

## Round 2

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### Regulation Tossups

(1) Kepler's conjecture concerns the packing of these figures in three-dimensional space, and the sum of angles of a triangle on this shape exceeds 180 degrees. The surface area of one of these objects is "4 pi r squared." For the point, name this 3D shape with a volume of "four thirds pi r cubed," exemplified by structures such as marbles and globes.

ANSWER: **Sphere** (accept **Spherical**; accept **Spherical** Harmonics; accept **Spherical** Triangle)

(2) This function appears three times in the formula for combinations, and it is estimated by Stirling's approximation. This function applied to 3 is 6, and when applied to 4 yields 24. Defined as the product of all positive integers less than or equal to "n," this is, for the point, what function denoted by an exclamation point?

ANSWER: **Factorial**

(3) This substance induces dysentery in its creators when produced from an aphid byproduct. This substance's low moisture content makes it inhospitable to microorganisms, which makes it the only known foodstuff to never spoil. Produced from stomach enzymes and stored in hexagonal wax combs, this is, for the point, what natural sweetener produced from nectar by bees?

ANSWER: **Honey**

(4) Extant varieties of these animals include the screaming hairy and pink fairy types. In the southern United States, the nine-banded variety of these animals always give birth to identical quadruplets, and that species is a vector for leprosy. For the point, name these armored mammals, some of which can roll into a ball when scared.

ANSWER: **Armadillos**

(5) Algeria has constructed a dam named for this color to halt overgrazing, and engineers in several African countries are constructing a Great Wall of this color to contain the Sahara Desert. Along with red, this color names a type of colorblindness that is more prevalent in males. For the point, name this color that identifies a type of beryl known as emerald.

ANSWER: **Green** (accept **Green** Dam; accept Great **Green** Wall; accept Red-**green** Colorblindness; accept **Green** Beryl)

(6) This compound can be artificially synthesized using dimethylurea and malonic acid. With theophylline, this compound is often used as a treatment for sleep apnea, and this stimulant is an alkaloid and adenosine antagonist commonly used to prevent drowsiness. For the point, name this stimulant found in tea and coffee.

ANSWER: **Caffeine** (accept **Guaranine**; accept **Methyltheobromine**)

(7) The newly discovered element Oganesson is considered to be part of this group. This group's members are characterized by a full complement of valence electrons in their outer shell, leading to their lower likelihood of taking part in a chemical reaction. For the point, name this group of elements that contains helium, neon and argon.

ANSWER: **Noble Gases** (accept **Group 18 Elements**; accept **Inert Gases**; accept **Aerogens**; prompt on "Helium Group" or "Neon Group")

(8) A volcano plot depicts how these substances bind according to the Sabatier principle. The number of active sites in the heterogenous type of these substances are lowered by "Poisoning," and these substances provide an alternate reaction pathway by stabilizing the transition state and lowering the activation energy. For the point, name these substances that speed up chemical reactions.

ANSWER: **Catalysts** (accept Heterogeneous **Catalysts**)

(9) A type of crystallography using this radiation was used by Rosalind Franklin to take a photo of the structure of DNA. The discovery of this radiation earned Wilhelm Röntgen [[RENT-gen]] a Nobel Prize in Physics. For the point, name this radiation with a lower frequency than gamma rays, which can be used to image bones.

ANSWER: **X-Rays** (or **X-Radiation**; accept **Röntgen Radiation** before "Röntgen")

(10) Plumes of this region are believed to cause volcanic hot spots. The highly ductile upper portion of this region is known as the asthenosphere, and conductions in the semi-liquid portions of this region cause the movement of tectonic plates. For the point, name this region of the Earth located between the inner core and the crust.

ANSWER: **Mantle**

(11) This technique's first description in Ancient India was found in the *Bower Manuscript*, which also mentioned Sushruta [[soo-SHROO-tah]], the "Father of [this procedure]." The Edwin Smith Papyrus describes procedures for this practice in Ancient Egypt, including the use of sutures. For the point, name this invasive medical technique that uses instruments to treat a patient's condition.

ANSWER: **Surgery** (accept descriptive answers regarding specific **Surgical** Procedures)

(12) These objects from precursor stars that exceed the Tolman-Oppenheimer-Volkoff limit. The Reissner-Nordstrom variety of these objects are non-rotating, and one of these objects is predicted to vanish, as described by Hawking radiation. For the point, name these regions of supermassive gravity from which light cannot escape.

ANSWER: **Black holes** (accept Reissner-Nordstrom **Black Holes**)

(13) The Quechua [[KEH-chwah]] used the Cinchona [[“seen”-KOH-nah]] tree to fight this disease. An outbreak of this disease led to the founding of the CDC, and this disease was effectively ended in the U.S. by the introduction of DDT. American soldiers in the South Pacific contracted, for the point, what disease that is spread by mosquitoes and named for the Spanish for "Bad Air?"

ANSWER: **Malaria**

(14) The second part of this process begins with a carbon dioxide molecule combining with RuBP to make a high-energy intermediate. Deciduous trees such as birches and maples perform this process using an organelle known as the chloroplast. Chlorophyll molecules absorb light in, for the point, what process in which plants use light energy to produce sugars?

ANSWER: **Photosynthesis** (accept **Light Reaction** or **Light**-dependent **Reactions** before “Second Part” is mentioned; prompt after mentioned; prompt on “Calvin Cycle” or “Calvin-Benson Cycle” or “Dark Reaction”)

(15) This man invented a mercury-fulminate-based blasting cap to reduce the need for fuses. This owner of the arms manufacturer Bofors developed the use of nitroglycerin as an active ingredient in explosives. For the point, name this Swedish chemist and inventor of dynamite who lends his name to annual prizes awarded for literature, peace, and science.

ANSWER: Alfred Bernhard **Nobel**

(16) A "tree" variant of this animal is native to New Guinea, and that variety is the only true arboreal macropod. *Osphranter* is a genus containing these animals, and that genus contains the red species of this large mammal. For the point, name this Australian marsupial and relative of the smaller wallaby.

ANSWER: **Kangaroo** (accept **Kangaroo** Island; accept Tree-**Kangaroo**)

(17) This organelle’s semi-permeable structure allows smaller molecules to pass through without assistance through either osmosis or diffusion. Both prokaryotic and eukaryotic cells contain this organelle in a phospholipid bilayer form. For the point, name this organelle, the cellular boundary that protects the inner organelles.

ANSWER: **Cell Membrane** (prompt on "Membrane" alone)

(18) The deadliest instance of this phenomenon affected the cities of Daulatpua and Saturaia in Bangladesh. These phenomena that can form from supercells are measured by their intensity on the Fujita scale. Waterspouts are aquatic versions of, for the point, what devastating natural disasters of revolving air columns?

ANSWER: **Tornado** (accept equivalents such as **Twisters**; accept **Cyclones**)

(19) The *Vaccinia* virus is used to inoculate against this disease that was once harvested from the hands of milkmaids. British and American forces used this disease as a bioweapon via contaminated blankets, and the world's first vaccines were produced by Edward Jenner to prevent this disease. For the point, name this disease caused by *Variola* viruses, which was eradicated in the 1970s.

ANSWER: **Smallpox** (prompt on "*Variola Major*" or "*Variola Minor*" before mentioned)

(20) The largest unit of this measurement is a yotta, although a bronto has been proposed. This computer component is supported by secondary forms, including cards, external hard drives, and the Cloud. For the point, identify this computer component that comes in Random Access and Read-Only types.

ANSWER: **Memory** (accept Random Access **Memory** or Read-Only **Memory** before mentioned)

(21) A possible test of this technology was known as the Vela Incident. Tests of this technology include Smiling Buddha and Castle Bravo, and the presence of these weapons in Cuba triggered a 1962 diplomatic crisis. For the point, name this military weapon that uses a fission reaction to create an explosion.

ANSWER: **Nuclear** Weapons (accept reasonable equivalents, like **Nukes**; accept equivalents mentioning the **Atom** Bomb or **Atomic** Bomb or **A-Bomb**; accept **Nuclear** Warheads; prompt on "Weapons of Mass Destruction;")

(22) William Jenney constructed some of these things using the "Chicago skeleton" method, employing curtain walls over a steel frame. Early examples of these places include one named for Equitable Life in New York and Louis Sullivan's example named for Ellis Wainwright in St. Louis. The invention of the safety elevator enabled an 1890s boom in, for the point, what very tall office buildings?

ANSWER: **Skyscrapers**

(23) Half of this object was first directly seen by Jim Lovell and two other crewmembers. This site of the Sea of Tranquility was first visited when Michael Collins stayed in orbit while his two colleagues used a module known as The Eagle. In 1969, Buzz Aldrin and Neal Armstrong became the first two people to reach, for the point, what heavenly body?

ANSWER: The **Moon** (accept **Luna**)

(24) Pedology is the scientific field concerned with the formation of this material that is grouped into layers called horizons. Along with water and gases, this material is primarily composed of sand, silt, and clay. For the point, identify this nutrient-rich mixture of organic material used to plant flowers and crops.

ANSWER: **Soil** (prompt on "Earth" or "Dirt")

(25) This planet's atmosphere is composed of extremely thick clouds primarily made of sulfuric acid. That thick atmosphere traps greenhouse gases, giving this planet the hottest surface temperature in the solar system. For the point, identify this second planet from the sun, sometimes called "Earth's Twin."

ANSWER: **Venus**

(26) Predecessors of these entities included Wingdings. A set of these entities is constantly expanded using the Unicode standard, and a face with tears of joy is the most popular one of these entities. For the point, name these pictograms often used in text messages that include a host of facial expressions and objects.

ANSWER: **Emojis**

(27) Lichens consist of a fungus and one of these organisms living in a symbiotic relationship. Ocean afforestation involves growing these organisms en masse, and rapid oxygen-depletion in the population of these organisms are known as their namesake "blooms." Cyanobacteria and seaweed are types of, for the point, what often green marine protist organisms that float on water?

ANSWER: **Algae** (accept Blue-Green **Algae**; accept **Seaweed**; accept **Algae** Bloom or **Algal** Bloom)

(28) A 1979 study found that the introduction of these cells resulted in a mutation of the measles virus. These cells multiply faster in zero gravity, according to an experiment conducted onboard the Korabl-Sputnik-2 satellite. The National Foundation for Infantile Paralysis wanted a mass-production of these cells after they proved essential for the polio vaccine. First replicated by Theodore Puck and Philip Marcus, these are, for the point, what "Immortal" cells taken from cancer patient Henrietta Lacks?

ANSWER: **HeLa** Cells

(29) When cooled to the lambda point, this element forms a superfluid Rollin film that appears to creep out of its container. Alpha particles are the nuclei of this element, which is the second-most abundant in the universe. Two hydrogen atoms combine to form, for the point, what lightest noble gas that makes balloons float?

ANSWER: **Helium** or **(He)**

(30) These biomes are the predominant environment in which the European chamois [[sham-WAH]] goat-antelope is found. The pika is a close relative of the rabbit that can be found in these biomes that also contain South American camelids such as guanacos and vicuñas. Plant-life typically stops above the snow line in, for the point, what high-altitude biomes that include the Himalayas?

ANSWER: **Mountains** (accept **Alpine**; accept **Mountain** Range; accept **Highlands**; accept Himalayan **Mountains**)

**Extra Questions**

(1) This force can be found by taking the product of its direction with the dot product of the unit vector and the Cauchy [[koh-SHEE]] stress tensor. For a ramp with an angle of inclination  $\theta$ , the magnitude of this force is equal to " $mg$  [[M-G]]  $\cos \theta$ ." This force prevents a book perched on a table from sinking through it. For the point, name this force produced by a contact surface perpendicular to itself.

ANSWER: **Normal** Force (or "**F sub N**")

(2) This task commonly uses clay in the K-AR technique. Another technique for this task uses zircon to calculate a uranium-thorium-lead decay chain, and another method for this task uses the 12 and 14 isotopes of carbon. For the point, name this process that uses radioactive decay to find the age of an object.

ANSWER: Radiometric **Dating** (accept Radiocarbon **Dating**; accept Carbon **Dating**; accept Uranium-Lead **Dating**; accept descriptive terms referring to finding a **Date** or an **Age** of an object)