

Round 2

Bee Round 2

(1) The thermal form of this quantity is inversely proportional to the product of cross-sectional area and thermal conductivity in Fourier's law. The inverse of this quantity is measured in siemens and is known as conductance. This quantity is multiplied by current to give voltage, according to a law that shares its name with this quantity's unit. For the point, name this measure of the difficulty of passing current through a system, symbolized R and measured in Ohms.

ANSWER: thermal and/or electrical resistance (prompt on "R" before read)

(2) Walter Heitler co-wrote an article with Fritz London to create a mathematical model to predict this behavior. When one of these bonds forms between atoms of different elements, it is said to be the polar type. Particles experiencing this type of bond follow the octet rule. Sigma and pi bonds are types of, for the point, what bonds created by the overlapping of orbitals and sharing of electrons, usually contrasted with ionic bonding?

ANSWER: covalent bonds (prompt on (chemical) bonds before mentioned)

(3) Wilson's Theorem tests whether an integer p is prime by checking whether this function of p minus 1 is divisible by p . This function appears three times in the formula for the binomial coefficients " n choose k ". The number of ordered lists of n items is this function of n . This function of n can be computed as n times this operation on n minus 1. For the point, name this operation that is the product of all integers from 1 to n , symbolized by an exclamation point.

ANSWER: factorial

(4) This organ, which is the main site of Wilm's tumors, is the secondary organ of gluconeogenesis. A measure of this organ's performance is the glomerular filtration rate. Vasopressin, also known as ADH, causes this organ to retain more water. The individual functional unit of these organs is called the nephron. A hemodialysis machine is used to treat patients with disorders of this organ. For the point, name this pair of excretory organs that pass urine to the bladder and are shaped like beans.

ANSWER: kidneys

(5) This type of creature represents the y value in the Lotka-Volterra equations. Keystone species of this type usually prevent the elimination of key plant species in an ecosystem. A class of these beings who dominate a particular environment are the "apex" type. Heterotrophs of this type usually feed on herbivores. The eagle and the lion are common examples of, for the point, what type of species that hunt down prey?

ANSWER: predators

(6) Carbon detonation occurs in these objects. A type 1-a supernova may result from the addition of too much mass onto one of these objects. These objects, which are bound by electron degeneracy pressure and cannot be more than about 1.44 solar masses, are found around the bottom left of the Hertzsprung-Russell diagram. After expelling a planetary nebula, a red giant will become, for the point, what type of small stellar remnant, the ultimate fate of our Sun?

ANSWER: white dwarf (prompt on dwarf, star, or stellar remnant)

(7) A reaction described by this word that relies on DMSO is named for Michael Swern. A number described by this word has a value of +7 for manganese. During hydrogen gas's reaction with fluorine gas, hydrogen undergoes this type of process; indeed, fluorine usually causes other substances to undergo this process, because it takes away their electrons. This process takes place at the anode. For the point, name this type of chemical reaction that is paired with reduction, examples of which include rust.

ANSWER: oxidation (accept oxidation number; state, and/or reaction; prompt on redox before reduction is said; prompt on reduction-oxidation before reduction is said, and accept it afterward)

(8) These are the larger of two entities that can make up a flanking line, which is created by the forced upward movement of warm air. Mammatus form underneath these structures. Ice crystals are formed at the top of these clouds, whose mature *incus* type is anvil shaped. For the point, name these clouds that are significantly taller than cumulus clouds and are often the site of thunderstorms.

ANSWER: cumulonimbus clouds (prompt on clouds before read)

(9) One form of this effect was verified in the Mössbauer rotor experiments. In astronomy, this effect is used to explain redshift and blueshift, in which stars change color as their distance from Earth changes. This effect explains the change in pitch when a police car's siren approaches, then passes, an observer. For the point, name this effect that explains the changes in wave frequency relative to motion, used in weather radar imaging.

ANSWER: Doppler effect

(10) This was the first extrasolar star to have its velocity calculated. Along with Procyon and Betelgeuse, this star, which is 8.6 light years from earth, forms the Winter Triangle. Alvan Graham Clark discovered, using Frederick Bessel's calculations, that this star is part of a system with a white dwarf. This binary star, the alpha star of the constellation Canis Major, is the star with the lowest apparent magnitude from Earth and thus the brightest star in the night sky. For the point, name this "dog" star.

ANSWER: Sirius (or Alpha Canis Majoris before "Canis" is read)

(11) This tissue contains the first protein where X-ray crystallography was used to determine its structure. This tissue performs an action that can be explained through the sliding filament theory involving actin and myosin. Duchenne names a disorder in which this tissue wastes away; sufferers of that dystrophy may require physical therapy. Smooth, skeletal, and cardiac are types of, for the point, what soft tissues that include the hamstrings and biceps?

ANSWER: muscles

(12) Feuerbach showed that a certain circle passed through this many points of a triangle. This number is the only proper power of a prime that is 1 larger than another proper prime power. Real numbers with a single digit repeating after the decimal point are equivalent to fractions with this denominator. An arithmetic check of “casting out” this composite number works by computing the digit sum, much like its divisibility test. For the point, name this largest one-digit integer.

ANSWER: nine

(13) *Marrobbio* is an Italian term for these events when caused, unusually, by a quick change in pressure. The Soloviev-Imamura scale measures the intensity of these events, for which DART stations provide warnings. One of these events devastated Indonesia in 2004 after a massive submarine earthquake. A drawback of water from the beach usually precedes, for the point, what large waves commonly known by a Japanese name?

ANSWER: tsunamis (accept tidal wave; accept seismic sea wave; accept harbor wave; prompt on waves before read)

(14) Surface features of this object include light Xanadu and the dark Ontario Lacus. This object, which is in a 4 to 3 orbital resonance with Hyperion, is home to the large Kraken Mare [mar-ay]. The Huygens [hoy-gens] lander, part of the Cassini Orbiter, was sent to study this satellite, the only moon with a significant atmosphere. Large methane lakes scatter the surface of, for the point, what second largest moon in the Solar System and largest moon of Saturn?

ANSWER: Titan

(15) In German papers, this number is sometimes named after Johann Josef Loschmidt. This number is multiplied by elementary charge to give the Faraday constant. Its namesake also names a law relating the volume of a given sample of gas to the number of molecules in that gas. For the point, name this number, roughly equal to 6.02 times 10 to the 23rd and thus celebrated on October 23rd, “Mole Day,” a number named for an Italian scientist.

ANSWER: Avogadro’s constant (or Avogadro’s number; prompt on approximations of the actual number before said)

(16) These locations replaced the “putting-out” system, which was largely done domestically. Richard Arkwright’s spinning frame allowed yarn to be produced in these facilities, ending a cottage industry. The River Rouge Complex was a large example of these facilities, where interchangeable parts move between workstations in an assembly line developed by Henry Ford. For the point, name these sites that were built during the Industrial Revolution, where workers use large machinery to build goods.

ANSWER: factory (accept any specific type of factory, like yarn factory, car factory, etc.)

(17) Marcus theory explains interactions that result in the transfer of these particles between chemical species. For two of these particles in an atom, at least one of the four quantum numbers for these fermions must differ, according to the Pauli exclusion principle. If these particles are found in the outermost shell of an atom, they are described as valence. For the point, name these particles that orbit an atom’s nucleus.

ANSWER: electrons (prompt on fermions before read)

(18) This programming language can use the Swing library to create graphic user interfaces. This language, which does not support operator overload or class inheritance, was originally called Oak, and its bytecodes are executed on a Virtual Machine. Widget toolkits in this language are useful for creating applets. James Gosling developed this language at Sun Microsystems. For the point, name this object oriented programming language whose logo is a cup of coffee.

ANSWER: Java (do not accept or prompt on “Javascript”)

(19) Peter Agre won a Nobel Prize for his work on the proteins that transport this substance into cells, the AQP family of channels. Catalase produces diatomic oxygen and this other compound, while cellular respiration of glucose produces carbon dioxide and this other compound. This is the primary substance found in blood plasma and urine, and it is the primary solvent for biological reactions. For the point, name this compound that makes up around 60 percent of a human body.

ANSWER: water (or H₂O)

(20) The presence of cataclasite can help identify the center of these features. A vertical plane above an area in one of these features is called the dip angle. In collapsed calderas, ring dikes can form from the passage of magma through these locations. Horizontal motion characterizes the transform type of these locations, which may also be classified as strike-slip. For the point, name these fractures in the Earth’s surface, exemplified by the San Andreas in California.

ANSWER: faults (accept transform faults; accept strike-slip faults; accept ring faults)

(21) Samuel Pepys [PEEPS] praised this man’s major work, which included pictures of the edge of a razor and the eye of a fly. This member of the Royal Society coined one term after noticing a resemblance of certain entities to honeycombs. This author of *Micrographia* also developed a namesake law of elasticity. For the point, name this English scientist who coined the term “cell.”

ANSWER: Robert Hooke

(22) Connecting the midpoints of adjacent sides of a quadrilateral produces one of these shapes named for Varignon. In a method of adding vectors named for this polygon, the sum is a diagonal. Consecutive angles in this polygon are supplementary and both pairs of opposite sides have the same length. Rhombuses and rectangles are special cases of, for the point, what type of quadrilateral with two pairs of parallel sides?

ANSWER: parallelograms

(23) Albert Ladenburg discovered an isomer of this compound with a triangular shape named prismane. A hydroxylated form of this compound called phenol is produced from petroleum and is a known carcinogen. August Kekulé’s dream of a snake chasing its own tail is thought to have led to this discovery of this aromatic compound’s shape. For the point, name this cyclic compound with chemical formula C₆H₆.

ANSWER: benzene (prompt on C₆H₆ before mentioned)

(24) The Fourier transform converts a function from the time domain to a domain named for this quantity. Longer waves tend to be described in terms of their period rather than this quantity, which is the reciprocal of the period. For the point, name this quantity, measured in hertz, that counts the number of repetitions of a phenomenon over a given unit of time.

ANSWER: frequency

(25) The company Myriad has been sued over their patents on these entities. Beadle and Tatum studied the “one [of these], one enzyme” hypothesis. Transposons are referred to as “jumping” types of these things, and BRCA1 [B-R-C-A one] is one of these things that normally protects against breast cancer. Different varieties of these things are known as alleles and can cause differing physical traits. For the point, name these regions of DNA, the units of heredity.

ANSWER: genes

(26) Irregularities in this object’s orbit were hypothesized to come from an undiscovered planet, Vulcan, but were later correctly explained through general relativity. This body is home to the large impact crater Caloris Basin, which was studied by *Mariner 10* and *MESSENGER*. This body has the highest difference between day and night temperature of any planet in the Solar System. For the point, name this moonless planet, the nearest to the sun.

ANSWER: Mercury

(27) Two vectors form one of these objects if their dot product is equal to 0. According to Thales’s [thay-leez’s] Theorem, the line segments from any point on a circle to the endpoints of the diameter will form one of these objects. Euclid postulated that all of these angles are congruent to each other, and they are congruent to their supplements. Triangles containing one of these angles are subject to the Pythagorean Theorem. For the point, name these angles that measure 90 degrees.

ANSWER: right angles (accept 90 degree angles or pi over 2 radian angles before “90 degrees” is read)

(28) The *Emerald Tablet* was a central text to this field, whose proponents were inspired by the writings of Hermes Trismegistus. Paracelsus described mercury, sulphur, and salt as this field’s universal elements. The search for the Philosopher’s Stone was central to this field, whose practitioners attempted to transmute metals. For the point, name this early form of chemistry, made difficult by the fact that lead cannot physically become gold.

ANSWER: alchemy

(29) This element’s nitrate is used in an aldehyde testing reagent named for Bernhard Tollens. In the Stern-Gerlach experiment, atoms of this element were deflected to detect spin. A common ore from which this element is extracted is argentite, as was found at the Comstock Lode in Nevada. For the point, name this transition metal that is symbolized Ag on the periodic table and is considered a “precious” metal, though somewhat less valuable than gold.

ANSWER: silver (accept Ag before mentioned)

(30) The Three Utilities Problem has no solution because one of these objects is nonplanar. Leonhard Euler **[oiler]** used one of these objects to solve the Seven Bridges of Königsberg problem, showing that no walk used each edge exactly once. A different kind of object with this name is the subject of the Vertical Line Test and plots points with the input and output measured along the horizontal and vertical axes. For the point, name these diagrams that represent functions in the xy-plane.

ANSWER: **graphs**

(31) One of these objects named for a homunculus is found around the star Eta Carinae. The expulsion of the outer layers of a red giant forms the planetary variety of these objects. The Pillars of Creation are found within one of these objects, and another resembles a horse's head. For the point, name these clouds of dust and gas, associated with stellar birth and stellar death, that include examples named Eagle and Crab.

ANSWER: **nebulae**

(32) Meteor impacts and these events can result in the discharge of lapilli. Steam is given off in the phreatic type of this event, while high-altitude gas columns are created in the Plinian type, named for an ancient historian who experienced one of these events in Italy. Pahoehoe flows out of the surface of the Earth after some types of, for the point, what fiery events in which ash and lava are released, often explosively?

ANSWER: volcanic **eruptions**

(33) Two “emergency planning zones” are found at each American location of this type. Iodine was released into the air after one of these on Three Mile Island experienced a meltdown. The Tohoku earthquake caused a level 7 event at one of these facilities in Fukushima. Fission is used to generate electricity in reactors in, for the point, what type of power plant that runs on subatomic interactions?

ANSWER: **nuclear** power plants (accept clear-knowledge equivalents that have **nuclear**)

(34) A variant of this process that splits up the steps between day and night is called CAM. The first half of this process occurs in the thylakoid membrane. This process consists of the light dependent and light independent reactions, the latter of which is also known as the Calvin cycle. This process takes place in the chloroplasts and begins with chlorophylls harvesting sunlight. For the point, name this process in which plants produce their own sugars.

ANSWER: **photosynthesis** (prompt on metabolism)

(35) Mixtures can undergo this process below the eutectic point. Liquid nitrogen is often used in the “flash” form of this process, common in the meatpacking industry. Supercooling is when this process's namesake point is crossed without the occurrence of this process; for water, that happens below zero degrees Celsius. For the point, name this process by which a liquid becomes a solid, the opposite of melting.

ANSWER: **freezing** (accept word forms; accept descriptions of **turning into a solid** before “solid” is read)

Extra Question

Only read if moderator botches a question.

(36) One star in this constellation forms the center of the Winter Hexagon. A line extending from this constellation's two brightest stars passes close to Castor and Pollux. The largest star in this constellation is a red supergiant about 600 light years away that will go supernova within a million years. The two brightest stars in this constellation are Rigel and Betelgeuse. For the point, name this constellation that depicts a hunter and has a group of three stars forming its "belt?"

ANSWER: Orion (prompt on "hunter" before mentioned)