Round 3

Bee Round 3

(1) Procyon B is an example of this class of star, whose name was coined by Willem Luyten. Most planetary nebulae are believed to be formed when the outer layers of a red giant are shed by stellar winds, leaving behind this class of star. If the mass of these stars exceeds 1.4 times the mass of the Sun, a value called the Chandrasekhar limit, then they will eventually undergo a supernova. These stars do not support fusion reactions. For the point, name this class of small stars, brighter than a brown counterpart.

ANSWER: **white dwarf**

(2) Frost crack can damage this structure, causing vertical grooves to split in it. This structure protects the vascular cambium and xylem, and its innermost layer is phloem. The cork cambium produces the outermost layer of this material, a dead tissue that peels off and is replaced by new tissue as the stem or root that it protects grows in circumference. For the point, name this protective plant structure, the outermost layer of trees and other woody plants.

ANSWER: tree **bark**

(3) An episode of *Saturday Morning Breakfast Cereal* showed amazement that this behavior is lost when every term with a nine is removed from the harmonic series, which normally has this behavior. This behavior is not exhibited by the series 1 plus one-half plus one-fourth, and so on, because that infinite series adds up to 2. For the point, name this infinite behavior in which a series does not converge to a single sum.

ANSWER: **diverge**nce (accept word forms and descriptions like **divergent** series)

(4) Within a Schwarzchild radius, this value is greater than the speed of light. It is generally calculated by setting kinetic energy and gravitational potential energy equal to each other; as a result, this quantity is proportional to the mass of the central object divided by its radius. It is equal to roughly 11.2 kilometers per second for an object on Earth. For the point, name this minimum speed needed to "break free" of a planet's gravitational pull.

ANSWER: **escape velocity** (or **escape speed**)

(5) Rachel Carson described biomagnification using one of these models to explain how using DDT resulted in a lower robin population. Autotrophs lie at the lower levels of these models. A keystone species is particularly interconnected within one of these models; predators are usually keystone species due to their direct influence on the population of the levels below them in these systems. For the point, give this term for an ecological model that describes what species eat what other species in an ecosystem.

ANSWER: **food web** (or **food chain**)

(6) Carbonado is a black, non-gemstone form of this mineral. Chemical vapor deposition is used to generate this mineral, and nano-sized specimens are formed in lab-controlled explosions. A type of igneous rock discovered in volcanic pipes in South America, kimberlite, is a common source of this mineral. This allotrope of carbon is capable of scratching corundum, according to its placement on the Mohs scale of hardness at rank 10. For the point, name this mineral, the hardest naturally-occurring mineral.

ANSWER: **diamond**

(7) When the mass of this structure reaches certain "magic numbers," it is believed to be found on the island of stability. George Gamow proposed a model of this structure as a drop of liquid. The discovery of this structure disproved the plum pudding model, and this structure was found in an experiment that fired particles at gold foil. This structure is held together by the strong force and makes up most of the mass of the atom. For the point, name this structure made of protons and neutrons, found at the center of the atom.

ANSWER: atomic **nucleus**

(8) Rather than requiring cell walls, animal cells rely on this substance to maintain the fluidity and structure of cell membranes. Atherosclerosis, a thickening of vascular tissue, is caused by buildup of this molecule, which is transported by both high- and low-density lipoproteins. For the point, name this waxy steroid that moves through blood in the aforementioned HDL and LDL, commonly called the "good" and "bad" kinds of this substance.

ANSWER: **cholesterol**

(9) This man considered the volume of space in his book *The Sand Reckoner*. This scientist gave the first explanation of the law of the lever, and he created a namesake screw used to elevate water. According to legend, he discovered the laws of buoyancy while taking a bath, after which he ran through the streets naked. For the point, name this ancient Greek scientist and mathematician known for his "Eureka!" moment.

ANSWER: **Archimedes** of Syracuse

(10) Multiplying by this number is equivalent in an Argand diagram to making a simple, counter-clockwise 90 degree turn. In Euler's [oiler's] Formula, this value is multiplied by pi. This value is defined as one of the solutions to x squared plus 1 equals zero, thereby extending the real number system. This number cubed is negative itself, and raised to the fifth power is positive itself. For the point, name this imaginary unit, defined as the square root of negative one.

ANSWER: **i** (accept **imaginary number** or **imaginary unit** before it is read; accept square **root** of **negative one** until it is read)

(11) Compounds containing these bonds are typically referred to by their empirical formulas, and have lattice energies. These bonds tend to form between atoms with large differences in electronegativity. These bonds are stronger than bonds with polar character. Compounds formed by these bonds tend to be solid at room temperature, dissociate in water, and serve as electrolytes. For the point, name this kind of bond formed by the attraction between positively and negatively charged atoms, which is stronger than a covalent bond.

ANSWER: **ionic** bonds

(12) A formula to describe this quantity in an ideal gas was developed independently by Sackur and Tetrode. This quantity is at a maximum at equilibrium, and is equal to zero for a perfect crystal only at absolute zero, according to the Third Law of Thermodynamics. The Second Law of Thermodynamics states that, in a closed system, this quantity cannot decrease. For the point, name this quantity that measures the level of disorder in a system.

ANSWER: **entropy** (prompt on "S")

(13) A letter-writing campaign convinced one of these objects to change its name from *Constitution* to *Enterprise*. These craft carried out 135 STS missions, though in 1986 and 2003, two of these craft and their seven-person crews were lost; the former on takeoff and the latter on re-entry. The *Challenger* and *Columbia* were, for the point, what NASA re-usable spacecraft that were officially retired in 2011?

ANSWER: **Space Shuttle** orbiters

(14) This usually non-crystalline rock differs from scoria in that it is denser and has larger vesicles, or cavities, in the rock, which allow this rock to be used as a low-density filler in concrete or as an abrasive for skin exfoliating. For the point, name this volcanic rock whose extremely rapid cooling traps gases in the rock, creating a porous structure that can allow it to float.

ANSWER: **pumice**

(15) The rhamphotheca protects this structure. Tomia are found inside the edges of this structure. Nares are holes on this structure that provide passage to the respiratory system. Darwin noticed that this structure was specialized based on the foraging habits of finches. Eggs can be cracked by a specialized tooth on, for the point, what hard protruding structures on bird heads that are used for eating?

ANSWER: **beak** (or **bill** or **rostrum**)

(16) In a wire, this quantity depends on the length and cross-sectional area of the wire. The circuit component that provides this quantity is represented in diagrams by a zigzag line. This value is equal to voltage divided by current, according to a law named for the namesake of the SI unit for this quantity, Georg Ohm. For the point, name this electric analog of friction, a quantity that describes how hard it is for a current to pass through a conductor.

ANSWER: electrical **resistance**

(17) A relation is an equivalence relation if it is reflexive, symmetric, and has this property. Bradley Efron invented a set of dice that lack this property, which is also lacked by the ruleset for Rock, Paper, Scissors, because two rules for dominance do not imply a third rule. The "less than" and "greater than" relations have this property. For the point, name this property that describes how a is related to c if it is known that a is less than b and b is less than c.

ANSWER: **transitive** property

(18) This body includes methane lakes like Ligeia Mare [mah-ray] and Kraken Mare. Like Earth, this body's atmosphere is dominated by nitrogen, making it the only satellite in the solar system with a significant, stable atmosphere. That atmosphere prevented this moon's surface from being observed until the Huygens [hoy-gens] probe landed there in 2005. For the point, name this second-largest moon in the solar system, the largest moon of Saturn.

ANSWER: **Titan**

(19) Io's atmosphere is dominated by this element's dioxide gas. This element is added to a two-carbon chain to form ethanethiol [eth-ane-thigh-ol]. This element is bonded to two hydrogen atoms in a common odorizer for household natural gas; that explosive odorizer is responsible for the distinctive smell of rotten eggs. For the point, name this 16-proton nonmetal element with a yellow solid form whose atomic symbol is S.

ANSWER: **sulfur** (or **S** before mentioned)

(20) This theory originated from Aristotle's claims about combining water and vital heat. This theory was challenged by Francesco Redi, who used open and clothed containers in an experiment that looked for worms. This theory was dispelled by Louis Pasteur, who used a swan-necked bottle to prevent bacterial growth in broth. For the point, name this theory stating that life arises out of inanimate materials, like maggots forming from dead meat.

ANSWER: **spontaneous generation** (accept **anomalous generation**, prompt on "abiogenesis")

(21) Henri Buisson and Charles Fabry's study of the UV spectrum deduced the existence of this substance in the atmosphere, after which Gordon Dobson invented an instrument to measure this substance. Free radicals like nitric oxide, chlorine, and bromine cause a chain reaction that depletes this substance, which led to the banning of CFCs starting in the 1970s. For the point, name this molecule consisting of three atoms of oxygen, which forms a protective layer against UV radiation in the stratosphere.

ANSWER: **ozone** layer

(22) An apparatus made from one of these devices and two weights is used to demonstrate constant acceleration and is called an Atwood machine. One of these devices placed to pull a weight across a table can be used to compute friction coefficients. In order to increase its mechanical advantage, two of these devices can be combined into a block-and-tackle. For the point, name this simple machine consisting of a rope around a wheel on an axle often used for lifting.

ANSWER: **pulley**

(23) Pittsburg Compound B is used in PET scans to detect this disease. Acetylcholine deficiency is a poorly-regarded hypothesis for the cause of this disease; other theories discuss tau protein mutations and the buildup of beta amyloid plaques. Ronald Reagan suffered from, for the point, what neurodegenerative disease that causes a loss of motor skill and memory and is blamed for the majority of cases of dementia?

ANSWER: **Alzheimer**'s disease (prompt on dementia before mentioned)

(24) In a 1968 letter lamenting the difficulty of working with some of these things, Edgar Dijkstra bashed the GOTO statement, instead preferring the development of structures like subroutines and "for" loops. Procedural examples of these things include COBOL and BASIC, while object-oriented ones include Ruby. For the point, name these invented systems that formalize the process of giving instructions, or source code, to a computer, such as C++ [C plus plus].

ANSWER: computer **programming language**s (or **computer language**s; accept descriptions of computer source **code** before mentioned)

(25) These objects are classified by their foliation, since their grains are oriented parallel to each other and perpendicular to the direction of the stress. These rocks originate as protoliths, as when mudstones become shale, a type of this classification of rock. Marble is this type of rock that formed from the protolith limestone. For the point, name this class of rocks which form from a transformation of rocks under extreme heat and pressure, contrasted with igneous or sedimentary rocks.

ANSWER: **metamorphic** rocks (prompt on rocks during the first sentence)

(26) The Zvezda system reclaims water at this location, where it is used by the Elektron, its primary oxygen generator. Its series of sixteen solar panels rotates when the Progress or Dragon delivers supplies to this location; the Dragon launches on Falcon 9 rockets produced by SpaceX to reach it. For the point, name this Earth-orbiting satellite, currently manned by a crew of three Russians, a Brit, and two Americans.

ANSWER: **International Space Station** (or **ISS**)

(27) The diffraction of these things can be used to determine the structure of a crystal, as was used to discover the double helix of DNA. These things were discovered to cause fluorescence in a Crookes tube by Wilhelm Röntgen. This form of radiation is lower in energy than gamma radiation, but higher in energy than ultraviolet radiation. For the point, name this form of radiation used in medical imaging to visualize bones.

ANSWER: **X-ray**s (prompt on "photons;" prompt on "light;" prompt on "electromagnetic radiation")

(28) The fundamental theorem of this branch of mathematics requires a function to be continuous on a closed interval. An important tool used in this branch of mathematics considers the difference quotient as the limit of the denominator approaches zero. This branch was independently developed by Gottfried Leibniz and Isaac Newton in the 17th century. For the point, name this branch of mathematics that studies change with tools like integrals and derivatives.

ANSWER: **calculus**

(29) Edmund Denison created his double three-legged gravity escapement while constructing one of these objects. Isma'il al-Jazari invented an "elephant" one of these devices. The Greeks used a version of these items called clepsydra. Christiaan Huygens' [hoy-gens] version of this type of device used pendulums. The National Institute of Standards and Technology uses cesium to control an atomic one of these devices. For the point, name these timekeeping instruments.

ANSWER: **clock**s (accept water **clock**; accept elephant **clock**; accept castle **clock**; accept atomic **clock**)

(30) These substances are described as having a "sea of electrons". A set of elements named for being similar to these occupies a staircase shaped region on the periodic table; that set includes boron and silicon. These substances are typically malleable, ductile, and are usually good conductors of heat and electricity. A block of elements in the middle of the periodic table are called the transition type of these compounds. Mixtures of these materials are called alloys. For the point, name these often-shiny materials such as iron and gold.

ANSWER: **metal**s

(31) These things reproduce by either the lytic or lysogenic cycles. The first of these pathogens to be discovered causes a noticeable discoloration, often described as a mosaic, on tobacco leaves. Many of these pathogens have an envelope protecting their capsid, or a protein shell that holds their genetic material. For the point, name this non-living infectious agents that replicate within host cells, exemplified by influenza and the precursor infection to AIDS, HIV.

ANSWER: **virus**

(32) In hyperbolic geometry, a Lambert quadrilateral possesses exactly three of these features. According to Thales' [thay-lees'] theorem, if the diameter of a circle is part of an inscribed triangle, one of these features is opposite the diameter in that triangle. This feature is created by the intersection of orthogonal lines, as seen with lines with slopes 1 and negative 1. A rhombus need not have any, but a rectangle must have four of, for the point, what type of angle that measures 90 degrees?

ANSWER: **right angle** (accept **90 degree angle** before it is aread)

(33) Percival Lowell's work included imaging of this body, but that discovery was unappreciated until well after Clyde Tombaugh "officially" discovered it. In July 2015, eight years after gaining a gravity assist by flying by Jupiter, the New Horizons probe sent back detailed images of Nix and Charon, two of this body's moons. In 2006, the IAU reacted to the discovery of Eris by reclassifying this body. For the point, name this dwarf planet that was once considered the ninth planet from the Sun.

ANSWER: **Pluto**

(34) Tubes of fulgurite can be formed when this phenomenon occurs in a desert. A rare form of this phenomenon is thought to consist of small amounts of spherical plasma. A common rule of thumb holds that the distance from the observer to this phenomenon is equal to one mile for every five seconds that elapse between seeing this weather phenomenon and hearing it. For the point, give this term for the bright electric discharges that cause thunder during storms.

ANSWER: **lightning** (accept **ball lightning**)

(35) Charles's law states that at constant pressure, increasing this quantity will cause a gas to expand. This quantity is effectively a measure of how fast the atoms of a substance are moving. A substance's specific heat is the amount of energy needed to change this quantity by one unit. This quantity's lower bound is called absolute zero. For the point, name this quantity, measured in Kelvins or on the Fahrenheit scale, which describes how hot or cold something is.

ANSWER: **temperature**

Extra Question

Only read if moderator botches a question.

(36) In any triangle, this term refers to line segments that meet at the centroid and have endpoints on a vertex and the opposite side's midpoint. This name is shared by a quantity that is equivalent to the 50th percentile and has separate calculations for data sets with odd or even numbers of values. For the point, give this term for this measure of central tendency that lies between the two halves of an ordered set of values.

ANSWER: **median**