tossup 21) A modular steel version of one of these structures was created by Donald Bailey and was often used during wartime. Counterweights help to open and close the bascule version of these structures. Abutments and piers in these structures help to balance compression and tension as gravity and load act on their spans. Arches help to support one type of, for the point, what structures that may also come in cantilevered, cable-stayed, and suspension varieties, designed to cross an obstacle such as a river or roadway?

ANSWER: bridges

(Tossup 22) Every other one of these numbers is also a centered octagonal number, and those that end in the same digits as their generators are called automorphic numbers. Lagrange proved that all natural numbers can be stated as the sum of four of these numbers. Two triangular numbers sum to a number of this kind, while the difference between successive examples of these numbers generates the sequence of odd numbers. For the point, name this kind of number such as 4, 16 or 25, generated from integers multiplied with themselves.

ANSWER: perfect squares (or square numbers)

(Tossup 23) Frederick Soddy suggested the existence of this classification of elements to explain the difficulty in placing them in the periodic table. Replacing an element with an atom with this classification slows down the rate of a reaction in a kinetic effect named for this classification. Deuterium and tritium have this classification with respect to hydrogen. The existence of elements with this classification allows for carbon-dating. For the point, name these variants of an element which contain more neutrons but the same number of protons.

ANSWER: isotopes (accept nuclide)

(Tossup 24) A series of pouches named for this scientist preserved nerve supply unlike the Heidenhain pouches of his mentor. As the founder and first chair of physiology at the Institute of Experimental Medicine, this scientist developed a theory to explain “psychic secretions” he noticed when he approached his subjects, who believed they were about to be fed. For the point, name this Russian scientist whose work on classical conditioning involved training dogs to salivate at the sound of a bell.

ANSWER: Ivan Petrovich Pavlov

(Tossup 25) Along with acid rain, the Hubbard Brook Ecosystem Study examined this process’s effect on watersheds. Jared Diamond blames this process for the collapse of the Easter Island society. On satellite images, the Dominican Republic-Haiti border is easily seen because of this process, also done to expand palm oil plantations, which threatens Indonesia’s orangutans. A consequence of slash-and-burn agriculture, this process destroys a soccer field-sized patch every minute in Brazil. For this point, name this process in which trees are cleared from large areas of land.

ANSWER: deforestation (accept logging or any answer describing the removal of trees)

(Tossup 26) Chyme is an acidic material produced during this process whose pH is neutralized after the release of the CCK hormone in the duodenum. A crop is a specialized organ used for this process in some birds and insects, primarily for storage. Bile from the liver and lipase from the pancreas help to break down fats during this process, while pepsin breaks down proteins into amino acids. For the point, name this process of obtaining nutrients from food via organs like the esophagus and stomach.

ANSWER: digestion (accept word forms)

(Tossup 27) Kurt Gödel's gur-dull's solution to equations governing this theory curiously exhibits rotation and twisting worldlines. Arthur Eddington tested this theory in 1919 by taking measurements from a solar eclipse. LIGO has confirmed the existence of waves predicted by this theory. For the point, name this theory that describes gravity as spacetime curvature, developed by Einstein after considering a more special case of the same concept with electromagnetism.

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

(Tossup 28) When too much pressure is created by the aqueous humor found inside this organ, it can lead to glaucoma. When this organ's shape becomes over-elongated, a person may be diagnosed with myopia. A stage of sleep is named for the rapid movement of this body part. This structure's lens focuses light on the fovea which activates rods and cones in the retina. Parts of this structure include the iris and pupil. For the point, name this part of the body that is responsible for vision.

ANSWER: the eyes

(Tossup 29) A function described by this adjective obeys the stipulation that  $-f(x)$  negative f of x is equal to  $f(-x)$  f of negative x for all  $x$  in the domain, or equivalently, functions described by this word have rotational symmetry about the origin. It is an unsolved problem whether there are any integers of this type that are perfect numbers. In its plural form, this word describes the ratio of the probabilities of an event happening and not happening. For the point, give this word that describes numbers of the form  $2n + 1$ , which are the opposite of even numbers.

ANSWER: odd (accept odds)

(Tossup 30) When this quantity equals one over the square root of  $L$  times  $C$ , an LC circuit will exhibit resonance. A photon's value for this quantity is equal to energy over Planck's constant. Woofers are designed to produce low values of this quantity. For a given wave, this quantity is equal to one over the period. For the point, name this quantity measured in hertz.

ANSWER: (angular) frequency

## Backup

(Tossup 31) The Hubble Deep Field images show an area of the sky within this constellation. In Arab tradition, the "three leaps of the gazelle" mark the legs of this constellation, which also contains the Owl Nebula and Pinwheel Galaxy. In the northern hemisphere, it is the largest circumpolar constellation, and its most recognized asterism has pointer stars that direct the observer to the North Star. For the point, name this "Great Bear" constellation that contains the seven stars of the Big Dipper.

ANSWER: Ursa Major (accept Great Bear before it is mentioned; prompt on Big Dipper)

(Tossup 32) This device relies on Bussard collectors to replenish its fuel, typically stored in deuterium cartridges. Zefram Cochrane's *Phoenix* was the first vessel powered by one of these devices. Ten is the theoretical maximum output for this device, which displaces gravimetric fields and requires a dilithium crystal matrix to mediate the matter-antimatter reaction. Invented in the year 2063, for the point, name this Federation starship device that allows faster-than-light travel in the *Star Trek universe*.

ANSWER: warp drive (accept warp engine)