Winter Science Bee - Round 1 (M/E)

Round 1 Tossups

(1) For a perfect black body, this quantity equals sigma times area times temperature raised to the fourth power according to the Stefan-Boltzmann equation. The maximum value for this quantity is proportional to stellar mass due to the Eddington limit. This quantity is the vertical axis of the HR diagram, plotting it against color. For the point, name this measure of the total amount of light emitted by a star.

ANSWER: **Luminosity** (accept **Absolute Magnitude**; prompt on "magnitude")

(2) When subjected to nonzero values of this quantity, piezoelectric [[pee-EH-zoh-"electric"]] materials experience electric polarization and release electricity. When forces are applied parallel to the plane of the cross-sectional area, this quantity's sheer form arises. When this quantity exceeds the strength factor, permanent deformations can occur. For the point, name this measure of internal forces, which can lead to strain.

ANSWER: **Stress**

(3) During World War One, this scientist developed mobile radiography units to quickly X-ray wounded soldiers. This scientist unsuccessfully attempted to sell her gold Nobel Prize medals to the French National Bank to help the war effort. This woman died of aplastic [[AY-"plastic"]] anemia, obtained as a result of prolonged exposure to her work with radiation. For the point, name this woman, the first person to win two Nobel Prizes in two different scientific fields: Chemistry and Physics.

ANSWER: Marie **Curie** (or Marie Salomea Skłodowska **Curie**; or Maria Salomea **Skłodowska**; accept Madame **Curie**)

(4) When orbiting a larger body, these objects can undergo destructive carbon detonations. These objects, the most common stellar endpoint, are found in the lower-left corner of an HR diagram. These stars are supported from collapse by the degeneracy pressure of their fast-moving electrons. For the point, name these small stellar remnants, which are not massive enough to become a neutron star.

ANSWER: **White dwarf**s (accept **Degenerate dwarf**; prompt on "dwarf" or "star")

(5) On the moon, this region possesses the body's magnetic field, making it irregular. Subduction zones occur when parts of this region are forced below the Moho Discontinuity, melting and becoming part of a lower layer. This layer, which moves along the asthenosphere [[as-THEH-noh-"sphere"]], is divided into several tectonic plates. For the point, name this outermost layer of the Earth, which sits on top of the mantle.

ANSWER: **Crust** (prompt on "lithosphere")

(6) This scientist names inhibitory cells within the brain which are classified as Type One or Two based on their axon length. A staining method named for this scientist that uses silver chromate led to the discovery that brain tissue consists of individual neurons. An organelle named for this scientist passes vesicles [[VEH-sih-kuls]] through folds called cisternae [[sis-TER-nay]]. For the point, name this Italian biologist whose namesake "apparatus" packages proteins within the cell.

ANSWER: Camillo **Golgi** [[GOHL-jee]] (accept **Golgi** apparatus; accept **Golgi** complex; accept **Golgi** body; accept **Golgi** stain)

(7) This is the largest body to have its existence predicted by the now-discredited Titius-Bode [[TIH-tee-uss-BOHD]] Law. When he discovered this planet, William Herschel proposed the name "George's Star." The moons of this planet are named for Alexander Pope and William Shakespeare characters, including Titania and Miranda. This planet's axis of rotation sits at a 90-degree angle relative to its orbit. For the point, name this seventh planet from the Sun.

ANSWER: **Uranus**

(8) Felsic varieties of this substance can form namesake "domes." When this substance is extruded underwater, it can form its "pillow" variety. This substance can be classified as either ʻaʻā [[AH-AH]] or pahoehoe [[pah-HOY-HOY]] based on its texture and makeup. Pumice [[PUM-iss]] and obsidian are examples of igneous rocks formed by the cooling of this substance. For the point, name this form of molten rock created when magma reaches the Earth's surface.

ANSWER: **Lava** (do not accept or prompt on "magma")

(9) This organ is made up of several hexagonal lobules [[LOB-yools]], which consist of this organ's namesake cells arranged around a central vein. In the Cori cycle, lactose is moved into this organ where it is converted into glucose. Cirrhosis [[sih-ROH-siss]] of this organ can cause jaundice, or the yellowing of skin, often resulting from long-term alcohol abuse. For the point, name this large abdominal organ which removes toxins from the blood and produces bile.

ANSWER: **Liver** (accept **Liver** cells)

(10) An autoimmune disease impacting this organ is the most common cause of pernicious anemia. This organ's intrinsic factor is required to absorb vitamin B12. Infections with *H. pylori* bacteria and misuse of NSAID [[EN-sed]] painkillers are the most common causes of ulcers in this organ. This organ releases chyme [[KIME]] into the duodenum [[doo-AH-deh-num]] of the small intestine. For the point, name this organ that digests food with its namesake acid.

ANSWER: **Stomach** (accept **Stomach** acid)

(11) At the time of its launch, the Unity Engine was exclusively used for making these programs on macOS [[MAK-O-S]]. BlueMaxima's Flashpoint is a project dedicated to saving these programs made on Adobe Flash. One of the most popular frameworks for making 3D types of these programs is the Unreal Engine owned by Epic. For the point, name these computer entertainment programs, early examples of which include *Pong* and *Pac-Man*.

ANSWER: **Video Game**s (accept **Computer Game**s; prompt on "Game(s)")

(12) When these structures are unable to become ionized, they become the reflection type instead of the emission type. The planetary variety of these structures occur when a red giant expels its outer layers. The Pillars of Creation are a formation within one of these structures named Eagle. The Crab is a well-known example of, for the point, what large star-forming clouds of dust and gas?

ANSWER: **Nebula**e (or **Nebula**sl accept Reflection **nebula**; accept Emission **nebula**; accept Planetary **nebula**; accept Eagle **nebula**; accept Crab [a]nebula)

(13) This force causes objects to become charged in the tribo-electric effect. Amonton's [[ah-mohn-TOHNS]] Law states that this force is independent of surface area. This force is described by a namesake coefficient, represented with the letter *mu* [[MYOO]], and comes in dynamic and kinetic varieties. Causing your hands to warm up when you rub them together, for the point, what is this force which resists an object's motion?

ANSWER: **Friction** (accept Dynamic **friction**, Static **friction**, or Sliding **friction**; accept Kinetic **friction**; accept Coefficient of **friction**)

(14) The WRB and UK-ADAS [[u-k-AY-duss]] systems classify this substance on a triangular diagram. This substance naturally sorts into distinguishable layers known as "horizons." Loam [["LOW"-um]] is a type of this substance particularly valuable for agriculture, and this substance can be enriched with humus [[HYOO-muss]]. This substance is composed of organic matter, sand, silt, and clay. For the point, identify this substance in which seeds are planted.

ANSWER: **Soil** (accept **Dirt**; accept **Earth**)

(15) One variety of these organisms can leave behind hardened scars known as their namesake "boot." Gilded flickers form nests inside these organisms. Carmine dyes are made from a type of beetle that lives on these organisms, one species of which, Peyote [[peh-YOH-teh]], contains the hallucinogen mescaline [[MEH-skah-lin]]. Other examples of these plants include pincushion and saguaro varieties. For the point, name these desert plants that are covered in spines.

ANSWER: **Cactus** (or **Cacti**; or **Cactus**es; accept **Cactaceae**; accept Saguaro **cactus**; accept Pincushion **cactus**; accept Peyote **cactus**)

(16) One of these devices named for Clarence Zener allows for reverse flow below the breakdown voltage. A triangle whose point leads into a line is the standard circuit notation for these devices. The simplest kind of these devices is a single p-n junction. For the point, name these devices that only allow current flow in a single direction, which include a notable "light-emitting" variety.

ANSWER: **Diode** (accept Light-Emitting **Diode**; accept Zener **diode**; accept P-N **diode**; prompt on "LED")

(17) A function named for this man gives the number of integers less than a given integer, his totient [["TOE"-shent]] function. With Mascheroni [[mah-skeh-ROH-nee]], this man names a constant symbolized with a lowercase gamma. This man's namesake number is defined as the limit of "one plus one over n all to the nth power" as n approaches infinity, roughly equal to 2.718. For the point, name this Swiss mathematician whose namesake number is the base of the natural logarithm.

ANSWER: Leonhard **Euler** [[OY-lehr]] (accept **Euler**'s totient function or **Euler**'s phi function; accept **Euler**–Mascheroni constant or **Euler**'s constant; accept **Euler**'s number; prompt on "e")

(18) This compound, which is the reduced form of carbon dioxide, could trigger a runaway feedback loop according to the "gun hypothesis." This greenhouse gas is commonly trapped inside ice clathrates [[KLATH-"rates"]] at the bottom of the ocean. This compound is the primary fuel found in natural gas. For the point, name this simplest hydrocarbon, a tetrahedral compound with chemical formula CH4.

ANSWER: **Methane** (accept **CH4** before mentioned)

(19) These particles are theorized to have a half-life of 1.67 times 10 to the 34th years and would decay into a neutral pion [["PIE"-on]] and a positron. These particles can capture an electron through inverse beta decay. These particles make up the nucleus of the protium isotope of hydrogen. For the point, name this positively charged baryon [[BAY-ree-on]], which forms the nucleus with neutrons.

ANSWER: **Proton**

(20) The largest known variety of these animals is the *raja ofu* [[rah-jah-OH-foo]]. Some varieties of these animals from the *Anthophila* [[an-thoh-FEE-lah]] clade [[KLADE]] are able to communicate distance information through a "waggle dance." Neonicotinoid [[nee-oh-nih-KAH-tih-noyd]] pesticides are considered the most common cause of colony collapse disorder among these animals. The "Africanized" hybrid type of these animals are often known as the "killer" variety. For the point, name these insects that live in colonies and produce wax and honey.

ANSWER: **Bee**s (accept **Honeybee**s; accept Africanized honey**bee**s; accept Killer **bee**s; accept Wallace's giant **bee**; do not accept or prompt on "wasps")

(21) This element was first isolated by Hennig Brand, who boiled down gallons of his own urine. This element names a type of photoluminescence often contrasted with fluorescence. This element's allotropes include a tetrahedral white variety and an amorphous red variety. The primary ingredient in match heads, for the point, what is this element which is located below nitrogen on the periodic table, with atomic number 15 and symbol "P"?

ANSWER: **Phosphorus** (accept **P** before mentioned; accept White **phosphorus** or Tetra**phosphorus**; accept Red **phosphorus**)

(22) The formation of this material lends its name to the Carboniferous [[kar-boh-NIH-fer-us]] period, during which it was deposited in namesake seams and beds. This material is made from the deposition and compression of ancient plant matter, which eventually solidifies to become peat and this material. Varieties of this material include lignite, anthracite, and the bituminous variety. For the point, name this solid fossil fuel.

ANSWER: **Coal** (accept Black **coal**; accept Bituminous **coal** before mentioned; accept **Lignite** or **Anthracite** before mentioned)

(23) This field's structure is equivalent to the non-empty set A. This field takes its name from the Arabic for the "reunion of broken parts" or "bone-setting." According to the fundamental theorem of this field, at least one complex root can be found for every non-constant single-variable polynomial with complex coefficients. For the point, name this field of mathematics used to solve for unknown variables.

ANSWER: **Algebra** (or **al-Jabr**; accept Fundamental Theorem of **Algebra**)

(24) With Maurice Koechlin [[KEH-klin]], this engineer built the Garabit [[gah-rah-BEE]] Viaduct. This engineer designed the interior supports for the Statue of Liberty. One of this engineer's projects, which at the time was the world's tallest manmade structure, relied on an exponential shape and latticework to withstand high wind speeds. For the point, name this French civil engineer, who names a triangular tower in Paris.

ANSWER: Gustave **Eiffel** (or Alexandre Gustave **Eiffel**; or Bönickhausen dit **Eiffel**; accept **Eiffel** Tower or Tour **Eiffel**)

(25) This compound is oxidized by heating it with oxygen to form nitric oxide in the first step of the Ostwald process. Mixing this compound with bleach-containing substances produces toxic chloramine [[KLOH-rah-meen]] vapors. An artificial nitrogen fixation process for manufacturing this compound was discovered by Fritz Haber [[HAH-buh]]. For the point, name this simplest amine [[AM-een]] compound, whose chemical formula is NH3.

ANSWER: **Ammonia** (accept **NH3** before mentioned; do not accept or prompt on "Ammonium")

Extra Question

(1) The olm is a salamander species that is the only European vertebrate to exclusively live in these habitats. Unlike many insects living in these habitats, *Leptodirus* [[lep-toh-"DIE"-russ]] beetles retain their bright colors. Species that live in these habitats are referred to as troglobites. For the point, name these habitats inhabited by many depigmented and blind species, which are also a popular roosting spot for bats.

ANSWER: **Cave** (or **Cavern**s)