

Round 3

Regulation

(Tossup 1) A severe reaction to this condition is known as anaphylaxis and can be treated with an epinephrine injection. This condition is caused by increased histamine levels which can lead to hives, runny nose, and in severe cases, an inability to breathe. For the point, name this condition triggered by the immune system's response to a foreign substance – such as peanuts, dust, or pollen.

ANSWER: allergies (or allergy; accept specific types)

(Tossup 2) One application of this physical principle involves aligning an ultrasound signal parallel to blood flow in an artery to measure the speed and direction of blood flow. Another application of this principle allows weather radar to accurately determine the speed and direction of storms without having to rely on repeated imaging. For the point, identify this principle also used to determine the expansion of the universe by detecting red shifts in the light from galaxies, a physical principle named for an Austrian scientist.

ANSWER: Doppler effect (accept Doppler shift)

(Tossup 3) These substances are trapped by a stable one called TEMPO in EPR spectroscopy. These substances, which are created by homolysis, are drawn with single barbed fish-hook arrows. These substances, such as superoxide, cause damage when they build up in cells. For the point, name these highly reactive substances with unpaired electrons that are protected against by anti-oxidants.

ANSWER: free radicals

(Tossup 4) These objects are subject to the void coefficient of reactivity. Fast neutrons can be produced by fission via these objects. These objects produce energy through a thorium fuel cycle or other methods of radioactive decay. For the point, name these devices that can suffer meltdowns that release radiation.

ANSWER: nuclear reactors

(Tossup 5) Epistasis occurs when one of these units depends on the presence of another. The locus gives the position of these units and can help determine whether two of these units are linked. The ratio of these units in offspring can be determined using a Punnett Square, and laws of their inheritance were formulated by Gregor Mendel on pea plants. For the point, name these units of DNA that encode phenotypes.

ANSWER: genes (accept genotype; prompt on locus before mentioned)

(Tossup 6) These events are predicted by pressure recorders in the DART system. Abrupt deformation of the sea floor can cause a vertical displacement resulting in one of these events. In 2004, an earthquake along the Burma Plate and the Indian Plate caused one of these catastrophic events in the Indian Ocean. For the point, name these large waves with a Japanese name which can devastate coastal regions.

ANSWER: tsunamis (prompt on tidal wave; prompt on seismic sea wave)

(Tossup 7) This term describes a matrix whose elements are given by the Kronecker delta and has ones on the main diagonal and zeros elsewhere. Multiplying an element by its inverse gives this term, which is one for multiplication. For the point, give this term that names a property stating that any number times one is equal to itself.

ANSWER: Identity

(Tossup 8) These creatures of the subclass *Hirudinea* were used in a practice meant to restore the balance of “humours” in the body. These annelids create a Y-shape mark when they bite. To collect these creatures, old animals would be walked through wetlands so these creatures could bite them. For the point, name these bloodsucking parasites that were used to draw blood in medieval medicine.

ANSWER: leeches

(Tossup 9) Paul Dirac hypothesized that the age of this entity is inversely proportional to the gravitational constant. This entity is thought to be flat because measurements of the density parameter Ω are very close to one. The acceleration of this entity is thought to be caused by dark energy, and possible endings to it include heat death. For the point, name this entity that was created by the Big Bang.

ANSWER: the universe

(Tossup 10) Fowler’s solution, a compound containing potassium, oxygen, and this element was once used as a tonic. With the element gallium, this element forms a common semiconductor. A test using zinc and nitric acid is used to detect the presence of this element. That test is the Marsh test. This element was used in the so called “magic bullet” drug Salvarsan, the first effective treatment for syphilis. For the point, name this toxic element once used as a rat poison with symbol As.

ANSWER: arsenic (accept As before it is read)

(Tossup 11) This molecule’s inhibition of cytochrome c oxidase is the reason it quickly leads to death after inhalation. When this molecule is a part of an organic compound as a functional group, it is known as a nitrile. This molecule can sometimes smell of “bitter almonds.” It consists of a carbon atom triple bonded to an element to the immediate right of carbon on the periodic table. For the point, name this poison found in apple seeds with chemical formula CN minus.

ANSWER: cyanide (accept CN minus before it is read)

(Tossup 12) Many messenger RNAs contain a sequence of nucleotides known as the “response element” of this metal. Deficiency in this element is the most common nutritional deficiency in the world and can lead to its namesake form of anemia. This element is found in heme, and gives hemoglobin its affinity for oxygen. For the point, name this element with atomic number 26 and atomic symbol Fe.

ANSWER: iron (accept Fe before it is read)

(Tossup 13) On the Koppen climate classification, this climate is classified as BWh and BWk. The cold varieties of these climates typically occur in the rain shadow of high mountains. This climate occupies about one-third of global land surface and is characterized by great aridity. For the point, name this hot, dry climate that receives little rainfall and is typically known for having vast amounts of sand.

ANSWER: the desert

(Tossup 14) These numbers have a closed-form solution known as Binet's Formula. The limit of the ratio of these numbers is equal to phi, the golden ratio. These numbers are defined recursively as the sum of the two previous terms. For the point, name this set of numbers which begins 0, 1, 1, 2, 3, 5.

ANSWER: Fibonacci numbers (accept Fibonacci sequence)

(Tossup 15) The floor function returns the greatest element of this set of numbers less than the input. Diophantine equations always have solutions in this set of numbers. The symbol for this set of numbers is a blackboard bold Z. For the point, name this set of numbers that includes the whole numbers as well as the negative numbers.

ANSWER: integers

(Tossup 16) Early pioneering work on chaos theory was done by Edward Lorenz while studying the pattern of this entity on a digital computer. A company called "[this entity] underground" gives real-time updates on it. This entity is a catch-all term for phenomenon occurring primarily in the troposphere. For the point, name this state of the atmosphere which scientists try to "forecast" through readings of temperature and precipitation activity.

ANSWER: weather (do not accept or prompt on climate)

(Tossup 17) The Frasch process is used to produce an allotrope with this many sulfur atoms, known as a "puckered ring." There are this many hydrogen atoms in propane. With the exception of helium, noble gases usually have this many valence electrons. For the point, identify the number of carbons in octane.

ANSWER: eight

(Tossup 18) The radial velocity method of detecting these objects, involving small Doppler shifts, was the first successful method used to find these objects. In recent years, changes in brightness can help detect these objects by using variations of the transit method. Poltergeist and Phobetor [foh-beh-tor] were the first of these objects to be confirmed. For the point, identify these objects, of which over 4,000 have been discovered orbiting stars other than our sun.

ANSWER: Exoplanets (accept extrasolar planets)

(Tossup 19) One of these statements is an early statement of demonstrating that change in momentum is equal to the impulse imparted to an object. Another of these statements is an early statement of the conservation of momentum in terms of paired forces. One of these statements discusses the cause of acceleration being an outside unbalanced force applied to an object. For the point, identify this trio of statements which explain fundamental motion of objects as first written in the *Principia* by the man who also proposed the Law of Universal Gravitation.

ANSWER: Newton's Three Laws of Motion

(Tossup 20) Dangerously powerful storms on this landmass that can cut between mountain passes are locally known as "Herbies" and primarily impact the region surrounding McMurdo Sound. The largest known oceanic current flows clockwise around this landmass. Krill named for this landmass are probably the most abundant species on the planet. For the point, name this continent located at the South pole.

ANSWER: Antarctica

(Tossup 21) These objects are classified as C-type, S-type or M-type based on their spectral lines, and their astronomical symbol is a generic numbered disc. Large examples of these objects include Pallas and Vesta. These objects get their name from the Greek for "star-like." For the point, name these rocks that make up a namesake belt between Mars and Jupiter.

ANSWER: asteroids (accept asteroid belt)

(Tossup 22) This organ contains the smallest muscle in the human body, the stapedius. The Organ of Corti helps translate signals to the brain in the cochlea [coke-lee-ah] of this organ's inner portion. The middle portion of this organ contains the malleus, incus, and stapes, which are better known as the "hammer," "anvil" and "stirrup." For the point, name this organ that allows you to hear.

ANSWER: ears (accept inner/middle/outer ear)

(Tossup 23) This organelle binds to a Shine-Dalgarno sequence upstream of a sequence which codes for methionine. A, P, and E sites transport tRNA molecules through these organelles, which are found in the cytoplasm or attached to rough endoplasmic reticulum. For the point, name these organelles which synthesize proteins.

ANSWER: Ribosomes

(Tossup 24) J.P. Morgan withdrew funding from this man's Wardencllyffe Tower after this man offered to provide free energy to humanity. This man names a company led by Elon Musk. The SI unit for magnetic flux density is named after, for the point, what Serbian-American scientist who studied electricity with his namesake coil?

ANSWER: Nikola Tesla

(Tossup 25) The U.S. Army secretly sprayed nerve gas trails in the sky to kill thousands of these animals in Utah's Skull Valley. One of these animals was named 6LLS and was part of the Finnish Dorset breed. That animal was Dolly, who was the first mammal to be cloned. For the point, name these animals, commonly kept for their wool.

ANSWER: sheep

(Tossup 26) Zeno formulated one of these constructs involving the movement of an arrow. Considering the set of all sets that do not contain themselves leads to one of these statements named for Russell. The liar's version of this construct involves the declaration "this sentence is a lie." For the point, name these apparently self-contradictory statements.

ANSWER: paradoxes

(Tossup 27) Cotton fibers are almost exclusively made of this molecule. This molecule is the necessary chemical to act as the stationary phase in thin layer chromatography. Humans cannot digest this polysaccharide, but with the help of gut bacteria, cows and termites can. For the point, identify this polysaccharide, the most common naturally occurring organic polymer on Earth, known for being the main component of the cell walls of terrestrial plants.

ANSWER: cellulose

(Tossup 28) A cambered airfoil will experience more of this force than a flat airfoil, even at lower angles of attack. In some high performance and racing cars, this force is directed downward. This force is often incorrectly explained as a simple pressure difference cause by Bernoulli's [ber-noo-lees] Principle. For the point, identify this force, one of the four principle forces that operate on aircraft which causes aircraft to accelerate upwards.

ANSWER: lift

(Tossup 29) This tissue begins forming in early development when aggrecan and Type 2 collagen are secreted to form an extracellular matrix. Because the cells which produce these tissues are bound to particular locations, this tissue is difficult to repair when damaged. Chondrocytes [kon-droh-sights] are found in, for the point, what tissue that makes up inter-vertebral disks as well as human ears and noses?

ANSWER: cartilage

(Tossup 30) This biome is home to bogs known as muskeg. This biome experiences unequal temperature distributions called thermokarst. Trees like the Douglas fir are adapted to this biome's high moisture levels. The tree line marks the end of this biome and the start of tundra. For the point, name this largest terrestrial biome known as boreal forest.

ANSWER: Taiga (accept boreal forest before it is read)

Replacements

(Tossup 31) These functional groups are products of reactions named after Ullmann and Williamson. A cyclic variety of these compounds are known as their namesake “crown.” Its diethyl type was commonly used as an anesthetic. For the point, name these compounds consisting of an oxygen atom bonded to two alkyl or aryl groups.

ANSWER: **Ether**

(Tossup 32) This technique is conducted before the transfer step of a Southern blot. Molecular weight determines the migration rate of this technique. A carcinogenic dye called ethidium bromide helps to visualize this technique, which relies on an agarose matrix. For the point, name this technique which separates DNA using an electric field.

ANSWER: Gel **electrophoresis**