

Round 1

Bee Round 1

(1) The Betz limit notes that these devices can only capture up to 16/27ths of the maximum kinetic energy from their source. These devices are commonly built with a Darrieus vertical axis, or with a horizontal axis whose equipment is placed at the top of a tower. These devices usually have three tips and are arrayed in large farms. For the point, name these generators of renewable energy that produce electricity by spinning via natural forces.

ANSWER: wind turbine (or windmill)

(2) One unit used to measure this quantity is joules per radian. This value is found by taking the cross product of lever arm and force, or by multiplying the moment of inertia times the angular acceleration. Like a force, there can be no net amount of this quantity anywhere for a system to be in equilibrium. For the point, name this physical quantity, the rotational analogue of force, which is exerted on twisting or turning objects.

ANSWER: torque

(3) During World War II, the Vollum strain of this bacterium was developed and weaponized; Iraq may or may not have used that strain during the Gulf War. In addition to a rabies vaccine, Louis Pasteur claimed the invention of a vaccine against this bacteria. The Ames strain of this bacteria was taken from a cow in 1981 and used in terror attacks following 9/11. For the point, name this infectious bacteria whose spores were mailed to politicians in 2001.

ANSWER: anthrax (or Bacillus anthracis)

(4) This second lightest pnictogen [NICK-tah-jin] forms bonds that are chemically similar to arsenic, which is below this element on the periodic table. This element's white allotrope combusts in the air, and was replaced by its red allotrope for use in matches. Nitrogen, potassium, and this element are the most typical nutrients found in fertilizers. Sugars and an ion with an atom of this element form the backbone of DNA. FTP name this element found below nitrogen on the periodic table, with symbol P.

ANSWER: Phosphorus (accept P before mentioned)

(5) One operation on these things can only be performed in three or seven dimensions. The addition of these things is often performed "tip to tail." These mathematical objects can be the subject of an "inner product" like the dot product, which returns a scalar instead of one of these objects. Physical examples of these include velocity, but not speed. For the point, name these mathematical quantities that have both magnitude and direction.

ANSWER: vector

(6) This rock surrounds a layer of dolomite as the upper and lower layers of the Bakken Formation. A fossil-rich formation of this rock was found in British Columbia near Mount Burgess. This muddy, flaky rock often includes bits of quartz and calcite, as well as kerogen, a mix of organic materials that can be processed into fuel. For the point, name this common sedimentary rock that is commonly processed for oil, and which metamorphoses into slate.

ANSWER: oil shale

(7) This substance's freezing point oddly decreases at higher pressures. The high boiling point of this triatomic substance can be explained by hydrogen bonding. A form of this substance which contains deuterium is referred to as "heavy." The Celsius scale is set according to the boiling and freezing points of this substance, which atypically expands when it solidifies. Chemicals that are in solution with this universal solvent are "aqueous." For the point, name this substance with chemical formula H_2O [H-2-O].

ANSWER: water (accept H_2O before it is read; accept dihydrogen monoxide or dhydrogen hydroxide)

(8) This scientist's transfer to Birkbeck College may have convinced colleagues to publish a finding that was previously considered incomplete. The important Photo 51 was taken by this scientist, whose X-ray crystallography was improperly given by Maurice Wilkins to those colleagues. This scientist's 1958 death prevented her from being recognized by the Nobel committee. For the point, name this scientist whose research on the double helix structure of DNA was instrumental to the work of Watson and Crick.

ANSWER: Rosalind Franklin

(9) The downside of this process is explained by Muller's Ratchet. In this process, gametes do not fuse; instead, for many organisms that undergo it, haploid spores are produced. Many algae alternate between this process and its opposite; that ability is called heterogamy. Parthenogenesis is one example of, for the point, what type of reproduction, used by most single-celled organisms, in which an organism passes its genes to offspring without the use of a second parent?

ANSWER: asexual reproduction (anti-prompt on "parthenogenesis" until "spores" is read by asking "can you be less specific?"; do not accept or prompt on "parthenogenesis" after "spores" is read)

(10) Trigonometric functions can be written as polynomials generated by a type of these mathematical objects named for Brook Taylor. The value of one type of these objects is equal to its first term divided by one minus its common ratio; that is the geometric type. For a given sequence with terms a_n [a sub n], this concept is written as "sigma of a sub n." For the point, give this term for the sum of the terms of a sequence.

ANSWER: infinite series (do not accept or prompt on sequence)

(11) One of these events in 1572 was recorded by Tycho Brahe. These events are classified based on spectral emission; in particular, hydrogen spectral lines are missing from Type I examples of these events. A silicon-iron core collapse can lead to this event, resulting in the creation of a neutron star or black hole. In 1054, one of these events was observed by the Chinese; the remnants of that event became the Crab Nebula. For the point, name these massive explosions at the end of a large star's life.

ANSWER: supernova (do not accept or prompt on "nova")

(12) This process alters the balance of radiation that is reflected back toward the surface instead of being radiated out to space. As atmospheric gases absorb radiation that would have otherwise escaped, the temperature rises in this process. This effect creates a feedback loop that proceeded out of control on Venus. The burning of fossil fuels has increased the power of, for the point, what atmospheric effect, one of many mechanisms of global warming?

ANSWER: greenhouse effect (prompt on global warming before mentioned)

(13) Le Châtelier's principle describes what happens when systems in this situation are disrupted. In this situation, the Gibbs free energy is minimized. This situation is characterized by a value known as K_{eq} ["K sub E Q"]. This situation is typically dynamic rather than static, with forward and reverse reaction rates being equal. For the point, name this situation in which the concentrations of reactants and products do not change.

ANSWER: chemical equilibrium

(14) NOD 32 was an early one of these products which reached its 10,000th update in 2014. The namesake of one of these products candidly responded "I have no idea" to the question of how to uninstall this product. SAM is one of these products for Macintosh hardware released by Symantec, and popular free examples of these products include avast! and AVG. John McAfee and Peter Norton produced, for the point, what type of software that protects a computer against virtual threats?

ANSWER: anti-virus software (accept any software that defends against viruses, malware, etc.)

(15) Within this type of substance, an electric field created by one particle can interact with other particles that are within a distance called the Debye length. A tokamak can confine this type of substance using a magnetic field; using solid material wouldn't work, as this type of substance exists at too high a temperature for a solid to remain stable. For the point, name this highly ionized state of matter that makes up stars, often considered the "fourth" state after solids, liquids, and gases.

ANSWER: plasma

(16) The cirrate [SEE-rayt] suborder of these animals have internal shells and a pair of head fins. These animals push copper-rich blood past their gills with two of their three hearts. The striped "mimic" one of these animals can imitate over a dozen other species, and the Australian "blue-ringed" one is deadly to humans. Others of these animals detach their arms, which can move independently, when frightened, or repel attackers with ink. For the point, name these cephalopods, named for their eight arms.

ANSWER: octopuses (accept octopi; accept octopoda or octopodes)

(17) The survival of a chimpanzee named Enos green-lit this man's solo mission, for which M. Scott Carpenter served as backup. Although he lacked a basic science degree, he was awarded one for his journey on *Friendship 7*. In 1998, this astronaut served as a payload specialist on *Discovery's* STS-95 mission, in which he became the oldest person to go into space. For the point, name this astronaut and former senator, the first American to orbit the Earth.

ANSWER: John Glenn

(18) The charge of this particle was determined in the Millikan oil drop experiment. J.J. Thomson discovered these particles in a cathode ray tube. These particles are respectively lost and gained in oxidation and reduction reactions. Covalent bonds share these particles. An atom is neutral when the number of these particles is equal to its atomic number, since these particles balance the positive charge of protons. For the point, name this negatively charged particle.

ANSWER: electrons

(19) This function on complex numbers can be called the “modulus.” For $a + bi$ [a plus b times i], this value is equal to the square root of a squared plus b squared. The slope of this parent graph is negative 1 for negative values of x and positive 1 for positive x . This function reports the magnitude of the distance of a number from zero. For the point, name this algebraic function that displays a V-shaped graph, which outputs “3” for the inputs of both “3” and “negative 3.”

ANSWER: absolute value function (accept magnitude before it is read; prompt on “distance”(from zero))

(20) This type of object can be classified in monoclinic and triclinic systems, which have very few symmetries. Face-centered cubic is another system for the arrangement of these non-amorphous solids. The somewhat-contradictory liquid type of these materials is often used in electronics displays. For the point, give this term for a solid that is regularly arranged at the microscopic level or, as in snowflakes, a larger level.

ANSWER: crystalline solids (accept liquid crystal or LCD after “liquid” is read)

(21) An early Chinese version of this instrument designed by Zhang Heng dropped a bronze ball as an indicator, and was sensitive enough to detect an event in Gansu. A “shadow zone” where these instruments cannot detect anything is caused by the inability of secondary waves to pass through the outer core, but in most positions, this instrument outputs a graph by allowing a pen to mark a piece of paper by vibrating with the ground. For the point, name this scientific device that measures the intensity of earthquakes by recording the size of the waves generated by the crust’s motion.

ANSWER: seismometer (or seismograph; prompt on descriptions of “earthquake detecting equipment” before earthquake is said)

(22) This scientist used two types of lenses to create an upright-but-unfocusable image in a telescope. This man’s observations of the phases of Venus shifted scientific support from the Ptolemaic [toh-leh-may-ick] model to that of Copernicus. This astronomer discovered the Medicean stars, later determined to be the four largest moons of Jupiter. For the point, name this supporter of heliocentrism, an Italian astronomer who was placed under house arrest in 1633.

ANSWER: Galileo Galilei

(23) Samuel Rowbotham wrote *The Inconsistency of Modern Astronomy and its Opposition to the Scriptures* in support of this theory, having hypothesized a massive wall of ice. A popular myth holds that intellectuals in the Middle Ages held this belief, though evidence like ships disappearing over the horizon had properly been studied by the Greeks. For the point, name this theory that believes Earth is a 2-dimensional plane.

ANSWER: flat Earth theory

(24) One type of this quantity named for de Broglie [de BROUY] is equal to Planck's constant divided by the mass and the frequency of the wave. The velocity of a wave divided by its frequency gives this value which, for a longitudinal wave, is calculated between consecutive compressions or consecutive rarefactions. For the point, name this quantity that describes the distance between two corresponding points – say, two crests – of a wave.

ANSWER: wavelength

(25) Arnold Beckmann invented an electronic instrument to measure this quantity using a glass electrode. This quantity is equal to the negative logarithm of the concentration of hydronium ions in solution. It can be estimated by using methyl red, bromothymol blue, litmus paper, or other indicators that change color based on this quantity. A substance is alkaline if its value for this is high, and values near 7 on this scale indicate neutrality. For the point, name this chemical quantity that tells how acidic a solution is.

ANSWER: pH [”p h”] (prompt on “acidity” or word forms before “acidic” is read)

(26) This phenomenon is distinct from graupel, which is less stable, less uniform, and which falls in wintry conditions. This phenomenon begins when cloud condensation nuclei make contact with supercooled water vapor, which are then blown upwards in cumulonimbus clouds until they become too heavy to float. For the point, name this type of precipitation whose size is often given as a comparison with tennis balls and golf balls after it falls to the ground as solid ice.

ANSWER: hailstones (do not prompt on “precipitation” or other general terms)

(27) The deadliest form of this disease is caused by the falciparum species. Artemisinin provides a particularly fast treatment for this disease. This disease is caused by Plasmodium parasites that are passed through Anopheles saliva. The bark of the cinchona tree can be processed into quinine, which treats and prevents this disease. Fever and vomiting are common symptoms of, for the point, what mosquito-borne disease commonly found along the equator?

ANSWER: malaria

(28) This value can be defined as the sum of 1 over n factorial for all positive integers n . After one year, a dollar gaining 100% annual interest compounded continuously throughout the year will be worth this many dollars. While 10 is the base of the common logarithm, this value is the base of the natural logarithm. For the point, name this mathematical constant approximately equal to 2.71828, named for a Swiss mathematician and symbolized by a vowel.

ANSWER: e (accept Euler's number)

(29) This quantity remains constant in a fluid undergoing incompressible flow. The ratio of two of these quantities is given by the specific gravity, which can be measured by placing a hydrometer in a graduated cylinder. This value is lower for solid ice than it is for liquid water, explaining why ice cubes float. At four degrees Celsius, this value for water is equal to one gram per milliliter. For the point, name this physical quantity equal to an object's mass divided by its volume.

ANSWER: density

(30) One piece of evidence of these things was observed by Ohio State University's Jerry Ehman, who circled the string of characters "6, E, Q, U, J, 5" and wrote "Wow!" That data was collected by the "Big Ear" radio telescope. The Drake Equation tries to estimate the likelihood of these things existing. The various SETI projects search for evidence of, for the point, what hypothesized organisms that some conspiracy theorists believe have visited Earth in UFOs?

ANSWER: extraterrestrials (or aliens; accept ETs; accept elaborations, like alien civilizations)

(31) Close-packings in the shape of a cube and this shape are held by Kepler's conjecture as the most efficient packing system for spheres. No regular polygon with more sides than this shape can tessellate the plane, and this is the regular polygon with the fewest sides that cannot be the face of a Platonic solid. A truncated icosahedron has faces made of pentagons and this shape, as seen on soccer balls. For the point, name this polygon whose regular version has internal angles of 120 degrees between each of its six sides.

ANSWER: (regular) hexagon

(32) The wife of general Nathanael Greene claimed responsibility for improving this device by adding a series of brushes to clear away lint. This instrument works by using a series of hooks to pull material through "teeth" that removed seeds from the important fibers. For the point, name this invention, created by Eli Whitney, that bolstered the production of Southern cotton plantations.

ANSWER: cotton gin

(33) One type of these objects develops from pressurized firn. The movement of these bodies can create winding ridges of gravel called eskers. These objects can leave behind cirques, small depressions that become tarn lakes if they fill with water. These objects may ablate through calving, in which large bergs break off of them, or through melting. For the point, name these large, land-based bodies of ice.

ANSWER: glacier (accept iceberg until "gravel" is read; do not accept or prompt on it after)

(34) Georges Lemaitre [le-MET] first stated this hypothesis, which is supported by the discovery of galactic redshift and the cosmic microwave background, the surviving radiation from this event. The Planck epoch followed this event, during which the fundamental forces are believed to have been unified. This event, often described as a singularity, was followed by cosmic inflation. For the point, name this event that took place 13.8 billion years ago at the beginning of the universe.

ANSWER: Big Bang theory

(35) Most available forms of these drugs possess a beta-lactam ring. A form of *Staphylococcus aureus* has evolved a resistance to this type of compound, leading to the spread of MRSA in hospitals; as a result, doctors stress completing the full course of these medications. Amoxicillin and penicillin are common examples of, for the point, what class of medicinal compounds that fight bacterial infections?

ANSWER: antibiotics (or antibacterials)

Extra Question

Only read if moderator botches a question.

(36) This organ's diencephalon develops into the thalamus. In this organ, the pineal gland secretes hormones that regulate the circadian rhythm. This organ's medulla oblongata continues into the spinal cord, and its central sulcus separates it into left and right hemispheres. This organ is covered with gray matter and has a wrinkled appearance. For the point, name this organ that controls the nervous system.

ANSWER: brain