

Round 1

Regulation

(Tossup 1) Complications with this organ are typically seen in patients presenting Levine's sign. Bachman's bundles and Purkinje fibers depolarize this organ. This organ produces the signal for the QRS complex on an EKG. This organ is divided into four chambers known as atria and ventricles. For the point, name this cardiovascular organ that pumps blood through the body.

ANSWER: heart

(Tossup 2) For a wire, this quantity varies inversely with cross-sectional area and directly with length. The inverse of this quantity is measured in siemens [SEE-mens] and is called conductance. The ideal circuit component related to this quantity is represented by a zigzag on a circuit diagram. This quantity is measured in ohms. For the point, name this quantity that describes how much a device opposes electric flow.

ANSWER: electrical resistance (accept resistor; do not accept "resistivity")

(Tossup 3) One collection of these features gives its name to the Jurassic period. The process of folding in the crust can create these features. Varieties of these landforms include fold, block, and volcanic. Orogeny refers to the creation of a new range of these geographical landmasses due to uplift of tectonic plates. For the point, name this type of landmass, examples of which include Kilimanjaro and Everest.

ANSWER: mountains (or mountain range; accept Jura mountains or Jura mountain range; prompt on "Jura")

(Tossup 4) This function is generalized by the gamma function. Stirling's formula is an approximation of this function. This function applied to a positive integer n is given by n times quantity n minus one all the way down to one. This function gives the number of ways to arrange n distinct objects in a row. For the point, name this function symbolized by an exclamation point next to a number.

ANSWER: factorial (prompt on "exclamation" point)

(Tossup 5) This man invented the phonograph and an early projector known as the kinetoscope. This man controversially organized the killing of the elephant Topsy. This rival of George Westinghouse once employed Nikola Tesla at his Machine Works company. This "Wizard of Menlo Park" found a practical use for carbon filament that would later be replaced with tungsten. For the point, name this American inventor of the lightbulb.

ANSWER: Thomas Alva Edison

(Tossup 6) By chemical mass, this is the heaviest element in the only diprotic strong acid. When bonded to six fluorine atoms, this element forms a potent greenhouse gas. Two atoms of this element form a covalent "bridge" in proteins. This element sits below oxygen on the periodic table. For the point, name this element, associated with brimstone and bad smells, with chemical symbol S.

ANSWER: sulfur (accept sulfuric acid; accept disulfide bonds; prompt on S)

(Tossup 7) The fixed action patterns of aggression in some of these animals were studied by Niko Tinbergen. One of these vertebrates was first cloned by George Streisinger. These non-mammals include the stickleback and one named for its zebra pattern along its scales. For the point, name these water-breathing animals that include trout and salmon.

ANSWER: fish (accept Stickleback and Zebrafish before mentioned)

(Tossup 8) This theory can help explain adaptive radiation as the filling of various niches. This theory was formulated in part from observations of finches on the Galapagos Islands. The formulator of this theory referred to it as “descent with modification” and outlined his discoveries in *On the Origin of Species*. Natural selection is an important mechanism in this theory. For the point, name this theory formulated by Charles Darwin.

ANSWER: evolution (accept natural selection until mentioned; prompt afterwards)

(Tossup 9) This property’s indentation form is measured on the Rockwell scale and the Vickers scale, which presses into a material with a diamond indenter. Apatite has a value of 5 for this property while Talc has a value of 1. This property is defined as a mineral’s resistance to scratching. Diamond has the highest natural value of, for the point, what property measured by the Mohs scale?

ANSWER: (Mohs) hardness (accept indentation hardness; accept Vickers hardness; accept Rockwell hardness)

(Tossup 10) An equation described by this law is modified with a and b constants to create the van der Waals equation. This law only applies under the assumptions of kinetic molecular theory. The equation described by this law can be derived through a combination of Boyle’s law, Charles’ law, and Gay-Lussac’s law. For the point, name this law which relates the product of pressure and volume of an ideal substance to its temperature.

ANSWER: ideal gas law (accept gas law after “ideal”; accept PV equals nRT; accept PV equals NkT; accept equivalent expression)

(Tossup 11) According to the first law of thermodynamics, heat minus work equals the change in the “internal” form of this quantity. One form of this quantity is equal to one-half $m v^2$ where m is mass and v is velocity. This quantity is typically defined as a measure of “the ability to do work” and can be divided into kinetic and potential components. For the point, name this quantity whose SI unit is the Joule.

ANSWER: energy (accept potential energy; accept kinetic energy; accept internal energy; accept change in internal energy)

(Tossup 12) These objects can be placed into three principal categories based on work by Luke Howard, who developed the common Latin nomenclature used to describe them. Types of these objects include lenticular, nacreous, and contrails. Common classifications include cirrus, stratus, or cumulus. For the point, name these puffs of air and water vapor which form in the sky

ANSWER: clouds

(Tossup 13) An experiment using this organism compared the ratio of nitrogen 14 and nitrogen 15 in DNA. This organism was used by Meselson and Stahl to show that DNA replication was semi-conservative. This organism is infected by lambda phage. Outbreaks of this bacteria are usually caused by the O157:H7 strain. For the point, name this rod-shaped gut-residing bacteria from the Escherichia [ES-cah-REE-chee-uh] genus.

ANSWER: E. coli (accept Escherichia coli; accept just coli at the end)

(Tossup 14) The area of the sky obscured by this object is dubbed the “zone of avoidance.” Harlow Shapley believed this object was the only one of its kind to exist, a theory overturned in debates with Heber Doust Curtis using Hubble’s evidence of this galaxy’s neighbor, Andromeda. This galaxy is home to a black hole at its center called Sagittarius A* [A star]. For the point, name this galaxy which contains our solar system.

ANSWER: Milky Way (prompt on descriptions of “our galaxy”)

(Tossup 15) The wurtzite [vurt-SITE] form of this element’s nitride is harder than diamond. Oxygen, silicon, and this element are the three most common in Pyrex glass. This element commonly only makes three valence bonds, violating the octet rule. This element is the lightest metalloid on the periodic table, found just to the left of carbon. For the point, name this element with atomic number five and elemental symbol B.

ANSWER: boron (accept borosilicates; prompt on B)

(Tossup 16) One of these things named for Poisson can model events that occur with a fixed rate. The central limit theorem details how independent random variables can tend to one of these things that is described by the 68-95-99.7 rule. That example of these statistical things is sometimes named for Gauss and has a bell curve shape. For the point, name this statistical device which can be uniform or normal and describes the spread of data.

ANSWER: probability distribution (accept Poisson distribution; accept normal distribution; accept Gauss(ian) distribution)

(Tossup 17) After obtaining the product of this task, concentrating is done to remove gangue [gang]. This task has open pit, strip, and underground varieties. An effective method of cracking rock for this task was fire-setting, which was Alfred Nobel’s reason for inventing dynamite. For the point, name this task of extracting valuable material from the Earth, such as coal, diamonds, and various ores.

ANSWER: mining (accept mines; accept extracting ores or extraction; accept descriptions of obtaining minerals)

(Tossup 18) A reaction for creating soap uses this class of molecules along with esters. Sodium hydride is a “super” example of this class of molecules. Lewis variants are ones that donate electron pairs. Common examples include the weak one, ammonia, and sodium hydroxide. For the point, name this class of molecules with pH greater than seven which can be neutralized with acids.

ANSWER: bases (accept word forms like basic)

(Tossup 19) This organelle is the site of the Q cycle named for Coenzyme Q10. When cytochrome c is released from this organelle, apoptosis is initiated in the cell. This organelle's matrix is separated from the intermembrane space by folds called cristae, which increase surface area for the electron transport chain. For the point, name this primary factory of ATP synthesis that is affectionately known as the "powerhouse of the cell."

ANSWER: mitochondria (accept mitochondrion)

(Tossup 20) This object's Reiner Gamma exemplifies its namesake swirls. Studies of this object by George Darwin led him to propose the Giant-impact hypothesis of its formation. Hot lava regions that cooled into flat dark spots created the mares on this object, such as the Sea of Tranquility. This object has waxing and waning gibbous phases. For the point, name this object which orbits the Earth in approximately 27 days.

ANSWER: the moon (or luna)

(Tossup 21) The name for this sort of process is thought to be from an Anglicization of an Arab mathematician who invented a form of algebra. These processes typically have their asymptotic performance expressed using "big O" notation. Dijkstra [DIKE-struh] names one of these instructions that finds the shortest path between two vertices of a graph. Quicksort is an example of one for sorting. For the point, name this set of cookie-cutter instructions given to a computer to solve a problem.

ANSWER: algorithms (al-Kwarizmi is the Arab mathematician)

(Tossup 22) Erta Ale in Ethiopia is home to a lake filled with this substance. Domes named for this substance occur when it piles up near the vent due to slow movement through the conduit. This substance comes in pahoehoe [pah-ho-ay ho-ay] and aa [ah ah] varieties. This substance cools to form extrusive rocks like pumice and is emitted along with tephra. If this substance cools fast enough, it forms the glassy rock obsidian. For the point, name this hot fluid ejected from a volcano.

ANSWER: lava (accept lava lakes; accept lava domes)

(Tossup 23) ECMA can add functional groups to one member of this class of compounds. Wallace Carothers names an equation that describes the degree to which the formation of this class of compounds occurs. Cross-links can form between chains of this class of compounds which include plastics like Teflon. Nylon is a synthetic member of, for the point, what class of compounds made up of repeating monomers?

ANSWER: polymers (accept acrylics or acrylic polymers; accept synthetic polymers; accept plastics until mentioned)

(Tossup 24) Just below the upper surface of this structure is the palisade layer, which typically lies above the spongy layer. A waxy cuticle minimizes water loss from this structure. This structure contains tiny holes for gas exchange called stomata. This plant organ is specialized for photosynthesis and contains chlorophyll, which makes it green. For the point, name this plant structure that changes color and falls off trees in autumn.

ANSWER: leaf (accept leaves or leafage; accept foliage)

(Tossup 25) Two linear partial differential equations named for this device describe the change in voltage and current during transmission. Charles Wheatstone and W.F. Cooke created an early version of the needle system for this device. The single-wire version of this device was invented by Samuel Morse. For the point, name this early form of long-distance transmission of messages whose name is Greek for “far off writing.”

ANSWER: electric telegraph (accept telegrapher’s equations; accept telegraph equations; accept telegraphy)

(Tossup 26) According to Goldbach’s conjecture, all integers with this property can be written as the sum of two primes. Functions described by this term are symmetric about the y-axis. Performing an exponential on a negative real number with a natural number that has this property is always positive. The smallest prime number is the only prime with this property. For the point, name this property present in numbers divisible by two.

ANSWER: even (prompt on descriptions like divisible by two until mentioned)

(Tossup 27) James Challis blundered the chance to find this object using John Couch Adams’s calculations. Johann Gottfried Galle discovered this planet based on calculations done by Urbain Le Verrier [luh VARE-ee-AY]. This planet is orbited by the largest retrograde moon in the Solar System, Triton. Methane in this planet’s atmosphere reflects gives it its namesake blue color. For the point, name farthest planet in our Solar System, the eighth from the Sun.

ANSWER: Neptune

(Tossup 28) This material’s *hachimoji* variant has enhanced storage capability. This material can be cut using cas9. Topoisomerase corrects for supercoiling in this material. Its namesake polymerase attaches after helicase unzips it. This material is wrapped around histones in chromosomes. It is made up of four bases – adenine, thymine, cytosine and guanine. For the point, name this genetic material which is transcribed into RNA.

ANSWER: DNA (accept deoxyribonucleic acid)

(Tossup 29) This unit was recently redefined through measurements of Planck’s constant, until then this was the only SI unit defined by a physical device. The standard units for moment of inertia are derived by multiplying this unit by meters squared. Balances measure this SI unit, typically by one thousandths of it. For the point, name this SI unit for mass approximately equal to 2.2 pounds.

ANSWER: kilogram (do NOT accept or prompt on gram)

(Tossup 30) Hennig Brand discovered this element while attempting to turn his urine into gold. Match factory workers developed jaw deformation due to prolonged exposure to this element’s white allotrope. This element names a form of radiation that is not immediately re-emitted, contrasted with fluorescence. For the point, name this element with atomic number 15 and atomic symbol P.

ANSWER: phosphorus (accept white phosphorus; prompt on P until mentioned)

Extra

(Tossup 31) In languages like C++, this sort of data structure is similar to an array but has dynamic size. In linear algebra, this word describes mathematical objects that can be manipulated with dot and cross products. In biology, this term refers to organisms which carry and transmit disease. Velocity can be described by this term, unlike speed, which is scalar. For the point, name this term which can describe mathematical objects with magnitude and direction.

ANSWER: vectors