

Round 3

Regulation

(Tossup 1) This object was discovered in 1930 by Clyde Tombaugh. *New Horizons* made observations of this object in 2015 where pictures revealed its “frozen heart,” which likely had nothing to do with this object’s demotion to a trans-Neptunian object in 2006 after the discovery of Eris. For the point, name this dwarf planet that used to be the 9th planet from the Sun.

ANSWER: Pluto (accept 134340 Pluto)

(Tossup 2) Researchers at Johns Hopkins University used CT scans on one of these animals to determine how they can strain their necks 270 degrees without injuring capillaries. Two types of this bird are described as “great-horned” and “snowy.” Some of these birds are named for their screech while the most widely distributed is the common barn type. For the point, name these nocturnal birds associated with a “hoot-hoot” call.

ANSWER: owls (accept tawny owls; accept barn owls; accept screech owls; accept snowy owls; accept great horned owls)

(Tossup 3) Carmichael numbers don’t have this property but satisfy Fermat’s test for it. Eratosthenes names a sieve to find numbers with this property. The “twin” variety of these numbers differ by two. The factorization of natural numbers into these kind of numbers is guaranteed by the fundamental theorem of arithmetic. For the point, name this kind of number that has exactly two divisors, itself and one.

ANSWER: prime numbers (or primes; accept twin primes or prime factorization)

(Tossup 4) The first of these operations caused the deaths of Grissom, White, and Chafee due to a fire. These operations frequently made use the Saturn V [“five”]. Michael Collins was the third member of one of these seventeen operations; that operation included the quote “one small step for man.” For the point, name these series of missions with astronauts like Neil Armstrong and Buzz Aldrin going to the moon.

ANSWER: Apollo program

(Tossup 5) This material can be coated with kaolinite or talc to make it appear glossy. The invention of this material is attributed to Han eunuch Cai Lun [“sigh” loon]. The creation of this material involves the extraction pulp. Along with vellum, Johannes [YO-hahn-ess] Gutenberg implemented movable type on this material to manufacture his namesake Bible. For the point, name this material made from ground up fiber and cellulose in wood.

ANSWER: paper (accept coated paper; do not accept or prompt on “papyrus”)

(Tossup 6) Due to properties of 4f orbitals, lanthanides exhibit contraction of this quantity. Bohr names a value of this quantity for ground-state hydrogen. Bond length is typically defined as the sum of two values of this quantity. Francium has the largest value for this quantity, and helium has the smallest value. For the point, name this distance from an atom’s nucleus to its electrons.

ANSWER: atomic radius (accept radius at the end; prompt on “atomic distance”)

(Tossup 7) These phenomena can be classified into either diurnal [DIE-ur-null], semi-diurnal or a mixed pattern. The neap variety of these phenomena occurs when the sun's mass offsets it; the neap variety occurs twice a month, as does the spring variety. These phenomena occur because the Moon has stronger gravitational pull on the side of the Earth closer to it. For the point, name these daily changes in ocean elevation levels.

ANSWER: (neap/spring) tides (or tidal bulges; or tidal phenomena; accept anything indicating a change in tides; prompt on "change in sea level")

(Tossup 8) This value is zero in every inertial reference frame. For an object moving uniformly in a circle, this value is equal to the velocity squared divided by the radius. Newton's second law equations this quantity to net force over mass. For this quantity due to gravity on Earth, denoted little g, it is 9.81 meters per second squared. For the point, name this measure of how fast velocity is changing.

ANSWER: acceleration (do not accept or prompt on angular acceleration)

(Tossup 9) Sato generalized Ramanujan's formulas for calculating this number. This is the smallest positive x at which cosine of x is negative one. In radians, one degree is equal to this transcendental number divided by 180. The area of any circle is given by this number times the radius squared. For the point, name this ratio of the circumference to the diameter of any circle, approximately equal to 3.14 ["three point one four"]

ANSWER: pi (prompt on "3.14" and more decimal answers until mentioned)

(Tossup 10) Resolving errors in crystallographic data has led most scientists to believe osmium has the highest elemental value for this quantity. The ratio of this quantity to that of a reference substance is the specific gravity. This intrinsic property, commonly symbolized rho, defines how tightly an object packs its mass into space. For the point, name this property equal to mass divided by volume, which can be used to determine if an object floats in water.

ANSWER: density (accept descriptions of how dense the object / element is)

(Tossup 11) The introduction of the Ribwort Plantain led to one type of this insect, the Edith's checkerspot, nearly dying out. A rash named for this insect is a tell-tale sign of lupus. The wings of this insect, like *Heliconius*, warn off predators using Mullerian mimicry. Along with moths, this insect makes up Lepidoptera. Caterpillars metamorph into, for the point, what insect exemplified by the viceroy and monarch?

ANSWER: butterfly (or butterflies)

(Tossup 12) Exchanging these items for profit was the goal of Mt. Gox ["mount gocks"]. Ethereum uses similar technology to these items that were invented by the pseudonymous Satoshi Nakamoto. These items are exchanged along a consensus network that records transactions on a block chain. For the point, name this peer-to-peer cryptocurrency, a coin named for a single one or zero on a computer.

ANSWER: bitcoins

(Tossup 13) This structure's split deactivation is responsible for the tortoiseshell and calico patterns on some cats. This structure's lyonization creates a remnant Barr body. A child will always inherit a copy of colorblindness on this chromosome if the mother is red-green colorblind. For the point, name this sex chromosome which female mammals have two copies of.

ANSWER: X chromosome

(Tossup 14) This substance's electron temperature, density, and potential can be measured with a Langmuir probe. This substance is confined by a magnetic field in devices called tokamaks. This substance's occurrences on Earth include auroras and lightning. This substance is created through ionization of gas. For the point, name this substance, commonly described as "the fourth state of matter," which occurs at high temperatures.

ANSWER: plasma

(Tossup 15) A powerful reducing agent contains lithium, three atoms of chlorine, and one atom of this element. This metal's oxide makes up corundum. The Hall-Heroult ["hall hero"] process is a common method for smelting this element. Bauxite is rich in this element which replaced tin as a household product in cans and foil. For the point, name this light metal with chemical symbol Al.

ANSWER: aluminum (or aluminium; prompt on "Al")

(Tossup 16) Inge Lehmann suggested that this region has a solid component. Convection occurring in one portion of this region is the proposed mechanism for dynamo theory. This region can be divided into its outer molten component and inner solid component. For the point, name this region that sits directly below the mantle in the center of the Earth.

ANSWER: Earth's core (accept inner core; accept outer core)

(Tossup 17) The most common immortal cell line to study this species is known as HeLa. The existence of this species is the reasoning behind the anthropic principle. Impact from this species has led some geologists to suggest the Anthropocene epoch. Genomic evidence of skeletons has shown that this species interbred with Neanderthals. For the point, name this species scientifically referred to as *Homo Sapiens*.

ANSWER: humans (or Homo sapiens until mentioned, prompt afterwards; accept people or other synonyms; prompt on Henrietta Lacks)

(Tossup 18) The first of these utilities to be launched into space by NASA in 1973 was unsuccessful in re-entry, scattering debris over Western Australia. Another of these utilities named *Freedom* was approved by Ronald Reagan, but never built. *Skylab* and *Mir* are two examples of these satellites. For the point, name these satellites in orbit that can support a team of astronauts, including the international one – the ISS.

ANSWER: space stations (accept international space station; accept SkyLab until mentioned; prompt on "satellite" until mentioned)

(Tossup 19) Angiotensin converting enzyme is found in endothelial and kidney epithelial tissue, but it primarily operates in this organ's capillaries. DPPA is a surfactant in this organ that helps maintain compliance. Gas exchange occurs in this organ's alveoli. This organ's expansion and contraction is controlled by the diaphragm muscle. For the point, name this organ that filters in oxygen from the air.

ANSWER: lungs

(Tossup 20) Using this element and sulfuric acid, Gaston Planté made the first rechargeable battery. TEL, an anti-knocking agent, was phased out of gasoline for containing this element. This element's use and presence in pipes is a biological hazard, despite its Latin name inspiring the English word for "plumbing." For the point, name this element with atomic number eighty-two and chemical symbol Pb.

ANSWER: lead (accept plumbum before "plumbing," and prompt afterwards; prompt on Pb)

(Tossup 21) These phenomena can develop from thunderstorms known as supercells, which contain mesocyclones that take in cool air to form a condensation funnel. The Enhanced Fujita scale measures the intensity of these phenomena. In the U.S., these phenomena mostly form in a namesake alley. For the point, name these rapidly rotating columns of air, which are sometimes called twisters.

ANSWER: tornadoes (or twisters until mentioned; accept whirlwind; accept mesocyclone until "mesocyclone" is read)

(Tossup 22) The name for this element was given by Lockyer and Frankland after performing spectral analysis on the sun. When cooled below four Kelvin, this element becomes a superfluid with no viscosity. Nuclei of this element are equivalent to the alpha particle. This element is the lightest of the noble gases. For the point, name this element used to fill balloons and can create a high pitched voice effect.

ANSWER: helium (prompt on He)

(Tossup 23) Self-balancing examples of this data structure include the AVL and red-black variety. This data structure can be traversed post-order, in-order, or pre-order. This data structure takes its name from a plant since it's information is stored down descendants from a root node. For the point, name this data structure with a root that branches down to its leaves.

ANSWER: trees

(Tossup 24) Geneticists studying the pathology of this class of diseases split mutations into passengers and drivers for it. One subclass of these diseases can be divided into Hodgkin and Non-Hodgkin varieties. Two subtypes of these diseases are leukemias and lymphomas. Cells implicated in these diseases become dangerous when they metastasize. For the point, name this general class of diseases characterized by malignant invasive tumors.

ANSWER: cancer

(Tossup 25) One statement of this kind was put forth by Georg Cantor and is named after the continuum. Type I and type II errors occur due to accidentally accepting or rejecting the “null” version of this type of statement. Riemann names a statement of this kind about his namesake Zeta function. For the point, name this proposition a scientist makes, which might be testable by experiment.

ANSWER: hypothesis (or hypotheses; accept null hypothesis; accept continuum hypothesis; accept Riemann hypothesis)

(Tossup 26) A type of these objects known for reaching hot temperatures is the Wolf-Rayet type. These objects can be classified as Population I or II [“one or two”] depending on their metallicity. The Hertzsprung Russell diagram is a scatter plot of these objects. Young examples of these objects create energy by fusing hydrogen in their cores. For the point, name these spheroidal burning objects that light up the night sky.

ANSWER: stars

(Tossup 27) This organ may make use of crystallin to increase refractive index . The anterior and posterior chambers of this organ are filled with aqueous humour. Cataracts are a disease affecting this organ which contains a sensitive spot known as the macula. This organ contains cone and rod cells in its retina. The iris controls pupil size in, for the point, what organ responsible for vision?

ANSWER: eyes (anti-prompt on “lens”; anti-prompt on “cornea”; anti-prompt on “retina”)

(Tossup 28) Minute [my-newt] crystals in this mineral form jasper. This mineral is the simplest to exhibit conchoidal [con-COY-dull] fractures and comes in milky, smoky, and rose varieties. This mineral is at the bottom of Bowen’s reaction series and defines the value of seven for the Mohs hardness scale. For the point, name this mineral made up of silicon-oxygen tetrahedra, the second most abundant in the Earth’s crust after feldspar.

ANSWER: quartz (accept milky quartz; smoky quartz; accept rose quartz)

(Tossup 29) Assuming the cord is weightless and using two masses produces an Atwood Machine, which is in this class of machines that also includes block and tackle systems. This machine consists of a wheel on a fixed axle with a groove to support a sliding rope. For the point, name this simple machine whose name comes from the action performed on the rope to lift up an object.

ANSWER: pulleys

(Tossup 30) Some flat panel variants of these devices work via electroluminescence. These devices commonly use liquid crystals or light emitting diodes. Resolution is a measure of the accuracy of these devices, which is often reported in pixels. Capacitors react to skin contact to make these devices interactive in phones and tablets. For the point, name these devices used to provide a visual output for an electronic device.

ANSWER: electronic visual displays (accept screens; accept touchscreens; accept flat panel displays; accept ELDs or electroluminescent displays; prompt on television or TV with “What part of the TV?”)

Extra

(Tossup 31) In the yellow range of light, this element's spectroscopic signature has a doublet separated by less than a nanometer. To create a potential along an animal cell membrane, three ions of this element are pumped out for two potassium ions. This element's anion pairs with bicarbonate in baking soda. For the point, name this lightest alkali metal that makes table salt with chloride.

ANSWER: sodium (accept natrium; prompt on Na)