

Finals

Regulation Tossups

(1) The side lengths and diagonals of one type of these shapes can be related by Ptolemy's theorem. Points within the plane that form the cyclic type of these shapes must satisfy the intersecting chords theorem. Tetragon is another name for these types of shapes whose simple or planar forms must have interior angles that sum to 360 degrees. For the point, name these four-sided polygons.

ANSWER: **Quadrilaterals**

(2) Enzymes that catalyze the breakdown of this molecule by dephosphorylation are known as its namesake "ase." This molecule must bind to a magnesium cation [[KAT-"eye"-on]] to be active, and this molecule's synthase is powered by a proton gradient in the electron transport chain. Glycolysis yields a net gain of 2 of, for the point, what molecule, the energy currency of the cell?

ANSWER: **ATP** (or **Adenosine Triphosphate**)

(3) One type of military technology named for this civilization was introduced in a "Double piston pump" variety. That early flamethrower was a type of "Fire" named for this civilization that invented the clepsydra, a type of automated water clock. For the point, identify this civilization that made advancements in medicine thanks to Hippocrates.

ANSWER: **Greece** (**Greek** or **Greeks**; accept **Hellenic** Republic; accept **Elliniki** Dimokratia; accept **Ellas** or **Ellada**)

(4) This largely spherical body's highest point is the cryo-volcano Ahuna Mons. Along with Uranus, this body's orbit was predicted by the discredited Titius-Bode [[TIH-shuss BOHD]] Law. Vesta and this body were the destinations of the *Dawn* probe, and this body is the only dwarf planet within Neptune's orbit. For the point, name this largest object in the asteroid belt.

ANSWER: **Ceres**

(5) Some of the largest types of features made from this natural material include Christmas Island. Islands formed from this material comprise the countries of Tuvalu and Kiribati [[kee-ree-BAHS]], and this material also comprises the world's largest structure made by living organisms. For the point, name this material that forms the Great Barrier Reef.

ANSWER: **Coral** (accept **Coral** Atolls; prompt on "Great Barrier Reef" until mentioned)

(6) These constructs are unrolled during compilation, and vectorization obviates the need for these constructs. Retry statements can be used to exit these structures using the break command. For, while, and do are keywords that declare these constructs, which can run infinitely if left unsatisfied. For the point, name these blocks of code that are executed repeatedly until a particular condition is met.

ANSWER: **Loops**

(7) The Hartree-Fock method is a process for approximating these entities of more complex systems. The molecular variety of these entities can be calculated from the LCAO method. The simplest type of these entities is spherical and contains no radial nodes, and a singular one of these constructs can only hold two electrons. For the point, name these atomic regions that come in s, p, d, and f varieties.

ANSWER: **Orbitals** (accept **Wavefunctions** before "Molecular" is mentioned; accept specific orbital types such as S, P, D, or F **Orbitals** before mentioned)

(8) *Resacas* are types of these features that are formed when water moves from the Colorado River to the Gulf of Mexico. These features can release lethal amounts of carbon dioxide in events known as limnic eruptions. Billabong is the Australian term for one of the oxbow types of these bodies of water. For the point, name these bodies of water that include Okeechobee and Huron.

ANSWER: **Lakes** (accept **Oxbow Lakes**; accept **Billabong** before mentioned; accept specific lakes; prompt on "Limnic Eruption" before mentioned)

(9) Two enzymes and three of these compounds synthesize creatine. Residues of one type of these compounds make up about one-third of collagen, and the side chain of that type of these compounds is a single hydrogen atom. These compounds are the precursor to proteins, and 21 of them are known. For the point, identify these compounds of which methionine and lysine are essential types.

ANSWER: **Amino Acids** (prompt on partial answers; accept **Glycine**)

(10) The alpine form of this biome can be identified by the presence of stunted forests called *Krummholz*. Short growing seasons affect this biome where the Sami people of Finland reside. Animals native to this biome include the ptarmigan and lemming. For the point, identify this biome characterized by low temperatures and limited tree growth that contains permafrost in its Arctic example.

ANSWER: **Tundra** (accept Alpine **Tundra**; accept Arctic **Tundra** before mentioned; accept Antarctic **Tundra**)

(11) A project called Breakthrough Starshot aims to send many miniature spacecraft to this star system using solar sails. This star system is the brightest object in the constellation Centaurus. Comprised of three stars, this is, for the point, what closest stellar system to our Sun which contains a star known as Proxima?

ANSWER: **Alpha Centauri** (prompt on "Proxima Centauri" before mentioned)

(12) This type of electromagnetic radiation is utilized in Mossbauer spectroscopy. Bursts of this type of radiation last briefly before emitting radiation of a longer wavelength, such as X-rays. For the point, name this type of radiation that has the shortest wavelength on the electromagnetic spectrum and is named for a Greek letter.

ANSWER: **Gamma** Rays (accept **Gamma** Ray Burst; accept Terrestrial **Gamma** Ray Flash)

(13) The sarcoplasmic type of this organelle releases calcium ions during muscle contraction. It's not the Golgi apparatus, but flattened sacs called cisternae are found in this organelle. This organelle folds proteins, and its types are distinguished by the presence or absence of studded ribosomes. For the point, name this organelle that comes in smooth and rough types.

ANSWER: **Endoplasmic Reticulum** (or **ER**; accept Smooth **Endoplasmic Reticulum** or **ER**; accept Rough **Endoplasmic Reticulum** or **ER**; prompt on "Reticulum" or "Endoplasmic")

(14) The conservation of this quantity can be derived from Noether's [[NOY-thurrs]] theorem for systems that possess time invariance. The Lagrangian is the difference between the kinetic and potential types of this quantity. The joule is the SI unit that measures, for the point, what quantity that is needed in order to do work?

ANSWER: **Energy** (or Total **Energy**; accept Kinetic **Energy**; accept Potential **Energy** or any other specific type of energy)

(15) One of these creatures is biologically immortal due to its ability to alternate between its polyp and medusa phases. These creatures possess structures called nematocysts, or stinging cells. The lion's mane species of these creatures is the largest member of the phylum cnidaria [[NYE-dare-ee-uh]]. For the point, name these venomous aquatic animals that include the Portuguese Man O' War.

ANSWER: **Jellyfish** (accept **Cnidarians** before mentioned; accept specific **Jellyfish** species)

(16) The Tupolev Tu-144 is the Soviet analog of a type of aircraft that can accomplish this feat. One aircraft capable of accomplishing this feat, the Concorde, was primarily operated by Air France and British Airways for three-hour transatlantic flights to New York. Chuck Yeager flew in an X-1 rocket plane to accomplish, for the point, what feat in which a vehicle travels faster than Mach 1?

ANSWER: **Breaking the Sound Barrier** (accept Breaking **Mach 1**; accept **Supersonic**; accept **Concorde** before mentioned)

(17) In most oocytes [[OH-oh-sites]], these structures can be seen in their "lampbrush" form. In humans, these structures are numbered roughly in order of descending length, and two of them are the "Sex" type. Karyotypes are used to arrange and display these structures made of chromatin. Human genetic information is carried by, for the point, what cells that generally have 23 pairs?

ANSWER: **Chromosomes** (accept Lampbrush **Chromosomes**; accept Sex **Chromosomes**)

(18) The crusts of these objects are subject to frame dragging and strong magnetic dipole rotation that can cause starquakes. When these objects possess extreme magnetic fields they are called magnetars, and when these objects emit regular bursts of radiation they are known as pulsars. For the point, name these extremely dense stars composed of a namesake neutral particle.

ANSWER: **Neutron** Stars (accept **Pulsars** before mentioned)

(19) The namesake load of these devices can be found by dividing charge by voltage. These devices can be created by inserting a resistive dielectric between two parallel plates, and the namesake quantity of these devices is measured in farads. For the point, name these circuit components that passively hold an electric charge.

ANSWER: **Capacitors**

(20) This element forms a structural motif in DNA domains known as its namesake "finger." This element is commonly used to galvanize iron and steel against corrosion in heavy industry. This element's alloy with copper is brass, and it is the main component of pennies. Ointments and sunscreen commonly use an oxide of, for the point, what metal with symbol Zn?

ANSWER: **Zinc** (accept **Zn** before mentioned; accept **Zinc** Finger)

(21) Flank vents are peripherals to this type of landform that may form from a cinder cone. Calderas are formed on these landforms as the result of the collapse of a magma chamber. For the point, name these landforms that are prone to eruption and include examples such as Mt. Saint Helens.

ANSWER: **Volcano** (accept **Caldera** before mentioned; accept specific types of **Volcano**)

(22) Some compounds composed of these molecules have a lattice energy that can be measured via applications of Hess's law, and they are held together by electrostatic attractions. A covalent bond unites atoms in the polyatomic type of these molecules. For the point, name these charged molecules that can be either cations [[KAT-"eye"-ons]] or anions [[AN-"eye"-ons]].

ANSWER: **Ions** (accept **Ionic** Compounds; accept Polyatomic **Ions**; accept **Cation** or **Anions** before mentioned)

(23) This molecule is phosphorylated by hexokinase [[hek-so-KY-nase]] in the first step of its conversion to pyruvate. Formation of this molecule requires six carbon dioxide molecules and six water molecules, and cellulose is composed of units of this most abundant monosaccharide. For the point, name this six-carbon molecule, the main component of blood sugar.

ANSWER: **Glucose**

(24) Most of these objects are classified as chondrites, and these objects concentrate in the Transantarctic Mountains after striking glaciers. Particularly bright examples of these objects are known as bolides, but they get another name after striking the ground. Found inside impact craters, these are, for the point, what fallen space rocks?

ANSWER: **Meteorites** (prompt on "Asteroids;" prompt on "Meteoroids;" do NOT accept "Meteors")

(25) These structures are numbered based on the thoracic vertebra to which they attach. The lowermost of these structures are known as the floating type, and the false type of these structures are connected via cartilage to the sternum. For the point, identify this set of 12 paired bones that form a namesake cage in the chest.

ANSWER: **Ribs** (accept True **Ribs**; accept False **Ribs**; accept Floating **Ribs**; accept **Rib**cage before mentioned)

(26) This number that was estimated in the Buffon's [[boo-FOHNS]] needle problem appears as one of the two exponents in Euler's [[OY-luhrs]] identity. 180 degrees equals this number of radians, and twice the product of the radius and this number helps compute the circumference of a circle. For the point, give this number, which is approximately equal to 22 over 7, or 3.14.

ANSWER: **Pi** (accept **3.14** before mentioned; accept **Archimedes' Constant**)

(27) This organ is found at the end of the cecum [[SEE-kum]], which is located at the beginning of the large intestine. This hollow tube is closed on one end and is believed to be vestigial in humans. For the point, name this organ which can be easily removed to relieve its namesake inflammation due to having no currently known life-sustaining function.

ANSWER: **Appendix**

(28) Hygrometers [[hy-GRAH-mih-ters]] are used to measure this property which can be reduced or maintained using air-conditioner devices. High levels of this property reduce the rate of heat evaporation from skin surfaces. For the point, name this property found in high levels in tropical countries that measures the concentration of water vapor in the air.

ANSWER: **Humidity**

(29) This odd number is followed by twin primes, and this perfect square is the second in a series of squares whose digits add up to 18. This first reverse divisible number is often the basis for numerical magic tricks, because it can be the result of any two three-digit numbers, reversed then subtracted. For the point, identify this number, the product of 3 and 11.

ANSWER: **33**

(30) In standard procedures, a sterile loop is spread over one of these objects containing solid nutrient agar or another growth medium. Penicillin was discovered by Alexander Fleming from a type of mold growing in one of these objects. Cells can be cultured on, for the point, what shallow dishes named for a German microbiologist?

ANSWER: **Petri dishes** (accept **plates** before "German;" accept Petri **plate**)

Extra Questions

(1) A single bond between two atoms of this element is present in molecules used to catalyze radical reactions. Another molecule with three atoms of this element is present in the stratosphere and absorbs UV light. In respiration, a diatomic molecule of this element is exchanged for carbon dioxide. For the point, name this element with atomic number 8 and symbol O [[OH]].

ANSWER: **Oxygen** (accept **O** before mentioned; prompt on "Peroxide;" prompt on "Ozone")

(2) It's not the Earth, but scientists estimate this body formed 4.6 billion years ago from the gravitational collapse of matter. Copernicus first advanced the theory that the planets don't orbit Earth, but rather this object, the nearest star to Earth. For the point, name this massive body at the center of the solar system.

ANSWER: **Sun** (accept **Sol**)