

# Finals

## Regulation

(Tossup 1) This adjective describes the symmetry breaking that occurs in the Higgs mechanism. A reaction can be described by this adjective if the Gibbs free energy is negative, indicating that the conditions favor the formation of products and, thus, occurs without need of outside energy. For the point, name this adjective which described the sudden “generation” of maggots on meat.

ANSWER: spontaneous

(Tossup 2) In 2007, for their gene-editing work on this model organism, Smithies, Evans, and Capecchi won a Nobel Prize. This animal's knockout variant comes from the species *Mus Musculus*. This group of rodents is phenotypically characterized by tails longer than their bodies, a pointed nose, and rounded ears. For the point, name this most commonly lab tested rodent, commonly mistaken for rats.

ANSWER: mice (or mouse; accept house mouse or house mice; prompt on “rodents”)

(Tossup 3) British analysts referred to a stream of data during this war as Fish, which was created by the Lorenz cipher. At Bletchley Park during this war, a precursor to the computer named after Heath Robinson was built to help crack the Enigma machine. Alan Turing contributed to British intelligence in cracking Nazi code during, for the point, what war between Axis and Ally powers?

ANSWER: World War II (or WW2; or Second World War; prompt on “World War”)

(Tossup 4) A lysis reaction using this molecule splits alkenes into carboxylic acids and aldehydes. This molecule's concentration in the atmosphere is measured in Dobson units. Until they were banned by the Montreal Protocol, chlorofluorocarbons decreased the concentration of this molecule, resulting in a hole above Antarctica. For the point, name this molecule with chemical formula O<sub>3</sub> that forms a namesake layer in the atmosphere.

ANSWER: ozone (accept ozonolysis; accept ozone layer; accept O<sub>3</sub> before mentioned, prompt afterwards)

(Tossup 5) Imperfections in these devices can create spherical, coma, and chromatic aberrations. The power of these devices is measured in diopters and can be found by taking the reciprocal of their focal length. These devices come in concave and convex varieties and are usually made out of glass. For the point, name these curved optical devices found in microscopes, telescopes, and glasses.

ANSWER: lenses

(Tossup 6) These constructs can be reduced to row-echelon form in a process named for Gauss and Jordan. The characteristic polynomial of these constructs can be solved to find their eigenvalues. The identity of these constructs has ones along the diagonal and zeros everywhere else. Cramer's rule can be used to find their determinant. For the point, name these constructs that arrange numbers into rows and columns.

ANSWER: matrix (accept matrices; prompt on arrays)

(Tossup 7) It's not temperature, but this quantity can be measured by a psychrometer [sai-CRAH-mah-tur] which uses both a "dry bulb" and "wet bulb" thermometer. A psychrometer [sai-CRAH-mah-tur] is a type of hygrometer [hai-GRAH-mah-tur], which is a class of instruments that measures this quantity. This atmospheric measurement is actually "relative" since it indicates how close to saturation with water vapor the air is. For the point, name this percentage measurement, which is low in places that experience "dry heats."

ANSWER: relative humidity (accept humid; accept water vapor concentration before "water vapor" is mentioned prompt afterwards)

(Tossup 8) Christian de Nuve accidentally discovered this organelle by noticing enzyme activity dropped when acid phosphatase was present. Tay Sachs disease is one of the many genetic storage diseases that can affect this organelle due to its high amount of specialized hydrolytic enzymes. For the point, name this organelle whose name refers to the fact it breaks down waste products.

ANSWER: lysosomes

(Tossup 9) A mission to retrieve macroscopic samples from this object named "Grunt" failed to find a launch window out of Earth's orbit. This is the larger and closer of two moons discovered in 1877 by Asaph Hall, and it completes its orbit in 8 hours. This moon, home to the Stickney Crater, is named for Ares' son, the personification of fear. For the point, name this larger moon of Mars, paired with Deimos.

ANSWER: Phobos

(Tossup 10) He Jiankui unethically used CRISPR to edit two babies' DNA in hopes of giving them resistance to this disease. The HAART approach to treating this disease focuses on inhibiting multiple targets, including the virus's protease, integrase, and reverse transcriptase. For the point, name this disease that became an epidemic in U.S. in the 1980s and is caused by the retrovirus HIV.

ANSWER: HIV/AIDS (or acquired immunodeficiency syndrome; accept HIV or human immunodeficiency virus before mentioned)

(Tossup 11) If a number x has this relationship to integers a and b, then there exists a linear combination of a and b that equals x by Bezout's identity. This type of number for two coprime numbers is always one. The Euclidean algorithm is a simple way to compute this number given two integers. For the point, name this largest integer that divides each of two or more given integers.

ANSWER: greatest common divisor (or gcd; accept greatest common factor or gcf)

(Tossup 12) The concentration of this compound in the atmosphere is plotted on the Keeling curve. When this gas is dissolved, it forms the compound responsible for ocean acidification. Along with oxygen gas, this is the only compound formed in a complete combustion. This compound is produced during respiration. For the point, name this compound that is exhaled during breathing and whose formula is CO<sub>2</sub>.

ANSWER: carbon dioxide (accept CO<sub>2</sub> before mention)

(Tossup 13) A section of this surface known as the Endeavor Ridge is home to 150 feet tall black smokers named Mothra and Godzilla. The measurement “mbsf” refers to “meters below” this location. This general surface is where Benthivores feed and it is home to the creation of new crust due to its namesake spreading. For the point, name this surface whose largest trench is named Mariana and is where groundfish live.

ANSWER: Earth's seabed (accept indications of ocean floor or sea floor)

(Tossup 14) This organ's enterochromaffin-like cells produce histamine. G cells signal activation of parietal cells to secrete a liquid into this organ that is neutralized by bicarbonate on leaving this organ. This digestive organ sits between the esophagus and the duodenum. For the point, name this organ that uses hydrochloric acid to break down food products into chyme for the small intestine.

ANSWER: stomach

(Tossup 15) This computer component uses registers to quickly access data. They can be overclocked to yield additional performance. Parallel programming allows several of these components to work on a problem at a time using multi-threading. Modern ones are “micro” and fit on a single integrated chip. For the point, name this computer component that commonly goes by a three-letter abbreviation, responsible for carrying out instructions.

ANSWER: central processor (accept central processing unit or CPU; accept microprocessor; accept main processor)

(Tossup 16) This property names a class of thermoplastic polymers which are characterized by reversible crosslinking. A coefficient of restitution equal to one characterizes processes with this property. This property describes collisions where kinetic energy is conserved. Rubber bands are a canonical example of objects with this property. For the point, give this term for an object that can return to its original state after being stretched.

ANSWER: elastic collision (accept elastomer; accept perfectly elastic; accept elasticity)

(Tossup 17) A mixture of 96% of one of this type of compound and 4% water is notable because it cannot be distilled. This class of compounds is characterized by the presence of a hydroxyl group. The ethyl variety of this class of compounds is used as an additive in fuel and serves as the active ingredient in many hand sanitizers. For the point, name this class of compounds whose “drinking” variety is ethanol.

ANSWER: alcohols (prompt on “hydroxyl” before mentioned)

(Tossup 18) A large prehistoric remnant of one of these events in the San Bernardino Mountains is named for Blackhawk Mountain. This form of mass wasting is divided into a starting zone, a track, and a run out zone. Earthquakes in Nepal can cause these events on Mount Everest. For the point, name these events, which pose a serious threat to mountain climbers, where snow and other debris hurtles down at high velocities.

ANSWER: avalanches (accept rock avalanche; accept landslide; prompt on “mass wasting” before read)

(Tossup 19) This constellation is northwestward of the north star Sirius. This constellation contains the stars Rigel and Betelgeuse [“beetlejuice”]. Mintaka, Alnilam, and Alnitak form a diagonal line to make up this constellation’s “belt” while the namesake nebula of this constellation is located in the Sword asterism. For the point, name this constellation of a hunter from Greek mythology.

ANSWER: Orion

(Tossup 20) This word is replaced with “quantum” in a system whose energy levels are spaced by  $\hbar$ -bar times omega. This adjective describes the motion exhibited by pendulums under the small angle approximation. This adjective is paired with harmonic to describe systems which oscillate around a fixed point. For the point, name this six-letter adjective that describes straightforward systems that lack complexity.

ANSWER: simple (accept simple harmonic oscillator or simple harmonic motion; prompt on harmonic before mentioned)

(Tossup 21) These three letters are paired with “op” for the abbreviated name of an “operational” circuit device. A cyclic molecule containing adenosine is commonly referred to by “c” and these three letters. These three letters begin the SI unit for current and name a device used by electric guitars. For the point, name these three letters that begin a word that measures the distance from peak to trough [troff] of a wave.

ANSWER: amps (accept spelling a-m-p; accept amplitude or Amperes or amplifiers; accept cyclic AMP)

(Tossup 22) These cells are commonly counted with Wright’s stain. Neutrophils, monocytes, and macrophages all fall under this class of cells. Antibodies are made by B and T cells, two members of this class of blood cells. For the point, name this class of blood cells which regulate the immune system and are contrasted with red blood cells.

ANSWER: white blood cells (or leukocytes; or WBCs; prompt on “blood cells”)

(Tossup 23) This scientist names a “deep field” and “ultra deep field” observed in a small section of Ursa Major. In 1929, this scientist noticed galaxies appear to expand away from us in every direction, and that redshift increases as a function of distance. For the point, name this scientist who names a space telescope launched in 1990 and a law describing the expansion of the universe.

ANSWER: Edwin (Powell) Hubble

(Tossup 24) This medicine can increase a child’s risk for Reye’s syndrome. This nonsteroidal anti-inflammatory drug has a precursor that was extracted from willow tree bark. In 1899, Bayer gave the common trade name to this salicylate that reduces the risk of stroke and heart attack. For the point, name this anti-inflammatory drug that is often used to treat pain, fever, and headaches.

ANSWER: aspirin (accept acetyl-salicylic acid)

(Tossup 25) The sulfurs in two cysteine residues can form this type of structure in protein folding. Direct overlap between orbitals creates the sigma type of this structure. Four dots between two atoms in Lewis dot notation represents this sort of bond. Carbon can make four bonds of this type. In this type of bond, electron pairs are shared between two atoms. For the point, name this type of bond contrasted with ionic bonds.

ANSWER: covalent bond (accept molecular bond; accept covalence; accept disulfide bond; prompt on bond)

(Tossup 26) This particle, which comes in “thermal” and “fast” varieties, is the only particle to date observed to undergo beta decay. This particle can be slowed down using moderators in a reactor. Two down quarks and one up quark makeup this particle. Adding this particle to an element creates an isotope of that element. For the point, name this particle that makes up the atomic nucleus with protons.

ANSWER: neutrons

(Tossup 27) Cycloheximide can inhibit this structure’s translocation responsibility. This structure is confusingly referred to as an organelle in some scientific literature despite being present in prokaryotes and not possessing a membrane. This structure gives the rough endoplasmic reticulum its namesake characteristic. For the point, name this RNA-protein structure responsible for carrying out translation.

ANSWER: ribosomes

(Tossup 28) Altitude lowers the temperature needed for this process to occur due to decreasing vapor pressure. Adding salt to water increases the temperature needed for this process to occur. This process occurs at high temperatures for water due to hydrogen bonding, typically at 212 degrees Fahrenheit or 100 degrees Celsius. For the point, name this rapid vaporization, a phase transition from a liquid to gas.

ANSWER: boiling (accept boiling point; prompt on “vaporization”)

(Tossup 29) This material is studied in edaphology and pedology. The texture of the layers of this material are classified into horizons. Mycorrhizal [my-CUH-rai-zuhl] fungi live in this material. This mix of clay, sand, and humus sits on top of bedrock. Crop rotation helps preserve the fertility of this material. For the point, name this material that earthworms help improve and is commonly referred to as dirt.

ANSWER: soil (accept dirt until mentioned, prompt afterwards; accept earth until “earthworms” prompt afterwards)

(Tossup 30) Hero of Alexandria developed an early precursor to this machine known as the aeolipile. The Rankine cycle was developed to analyze this machine’s efficiency of creating pressure to move a piston. This machine was improved by James Watt by recycling the namesake vapor to a new vessel for condensation. For the point, name this machine that powered many factories during the industrial revolution.

ANSWER: steam engine (accept steam turbine; prompt on “engine” or “turbine” with “powered by what?”)

## Extra

(Tossup 31) Colloids containing nanoparticles of this element are produced in the Turkevich method. Alchemists used aqua regia to dissolve platinum and this element Rutherford discovered the nucleus while firing alpha particles at a foil of this element. Because of its malleability, this element is commonly used in jewelry. For the point, name this precious metal with atomic number seventy-nine and chemical symbol Au.

ANSWER: **gold** (accept **aurum**; prompt on “Au”)

(Tossup 32) In 2014, scientists identified a densovirus targeting organisms in this class causing a namesake wasting disease. The “crown of thorns” member of this class poses a threat to coral reef systems. These echinoderms are apart of the class Asteroidea. For the point, name this sea-dwelling creature whose five tentacles lend it its astronomical name.

ANSWER: **starfish** (or **starfishes**; accept **sea stars**; accept **Asteroidea** before mentioned)