Round 1

Regulation Tossups

(Tossup 1) An assumption of this theory is that differential fitness is heritable. The mechanism of this theory was independently discovered by Alfred Russel Wallace. Analogous structures are created in the convergent form of this process, and genetic variation is a prerequisite for this process to occur. For the point, name this theory about inherited changes in populations over time that was explained by Charles Darwin in On the Origin of Species.

ANSWER: **evolution** (accept natural selection)

(Tossup 2) Polygonal columns of this type of rock are found in the Giant's Causeway. Bowen's reaction series diagrams minerals that form this type of rock. Ultramafic, mafic, and felsic are classifications of these rocks based on their silicon dioxide content. Basalt and pumice are examples of this type of rock that form from magma or lava cooling. For the point, name this class of rocks contrasted with sedimentary and metamorphic.

ANSWER: **igneous** rock (accept basalt before mentioned, accept extrusive)

(Tossup 3) The largest molecule known to exhibit wave-particle duality contains 60 atoms of this element. An allotrope of this element with a hexagonal lattice first found in meteorites is called lonsdaleite. Another allotrope of this element comes in "single-walled" and "multiwalled" forms; those are their namesake "nanotubes." Graphite, graphene, and diamond are all made of this element. For the point, name this element that forms the basis of organic chemistry, symbolized C.

ANSWER: **carbon** (prompt on C, accept buckminsterfullerene or buckyball in the first line]

(Tossup 4) Both forms of this quantity are conserved under translational and rotational invariance according to Noether's theorem. Unlike energy, the linear form of this quantity is conserved during collisions. The angular form of this quantity can be obtained as the radius cross the linear form of this quantity. L is used to represent the angular form of this quantity. For the point, name this product of mass and velocity, quantification of an object's tendency to stay in motion.

ANSWER: **momentum** (accept linear momentum; accept angular momentum)

(Tossup 5) Projections of the cell membrane within this tissue are called T-tubules. The tetanus toxin blocks neurons attached to this tissue. The breakdown of this tissue releases large amounts of myoglobin into the bloodstream. A “power stroke” cycle allows for the contraction of this tissue via the interaction between myosin and actin. For the point, name this type of tissue whose “skeletal” type makes up the diaphragm and biceps.

ANSWER: **muscles** (accept smooth muscles; accept skeletal muscles)

(Tossup 6) By studying the rotation curves of these systems, Vera Rubin developed their rotation problem. SBc and E3 are classifications of these systems which lie on a “tuning fork” created by Edwin Hubble. “Barred” and “unbarred” are classifications of the “spiral” type of these systems. Examples of these systems include Triangulum and Andromeda. For the point, name these systems of stars exemplified by the Milky Way.

ANSWER: **galaxies** (or galaxy)

(Tossup 7) Part of the Collatz conjecture concerns tripling odd numbers and adding this number to the result. This number is the determinant of every identity matrix, and this is the only number repeated in the Fibonacci sequence. This number equals the cosine of zero, and this positive integer is its own reciprocal. For the point, identify this number, the multiplicative identity, meaning it solves equations like 2x equals 2.

ANSWER: **one** (or unity)

(Tossup 8) Lise Meitner found that a “core” one of these particles gets removed during the Auger effect. In the photoelectric effect, photons hitting metals cause the emission of these particles. Imagining a delocalized “sea” of these particles can explain why metals are conductive. The antiparticle of this subatomic particle is the positron. For the point, name this negatively charged particle that orbits the nucleus.

ANSWER: **electrons**

(Tossup 9) Inward and outward curvatures of this structure are respectively called lordosis [“LORE” doh sis] and kyphosis [kee - FO - sis]. Unbalanced pressure on cartilage within this structure can cause a type of hernia called a “slipped disc.” Fused bones called the sacrum and coccyx make up the end of this structure, which is affected by scoliosis [SCOH lee OH sis] and can be manipulated by chiropractors. For the point, name this bony structure in the back consisting of 33 vertebrae.

ANSWER: **spine** (accept backbone or spinal column or vertebral column do not accept “spinal cord”)

(Tossup 10) Henri Becquerel [BECK-uh-RELL] and two people with this surname shared the 1903 Nobel Prize in Physics. This is the last name of a physicist who won two Nobel Prizes for advancing the study of radioactivity and discovering Radium and Polonium. For the point, name this last name of Polish and French scientists Marie and Pierre.

ANSWER: **Curie** (accept Marie Curie, Pierre Curie, Jacques Curie)

(Tossup 11) The chloride of this element is used in the saturated calomel electrode. Thiols bond tightly to compounds of this element, so they are also named for “capturing” this element. Alloys that include this element are called amalgams. This element is bonded to sulfur in its most common ore cinnabar. This toxic element was used in early barometers and thermometers. For the point, name this metal that is liquid at room temperature and has symbol Hg.

ANSWER: **mercury** (or Hg before mention)

(Tossup 12) In dynamic systems theory, a space described by this word represents the possible states a system can enter. Pressure changes the temperature required for transitions between these states as described by the Clausius-Clapeyron [clow see us clap uh ron] equation. Sublimation and deposition are transitions between two of these states. For the point, name these states such as solid, liquid, and gas.

ANSWER: **phases** (accept phase space)

(Tossup 13) According to the solution to the Basel problem, summing one over n squared over every positive integer returns this number squared over six. e to the power of i times this number is equal to negative one according to Euler's identity and the area of a circle is given by this number times the radius squared. For the point, name this value, the ratio of the circumference of a circle to its diameter which is approximately 3.14.

ANSWER: **pi**

(Tossup 14) The largest deposit of this material in the United States is located in the Powder River Basin of Wyoming and Montana. Anthracite and bituminous are considered higher quality forms of this material whose lower quality forms include lignite and peat. Burning this material makes up 39% of the U.S.'s electricity. For the point, name this combustible, sedimentary black rock used as a fuel source.

ANSWER: **coal**

(Tossup 15) Naphthalene [NAFF thuh LEEN] and anthracene [AN thruh SEEN] contain two and three units of this compound, which can be modified to form phenol [FEE nol] or toluene [TALL u EEN]. This molecule's four-times-one-plus-two conjugated electrons obey Hu¨ckel's rule, making it aromatic. When fully hydrogenated, this molecule forms cyclohexane. Kekule discovered the structure of this molecule based on the image of a snake biting its own tail. For the point, name this planar molecule with formula C6H6.

ANSWER: **benzene** (prompt on C6H6)

(Tossup 16) Dactyl is a sattelite of one of these bodies named 243 Ida. They make up the Jovian Trojans, which orbit in Jupiter's Lagrange points. Gaps where these objects are not found are named after Kirkwood. One of the largest of these bodies is called Vesta which is found in a region between Mars and Jupiter. For the point, name these astronomical bodies that make up a namesake "belt" in the solar system.

ANSWER: **asteroids**

(Tossup 17) While improving radar during World War II, John Randall made common use of this device possible with improvements to the cavity magnetron. The “Radarange” was the first modern one of these devices invented by Percy Spencer after noticing the magnetron had melted a chocolate bar in his pocket. These things generally operate in the range of 700 watts to 1200 watts. For the point, name this device used to heat up food with a part of the spectrum between radio and infrared.

ANSWER: **microwave oven** (do not accept or prompt on “oven”)

(Tossup 18) Phosphate groups are added to this compound by the enzyme hexokinase. Individual units of this molecule make up the branched polymers amylopectin [am-UH-lo-PECK-tuhn] and glycogen [GLY co ZHen]. Pyruvate is formed from the breakdown of this carbohydrate during glycolysis. Combining this molecule with fructose forms sucrose. For the point, name this simple sugar with formula C6H12O6 that is the main product of photosynthesis.

ANSWER: **glucose** (accept dextrose)

(Tossup 19) Two of these objects merging resulted in the first recorded instance of gravitational waves by LIGO. Roger Penrose proposed extracting energy from the ergospheres of these objects. They lose mass through Hawking radiation, and a supermassive one exists at the center of our galaxy. For the point, name these astronomical bodies that have a gravitational singularity so strong that light cannot escape past their event horizon.

ANSWER: **black holes**

(Tossup 20) Atypeoferosioncausedbythissubstanceiscalledwedging.N´ev´e[NAY-VAY]isyounger than another type of substance called firn. Bubbles trapped in “cores” of this substance allow scientists to determine past atmospheric composition. The ablation of this substance is called calving and can happen from crevasses. This substance forms structures that leave eskers and moraines. For the point, name this cold substance that forms glaciers.

ANSWER: water **ice** [accept frost, snow, icebergs, or glacier before mention]

(Tossup 21) Francois Magendie first illustrated one form of this unit by running an experiment on a three-year-old dog. This unit of energy is equal to 4.184 Joules as it is defined using the specific heat of water. This unit is described as “empty” when providing little additional nutrition to the body. A gram of fat has a value of nine for this unit. Grams of protein and carbohydrates both have a value of four for this unit. For the point, name this unit used to count energy intake by food.

ANSWER: **calories** (accept empty calories)

(Tossup 22) In a reaction named for Fischer, carboxylic acid and one of these compounds react to form an ester. Salt and one of these compounds added to a test tube can cause DNA to precipitate out of solution. The “wood” type of this compound can cause blindness if ingested. These compounds have a hydroxyl group, or -OH. For the point, name this group of compounds that include methanol and ethanol.

ANSWER: **alcohols** [accept hydroxyls before mention]

(Tossup 23) Hydrolysis of this compound is required by ABC transporters. In the body, this compound is typically complexed with a plus 2 magnesium ion. Oligomycin A can inhibit the Fo [F-oh] subunit of a synthase that generates this compound. That synthase works on a rotary motor mechanism. This molecule is primarily produced during oxidative phosphorylation. Glycolysis begins by expending two units of this molecule. For the point, name this energy currency produced primarily by mitochondria.

ANSWER: **ATP** (or adenosine triphosphate)

(Tossup 24) John Logie Baird gave the first demonstration of this technology using moving silhouettes on a Nipkow disk. CASIO pioneered the portable use of this technology. NTSC and Phase Alternating Line are two color encoding systems for this technology that were popularized in the 1950s. American inventor Charles Frances Jenkins pioneered the creation of this technology with his paper on “Motion Pictures by Wireless.” For the point, name this technology used to watch cable channels, commonly abbreviated to TV.

ANSWER: **television** (accept TV before mentioned)

(Tossup 25) Dissolved amounts of this gas are detected using the Winkler test. This gas's "triplet" form is paramagnetic due to unpaired electrons in its MO diagram. This gas reacts with hydrocarbons in combustion reactions. Electrolysis of water produces hydrogen and this other diatomic gas. For the point, name this gas that makes up 21% of Earth's atmosphere which is absorbed in the lungs for respiration.

ANSWER: **oxygen** gas (accept O_2)

Extra Question

(Tossup 1) Cells named after this color are called erythrocytes. For humans, the longest wavelength cone primarily sees this color. Although they can vary greatly, algal blooms are sometimes called "tides" of this color. Litmus paper turns this color in acidic conditions. Rashes caused by chickenpox are this color. Iron causes hemoglobin to take, for the point, what color of blood cells contrasted with white blood cells?

ANSWER: **red**