Round 1

Bee Round 1

(1) The Primum Mobile is the outermost layer of this model, which makes use of circles known as deferents. This model explains retrograde motion through the presence of epicycles. This model, which was popularized in the *Almagest* by Ptolemy, was challenged by the Copernican revolution. For the point, name this incorrect astronomical model that places Earth at the center of the solar system and universe, contrasted with the heliocentric model.

ANSWER: **geocentric** model (accept word forms like **geocentrism**; accept **Ptolemaic** model or **Ptolemy**'s model of the universe/solar system before "Ptolemy" is said)

(2) One type of this quantity is multiplied by the mole fraction in a law dealing with ideal mixtures named for Raoult. Dalton's Law finds that the total value of this quantity is equal to the sum of its partial variants. The SI unit of this quantity is equivalent to one newton per meter squared. The atmospheric variety of this quantity can be measured with a barometer. For the point, name this quantity measured in Pascals, the force exerted per unit of area.

ANSWER: **pressure** (accept atmospheric **pressure**; accept vapor **pressure**; accept partial **pressure**)

(3) CERN participated in the OPERA project searching for one type of these particles, which were first predicted by Wolfgang Pauli. The Super-Kamiokande observatory discovered that these fermions oscillate between muon and tau flavors. These particles can pass through the Sun's core and are named for their apparently negligible mass and lack of electric charge. For the point, name these extremely low mass particles.

ANSWER: **neutrino**s (accept types of neutrinos, like electron **neutrino** or tau **neutrino** or muon **neutrino**)

(4) Parallel ridges form in a relatively small class of these features named for their resemblance to washboards. Another type of these structures is named after a lake nearby in Sweden. The terminal variety of these features is at the furthest point that an ice sheet extends to. These features can be formed from deposits of till. For the point, name these rocky accumulations of debris left behind by a glacier.

ANSWER: **moraine**s

(5) Ithiel Town developed an inexpensive form of these structures known as his lattice truss. Emily Roebling provided engineering support for the design of one of these structures. A type of resonance is thought to have been responsible for the collapse of one of these at the Tacoma Narrows. For the point, name these engineering projects, such as one between Brooklyn and Manhattan over the East River.

ANSWER: **bridge**s

(6) This structure is home to several zygomatic processes. The presence of two openings in this structure separates diapsids from other amniotes. At birth, this structure contains many fontanelles, or soft spots, which fuse early in life. This structure contains the parietal, frontal, and occipital bones and contain holes through which the optical nerves pass. For the point, name this bony structure that protects the brain.

ANSWER: **skull** (or **cranium**, prompt on "head")

(7) This trigonometric function is increasing and has a period of pi, with a vertical asymptote when x equals pi over 2. This function can be computed as an angle's sine divided by the cosine or, in a right triangle, as the opposite side divided by the adjacent side. This kind of line has the same slope as the curve at their point of intersection, causing them to be perpendicular to the radius in any circle. For the point, give this term for a line that just touches a curve once.

ANSWER: **tangent** (accept **tan** before "this kind of line")

(8) Anatoly Vlasov names an equation that describes the kinetics of this material. Stellarators and tokamaks are used to confine this material within magnetic fields. This material was once commonly used in flatscreen TVs, which have since been replaced in the market by LCDs. Solar wind moves particles in this state of matter away from the Sun, which is composed of this highly ionized matter. For the point, name this "fourth" state of matter.

ANSWER: **plasma**

(9) The energy used to create one of these species is measured by an atom's electron affinity. Molecules formed by combining two of these species, especially via the neutralization of an acid and a base, will form a salt; salts are held together by strong bonds named for this type of compound. For the point, name this type of compound in which the electron count differs from the proton count, thus giving the compound a positive or negative charge.

ANSWER: **ion**s (accept specific types of ions like **cation**s or **anion**s; accept **ion**ic bond(ing) after "bond" is read)

(10) The associative type of this data structure stores key-value pairs. Accessing a value in this data structure takes constant time, since its elements can be referenced by their index; an out-of-bounds exception is thrown whenever the index is less than 0 or larger than the length minus 1. In most programming languages, this one-dimensional data structure is declared with square brackets. For the point, name this term in computer science for an ordered list of data.

ANSWER: **array**s

(11) The largest globular cluster of this galaxy is Omega Centauri. The zone of avoidance is the region in the sky obscured by this object. This galaxy's centre is home to the radio source Sagittarius A-star, which is likely a supermassive black hole. This galaxy was shown to have a central bar in 2005, to go with its 4 main spiral arms. The nearest galaxy to this galaxy is Andromeda. For the point, name this galaxy of the Local Group that is home to our Solar System.

ANSWER: **Milky Way**

(12) One member of this phylum spreads the Lyme disease bacteria to humans. The organism in which Batesian mimicry was first observed is in this phylum, which also includes the model organism *Drosophila melanogaster*. These organisms have exoskeletons made out of chitin. The extinct trilobite belongs to, for the point, what large invertebrate phylum of crustaceans, arachnids, and insects, making up about 80% of all known species?

ANSWER: **arthropod**s or **arthropod**a

(13) For a logical proposition "P implies Q," this name is given to the proposition "not P implies not Q." For a function, this object can be constructed by reflecting the function's graph across the line y equals x. The functions "y equals the square root of x" and "y equals x squared" have this relationship to each other. The multiplicative type is often called a reciprocal. For the point, give this term for mathematical objects that undo operations, whose additive type for a number x is negative x.

ANSWER: **inverse** (accept **inverse** statement or proposition, accept **inverse** function, etc.)

(14) A recent study counting beetles in this biome used helium balloons to dislodge them from their habitat and estimated 25,000 species in San Lorenzo. In this biome, liana vines form bridges for sloths to slowly move within the canopy. Over 25 percent of global oxygen turnover derives from these locations. Logging threatens, for the point, what highly diverse biome in regions like South America's Amazon, named for its high level of precipitation?

ANSWER: tropical **rainforest**s (prompt on (tropical) forests)

(15) Parafollicular cells in the thyroid secrete a hormone that reduce levels of this element in blood. Deficiency in certain vitamins or this element can cause rickets. Clam shells and pearls are largely made up of this element's carbonate. This element, found to the right of potassium on the periodic table, is commonly found in dietary supplements for sufferers of osteoporosis to boost the strength of their bones. For the point, name this with element with chemical symbol Ca.

ANSWER: **calcium** (accept **Ca** before mentioned)

(16) This molecule exists in Z, A, or its more common B form. Adding methyl groups to this molecule will deactivate parts of it. Billions of copies of this molecule are created during PCR. This molecule wraps around histones to form chromatin, and this molecule's nucleotides are sequenced to study genomes. The genetic material for life is carried by, for the point, what polymer of nitrogenous bases that forms a double helix?

ANSWER: **DNA** (or **deoxyribonucleic acid**)

(17) The Portuguese took advantage of one type of this phenomenon using the *volta do mar* technique. The Roaring Forties are a particularly powerful version of this phenomenon in the Southern Hemisphere. This phenomenon's magnitude is measured on the Beaufort Scale. Kinetic energy from this phenomenon spins turbines, a source of renewable energy. For the point, name this phenomenon that, in a hurricane, measures over 74 miles per hour.

ANSWER: **wind**s

(18) An elastic form of this quantity is found by multiplying one-half times the spring constant times the change in spring length squared. Within Earth's gravity, this quantity for an object is given by the product of mass, the gravitational constant, and the height above Earth; as a result, this value is zero for an object on Earth's surface. A pendulum about to be swung has, for the point, what stored form of energy, contrasted with kinetic energy?

ANSWER: **potential energy** (prompt on energy alone before said)

(19) During a six-day stop on the island of St. Helena, this man noted differences between it and other islands. This man carried a copy of Charles Lyell's *Principles of Geology* during that expedition, which was led by Robert Fitzroy. This man studied land iguanas on an archipelago west of Ecuador, as well as finches that inspired his landmark theory. For the point, name this English naturalist who developed the theory of evolution by natural selection.

ANSWER: Charles Robert **Darwin**

(20) The lengths of line segments intersecting one of these shapes are related by the Power of a Point Theorem. The equation for these shapes is that the sum of the squares of the quantities "x minus h" and "y minus k" is equal to r squared. Trigonometric functions are defined using a unit example of this shape, which has a circumference of 2 pi. For the point, name these shapes in which the distance from each point to the center is equal to the radius.

ANSWER: **circle**s

(21) The interior of one of these objects was studied by the *Deep Impact* spacecraft. The breakup and destruction of one of these objects was observed in 1992 as it crashed into Jupiter; that object was named Shoemaker-Levy 9. These objects have a nucleus which is surrounded by a coma. The Philae lander is on one of these objects. For the point, name these celestial objects that, as they pass near the Sun, develop a bright tail.

ANSWER: **comet**s

(22) The Rossi-Forel scale was an early way of measuring the intensity of these events. A sonic boom-like effect can occur during the supershear type of these events when a rupture travels faster than the shear wave. The depth of focus measures how far underground these events occur. Aftershocks are smaller versions of, for the point, what seismic events measured on the Richter scale that can cause buildings to topple over?

ANSWER: **earthquake**s

(23) Archimedes studied this quantity of 96-gons to approximate pi. This measure is computed for polygons with the shoelace formula, and for regions bounded by a function, this quantity can be computed with integrals. Among all closed curves with a given perimeter, the circle has the largest value of this quantity. For the point, name this two-dimensional measure that can be computed for triangles as one-half base times height.

ANSWER: **area**

(24) Some organisms in this order secrete neurotoxins from their parotid glands. A ploidy series in a genus of this order includes a model organism used for its large embryos. This order contains the family Bufonidae and the model organism Xenopus laevis, a "clawed" species from Africa. Brightly colored members of this order include the "poison dart" ones. For the point, name this order of amphibians that includes toads and have young known as tadpoles.

ANSWER: **frog**s (or **anura**)

(25) A shortcut in writing electron configurations puts the symbols of these elements in brackets. Alpha particles are identical to an atom of one of these elements. An 1898 experiment performed by William Ramsay discovered three of these elements in a filtered sample of dry air, once the nitrogen, oxygen, and carbon dioxide was gone. For the point, name this group of elements that includes argon, neon, and helium on the far right of the periodic table.

ANSWER: **noble gas**es (or **inert gas**es; accept Group **18** of the periodic table)

(26) These systems are subject to Kirchhoff's laws, one of which notes that the sum of directed potential differences around one of them must be zero. An inductor joins with a capacitor in the "LC" type of these systems. These systems may be created out of copper wiring connecting elements like capacitors and resistors on "boards" found in computer hardware. For the point, name these pathways through which electric current can flow.

ANSWER: electronic **circuit**s (accept specific types of circuits; accept electrical **network**s)

(27) An orbiter designed to study this object's climate crashed in 1999 because of a faulty conversion between metric and imperial units. In 2004, two spacecraft successfully landed on opposite sides of this object's equator, while a larger and more recent spacecraft is studying this object's Gale Crater. *Spirit* and *Opportunity* are rovers on, for the point, which planet where *Curiosity* is driving around looking for water?

ANSWER: **Mars**

(28) One scientist from this country observed how a dead frog's leg apparently kicked when exposed to an electric spark. Another scientist from this country charted the Taurus constellation in his 1610 book titled *Starry Messenger*; that man derived his law of free fall in a thought experiment about dropping two spheres from a tower in this country. Galileo hailed from, for the point, what country home to Luigi Galvani and the Leaning Tower of Pisa?

ANSWER: **Italy**

(29) John Fanning names a quantity that describes the effects of this force on pressure in pipes. Guillaume Amontons [ghee-yom ah-mon-ton] names a set of three laws for this force, one of which states that it is unaffected by apparent area of contact. Sliding velocity does not impact the kinetic form of this force, whose static form keeps objects stationary. An object on an inclined plane may stay put due to, for the point, what force that opposes motion along a surface?

ANSWER: **friction** (accept static **friction** or kinetic **friction**)

(30) Bryan Kibble's watt balance seeks to redefine this SI unit. This unit of measure appears in the denominator of the definition of molality, in which it applies to the solvent. This unit to the first power is found in the numerator of an expression for joules, where it's multiplied by meters squared and divided by seconds squared. This is the only base SI unit that employs a prefix, indicating a size 1,000 times greater than a related unit. For the point, name this SI unit of mass equal to about 2.2 pounds.

ANSWER: **kilogram**s (accept **kg**; do not accept or prompt on gram; do not accept or prompt on mass alone, but prompt on descriptions of "the (SI) unit for mass")

(31) A 1960s study analyzed the effects of this form of precipitation on the Hubbard Brook ecosystem. Cap and trade programs have attempted to lessen this form of precipitation, which, in oceans, contributes to the dissolving of the limestone skeleton of coral. This precipitation arises when atmospheric water mixes with nitrogen oxide and sulfur dioxide. For the point, name this type of harmful, low pH rain.

ANSWER: **acid rain**

(32) This object's largest confirmed impact crater is the South Pole-Aitken basin, though if it were a crater, its Oceanus Procellarum would be bigger. This object was visited by 7 of NASA's Surveyor spacecrafts and will be visited by the Chang'e [chang-eh] craft. This object is tidally locked to the Earth, meaning that only one side ever faces it; that side includes the Sea of Tranquility. For the point, name this celestial body visited by the Luna spacecraft and Neil Armstrong.

ANSWER: Earth's **Moon** (or **Luna** before said)

(33) All multiples of 3 have this value as their digital root. Quadratic equations with negative determinants have this many real solutions. A positive number raised to this power gives a value of 1. This is the value of a when the equation "a times x equals b" has no solution, since division by this additive identity is illegal. For the point, name this number that, when added to any other number, does not change that number.

ANSWER: **zero**

(34) Charged particles that exceed this value within the medium glow blue as a result of Cherenkov radiation. Tachyons are particles that hypothetically exceed can this value. The relativistic mass is multiplied by this quantity squared to give energy in a formula derived by Albert Einstein. For the point, name this constant, approximately 3 times ten to the eighth meters per second within a vacuum, the speed of all massless particles.

ANSWER: **speed of light** (accept **c**; prompt on speed alone)

(35) The growth of this structure in bacteria is inhibited by beta-lactam antibiotics. The presence of peptidoglycan in this structure distinguishes Gram-positive from Gram-negative bacteria. In fungi, this structure is made out of chitin, while in plants, this structure contains pectin and cellulose. Animal cells do not have, for the point, what structure surrounding the cell membrane, a hard protective outer layer of some cells?

ANSWER: **cell wall**

Extra Question

Only read if moderator botches a question.

(36) The rate of this process is proportional to the square root of the ratio of the molar mass of two gases. Albert Einstein related a constant named for this process to mobility in a paper on Brownian motion. An equation that calculates the flux relating to this process is Fick's first law. This process occurs when particles move along a concentration gradient. For the point, name this process in which matter moves from areas of high concentration to those of lower concentration.

ANSWER: **diffusion** (prompt on effusion)