Round 2

Round 2 Tossups

(1) The impulse type of these devices cause changed velocities of the substances pushed through them. The ratio of input energy to outputs in these devices is the blade efficiency. One type of these devices named for James Francis are commonly used in hydroelectric dams. Examples of these devices mounted on tall poles are used to generate electricity from wind. For the point, name these devices that convert energy from the motion of fluids such as water or steam.

ANSWER: **Turbine** (accept Impulse **turbine**; accept Francis **turbine**; accept Wind **turbine**; accept **Turbine** generator; do not accept or prompt on "generator")

(2) The Mogi [[MOH-gee]] model predicts the impact of external deformations on the pressure found in these regions. The crystallization of and sinking in these regions can form plutons. Cooling in these regions can form large intrusive igneous bodies. Extremely large examples of these regions located close beneath the surface are required for a super-volcano eruption. For the point, name these areas under volcanoes, which contain molten rock.

ANSWER: **Magma Chamber**s (accept **Magma Pool**s; prompt on "volcano")

(3) In some programming languages, including C, the array data type is actually one of these objects due to the language's memory structure. This type is returned by a successful call to the "malloc" function, and aliasing is used when two or more of these objects have the same value. A "dangling" one of these types of objects can result in a segmentation fault, and in C, an asterisk is used to declare a variable of this type. For the point, name this data type which references locations of objects in memory.

ANSWER: **Pointer**

(4) Obstructions caused by this substance can be reduced with the drug Dornase alfa, and the amount of water in this substance can be increased with drugs such as guaifenesin [[gwai-FEH-neh-sin]]. In the stomach, this substance is secreted by goblet cells. The delta-F508 mutation in patients with cystic fibrosis produces a dangerously viscous type of this fluid. For the point, name this thick bodily fluid, which allergies can cause to accumulate in the nose.

ANSWER: **Mucus** (or **Phlegm**; prompt on "Airway Surface Liquid")

(5) Blueschist [[BLOO-shist]] is a rock created from this process, often forming accretionary wedges. Unstable regions in which this process occurs are known as Wadati-Benioff zones. Regions in which this process occurs are the only known origins of superthrust earthquakes. This process, which is slowed by mantle convection, allows crustal slabs to be recycled. For the point, name this process of one continental slab being pulled under another, which happens at namesake "zones."

ANSWER: **Subduction** (accept **Subduction** zone; prompt on plate "convergence"; prompt on plate "tectonics"; prompt on "metamorphosis" before "wedges")

(6) Long branch attraction is a systematic error that can occur when creating these constructs. The maximum parsimony method is used to construct the shortest one of these constructs possible. Nodes on these constructs indicate a speciation [[spee-see-AY-shun]] event and designate a clade [[KLAYD]]. Unlike cladograms, branches on these constructs indicate the amount of time since a species diverged. For the point, name these diagrams that illustrate evolutionary relationships.

ANSWER: **Phylogenetic tree**s (or **Evolutionary tree**s; accept **Network**s in place of **Tree**s; accept **Phylogeny**; do not accept or prompt on "cladogram"]

(7) One type of this process named for an Indian physicist is subdivided into Stokes and anti-Stokes varieties. Those varieties of this process are central to Raman spectroscopy. Interactions between photons and charged particles can result in the Compton type of this process. The sky appears blue because of a type of this process named for Lord Rayleigh. For the point, name this process of particles being deflected by other particles.

ANSWER: **Scattering** (accept Raman **Scattering**; accept Compton **Scattering**; accept Rayleigh **Scattering**; accept Elastic **Scattering**; accept Inelastic **Scattering**)

(8) A large, steerable device for observing this regime is located inside of a "quiet zone" near Green Bank, West Virginia. The Very Large Array is an observatory that studies light in this regime. On Earth, light in this regime is bounced off of the ionosphere to transmit information long distances through amplitude modulation transmissions. Telescopes used to observe this regime can detect the 21 centimeter line. For the point, name this radiation regime observed by dish and antenna telescopes, whose wavelength is greater than microwaves.

ANSWER: **Radio** waves (prompt on "radiation" or "electromagnetic radiation")

(9) The pathogen that causes septoria leaf blotch is able to infect wheat plants by blocking a receptor for this protein. This protein is composed of repeated monomers [[MAH-noh-mers]] of N-acetylglucosamine [[en-ah-SEE-til-gloo-KOH-sah-meen]] with beta-4 linkages. After cellulose, this is the second most common polysaccharide on Earth. This protein provides toughness to cephalopod [[SEH-fah-loh-pod]] beaks and mollusk radula [[RAD-yoo-lah]]. For the point, name this protein found in arthropod exoskeletons and fungi cell walls.

ANSWER: **Chitin** [[KAI-tin]] (be lenient on pronunciation)

(10) Products removed during this process are known as sidecuts. The product undergoing this process is fed through a long, winding tube that passes through an oven at 398 degrees Fahrenheit. Unsorted products of this process are known as naphtha [[NAP-thah]]. The most viscous products created from this process include paraffin and asphalt. For the point, name this process used to separate petroleum into components such as butane and kerosene.

ANSWER: **Distil**lation (accept Oil or Petroleum **distil**lation; accept Oil or Petroleum **refining**; accept word forms)

(11) Uranyl [[YOO-rah-nil]] acetate [[ASS-ih-tate]] is often used as a negative stain alongside these devices. Samples may be "fixed" with osmium tetroxide or glutaraldehyde [[gloo-tah-RAL-dih-"hide"]] before being analyzed by one of these devices. Antibodies bound to gold nanoparticles are used as a contrast agent when using these devices, the development of whose "cryo-" type won the 2017 Nobel Prize in Chemistry. These devices come in both "scanning" and "transmission" varieties. For the point, name these devices that fire a beam of negatively charged particles at samples to produce high-resolution images.

ANSWER: **Electron Microscope**s (accept **Electron Microscopy**; accept Scanning **Electron Microscope**s; accept Transmission **Electron Microscope**s; accept **EM**; accept cryo-**EM**; accept S**EM**; accept T**EM**; prompt on "microscope")

(12) One disease of these organelles gives macrophages [[MAK-roh-fay-jez]] a wrinkled "tissue paper" appearance and is called Gaucher [[goh-SHAY]] disease. Endosomes that mature into multivesicular bodies later fuse with these organelles. A mannose-6-phosphate tag targets proteins to these organelles, which also accumulate toxic gangliosides in Tay-Sachs disease. Lipases [["LIE"-pay-ses]] and acid hydrolases are found in, for the point, what vesicles with a pH of about 4.5 that break down cellular waste products?

ANSWER: **Lysosome**s

(13) These substances are more easily peptized if they have high values for the zeta potential at the double layer. DLVO theory uses the sum of van der Waals and electrostatic forces to determine whether these substances undergo flocculation [[flok-yoo-LAY-shun]]. These substances often appear blue, because they scatter low wavelength light via the Tyndall effect. Gels and emulsions are types of, for the point, what mixtures in which small particles are evenly suspended within another substance?

ANSWER: **Colloid**s (or **Colloid**al suspensions; accept **Gel**s before mentioned; accept **Emulsion**s before mentioned; accept Aero**sol**s before mentioned; prompt on "dispersions")

(14) This letter names a phenomenon in which carbonyl groups donate electrons to orbitals on transition metals, which is called "backbonding." Osmotic pressure is symbolized by the uppercase form of this letter, which also denotes the delocalized electrons within a conjugated system. A carbon-carbon triple bond contains two bonds denoted by this letter. For the point, name this Greek letter that names covalent bonds weaker than sigma bonds, formed from the overlap of p orbitals.

ANSWER: **Pi** (accept **Pi** bond; accept **Pi** electrons; accept **Pi** backbonding; prompt on "p")

(15) Damage to this structure is responsible for causing MELAS [[ME-lahs]] syndromes such as Leber hereditary optic neuropathy and MERRF [[MERF]] syndrome. Along with the Y chromosome, this is the primary structure used to analyze haplogroups. This circular structure interacts with its nuclear counterpart as a consequence of endosymbiosis. For the point, name this genetic material that is named for being found in an organelle commonly called the powerhouse of the cell.

ANSWER: **Mitochondrial DNA** (or **mtDNA** or **mDNA**; or **Mitochondrial genome**; prompt on "DNA"; prompt on "Mitochondria" before "genetic" is mentioned)

(16) The solubility of these compounds approaches the CMC at the Krafft temperature. An anionic [[an-"eye"-AH-nik]] type of these compounds called SDS is added to denature proteins before gel electrophoresis [[ee-lek-troh-foh-REE-sis]]. In solution, these compounds self-assemble into spherical aggregates called micelles [[mih-SELLS]], whose exteriors contain their hydrophilic head groups. Phospholipids and detergents are classes of, for the point, what amphiphilic [[am-fee-FIH-lik]] compounds that reduce surface tension?

ANSWER: **Surfactant**s (accept **Detergent**s before mentioned)

(17) Lake Valencia in Venezuela is notable for experiencing the sewage-caused variety of this process. Decreased light penetration caused by a consequence of this process halts lower-level photosynthesis and causes hypoxic "dead zones" to form. This process is most commonly caused by agricultural runoff rich in nitrates and phosphates. For the point, name this process in which a body of water becomes excessively nutrient-enriched, leading to algae blooms.

ANSWER: **Eutrophication** (or Hyper**eutrophication**; prompt on "algae blooms" or "phytoplankton blooms" before "blooms" is mentioned)

(18) This region was discovered in 1992 by David Jewitt and Jane Luu with the aid of charge coupled devices. This region, a circumstellar disk, is thought to be the source of short-period comets, and this region is home to such bodies as Eris and Pluto. For the point, name this ring of small objects at the edge of the solar system named for a Dutch-American astronomer.

ANSWER: Edgeworth-**Kuiper Belt** [[KY-per]]

(19) The Marr-Albus model describes input to this structure along a series of climbing fibers that connect to its four deep nuclei. This structure's white matter is collectively called the *arbor vitae* [[VEE-tay]]. The destruction of Purkinje [[per-KIN-jee]] cells within the cortex of this structure can cause ataxia. This structure is located behind the brainstem and beneath the occipital [[ok-SIH-peh-tul]] lobe. For the point, name this part of the brain responsible for balance and motor control, whose name is Latin for "little brain."

ANSWER: **Cerebellum** (prompt on "Brain"; do not accept or prompt on "cerebrum")

(20) This man names a type of space formed from expanding vector algebra and calculus from 2D and 3D planes. This man names a program that would prove the consistency of complex systems by breaking them into smaller parts. In one thought experiment, this man showed that a countably infinite number of guests could be added to a completely full and infinitely large hotel. For the point, name this mathematician who produced a set of 23 then unsolved problems.

ANSWER: David **Hilbert** (accept **Hilbert** space; accept **Hilbert**'s program; accept **Hilbert**'s paradox of the Grand Hotel or **Hilbert**'s Hotel; accept **Hilbert**'s problems)

(21) This compound's H2 receptors are inhibited by drugs such as ranitidine [[rah-NIH-tih-deen]] and cimetidine [[sih-MEH-tih-deen]]. Like gastrin, this compound induces hydrochloric acid release from the stomach's parietal [[pah-"RYE"-eh-tull]] cells. Binding Immunoglobulin [[ih-myoo-noh-GLAH-byoo-lin]] E causes basophils [[BAH-soh-fils]] to release this compound. Allegra, Zyrtec, and Benadryl are name-brand drugs that inhibit the release of this compound. For the point, name this organic compound released during an allergic reaction and inflammatory responses.

ANSWER: **Histamine**

(22) The measure of this quantity can be represented in 2D with an oscilloscope. For a point charge, this quantity is yielded by the product of Coulomb's constant times charge over distance, or kQ divided by r. According to Kirchoff's [[KEER-koffs]] second law, this quantity around a loop always equals zero. Current times this quantity gives the power emitted by a circuit component. For the point, name this quantity equal to current times resistance according to Ohm's law.

ANSWER: **Voltage** (or Electric **potential difference**, **electromotive force**, **emf**, **electric pressure**, or **electric tension**)

(23) In one paper, this thinker proposed a circular and contextual conception of stimulus and response. This author of "The Reflex Arc Concept in Psychology" responded to Walter Lippman in *The Public and its Problems*. This thinker founded the University of Chicago Lab School to test his progressive educational theories. For the point, name this American psychologist and pragmatist philosopher, the author of *Democracy and Education*

ANSWER: John **Dewey**

(24) Boards of this mineral are used in construction to make plasterboard. This flame-retardant mineral was the basis of the oldest mortars. This evaporite mineral can form translucent structures known as selenite. Satin spar and desert rose are crystalline desert formations of this mineral. This mineral component of Plaster of Paris is a two on the Mohs hardness scale. For the point, name this soft mineral made of calcium sulfate dihydrate.

ANSWER: **Gypsum**

(25) The Darcy–Weisbach [["WISE"-bahk]] equation gives the head or pressure loss caused by this force. This force is directly proportional to the applied load according to Amontons's [[ah-mohn-TOHNS]] First Law. Newton's formula can determine the quantity of this force by multiplying a material's namesake coefficient by its normal force. According to Coulomb's law of [this force], this force's kinetic form is independent of sliding velocity. For the point, name this force that resists movement.

ANSWER: **Friction** (accept Coefficient of **friction**)

(26) This researcher coined the terms echoics, mands, and tacts in a book analyzing the communication of ideas to an audience. Noam Chomsky heavily criticized this researcher's theory of the origin of language, which was described in the book *Verbal Behavior*. Inventions created by this researcher include the air crib and the cumulative recorder. For the point, name this behaviorist psychologist who used a namesake "box" to study operant conditioning.

ANSWER: Burrhus Frederic "B.F." **Skinner**

(27) The ability of this substance to deionize water is described by its cation [[KAT-"eye"-on]] exchange capacity. The components involved in creating this substance are abbreviated with the acronym CLORPT. This substance is divided into layers known as horizons. This substance, whose varieties include loam, is composed of decayed organic matter, or humus [[HYOO-mus]], as well as sand, silt, and clay. For the point, name this material in which farmers grow plants.

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

(28) This object is two-and-a-half times brighter than when it was originally observed by Ptolemy, changing its classification from third to second-magnitude. This star serves a role previously held by Alpha Draconis and which will eventually be usurped by Vega. This star lies along the line connecting Dubhe [[DOO-bay]] and Merak [[MEE-rak]], and it is the brightest star in Ursa Minor. For the point, name this star found at the end of the Little Dipper's handle, commonly known as the North Star.

ANSWER: **Polaris** (or **Alpha Ursae Minoris**; accept **Pole Star**; accept **North Star** before mentioned)

(29) A pentavalent [[pen-tah-VAY-lent]] compound of this element named for Dess and Martin oxidizes alcohols into carbonyl groups. A solution of this element fixes crystal violet dye during a bacterial Gram stain. A salt of silver and this element is used to cause precipitation during cloud seeding. This element forms a dark blue complex with starch in its namesake "clock reaction" commonly performed in lab demonstrations. Goiter is caused by a deficiency in, for the point, what halogen often added to table salt?

ANSWER: **Iodine** (or **I**)

(30) Stars named for this element are classified with the R-N and Morgan-Keenan methods. Those stars named for this element are characterized by a bright red color and a "sooty" atmosphere. With oxygen and nitrogen, this element is used as a catalyst in the CNO cycle. For the point, name this element whose allotropes on Earth include graphite and diamond.

ANSWER: **Carbon** (accept **C**)

(31) Linear independence of functions is shown by a type of this value called the Wronskian. The Jacobian type of this value is used when changing variables in a multiple integral. This value and the trace appear as coefficients of the characteristic polynomial. Cramer's rule solves systems of equations using ratios of these values, which must equal zero for a non-invertible matrix. For the point, name this value which equals "A D minus B C" for a two-by-two matrix.

ANSWER: **Det**erminant

(32) These materials are characterized by possessing small but finite band gaps. These materials are divided based on their affinity for holes or electrons into P and N subtypes. These materials can have impurities introduced in a process called doping. The most common types of these materials used in circuits are made from silicon and gallium compounds. For the point, name these materials with properties between an insulator and a conductor.

ANSWER: **Semi-conductor**s

(33) In a book whose title references his opposition to this concept, Paul Feyerabend [["fire"-AH-bend]] proposed the idea of epistemological anarchism. Karl Popper refuted verificationism by arguing that ideas examined with this concept can be falsified. The *Novum Organum* of Francis Bacon is often credited with formalizing this concept, which he referred to as "true induction." For the point, name this concept, which involves testing hypotheses with experiments.

ANSWER: **Scientific method**

(34) Concentrated solutions of this compound known as "high-test" are often used as rocket propellant. A solution of this compound with iron salts called Fenton's reagent is used to treat wastewater, because this oxidizing agent readily disproportionates to form hydroxyl radicals. This is the simplest molecule with an oxygen-oxygen single bond. The enzyme catalase breaks down, for the point, what molecule with formula H2O2, which is a common antiseptic?

ANSWER: **Hydrogen Peroxide** (accept **H2O2** before mentioned; prompt on "Peroxide")

(35) In a 2012 study at UCSB, this situation was tested with a piezoelectric [[pee-EH-zoh-"electric"]] "tuning fork." This situation lends its name to a type of quantum situation where a particle is superpositioned into diametric outcomes. This situation was designed to critique the Copenhagen interpretation and imagines a vial of poison that will be released if a particle randomly decays. For the point, name this thought experiment depicting a feline that is both dead and alive.

ANSWER: **Schrödinger's Cat**

Extra Question

(1) This disease's drug-induced variant can be caused by the arrhythmia drug procainamide [[pro-KAY-nih-mide]] and the anti-convulsant phenytoin [[feh-nih-"TOE"-in]]. This disease is the most common cause of Libman-Sacks endocarditis [[en-doh-kar-"DIE"-tis]]. This disease, which causes a malar [[MAY-lar]] rash, is worsened by sunlight exposure. This disease is characterized by the appearance of a "butterfly" mark on the face. For the point, name this autoimmune disorder which gets its name from a mark resembling a wolf bite.

ANSWER: **Lupus** (or System **Lupus** Erythematosus; or **SLE**)