Question #1: Science

10 points

The Hubble Telescope's Near Infrared Camera and Multi-Object Spectrometer [spek-TRAH-mih-tur] detected clouds in the northern hemisphere of this planet after an earlier flyby found clouds only in its southern hemisphere. The brightest part of this planet's surface is its southern collar. Each pole of this planet receives around 42 years of direct sunlight followed by 42 years of darkness due to this planet's extreme tilt, which is about 98 degrees. This planet's moons are named after characters in the works of Alexander Pope and William Shakespeare. Name this cyan-colored planet, an ice giant similar in composition to Neptune.	<u>Uranus</u>

Question #2: Miscellaneous

10 points

These lines separate both the attacking and defending zones from the neutral zone. These lines are one foot wide and 75 feet from the end of the playing surface. If the crossing of this line could lead to a future penalty, the referee puts one hand in the air and points to this line with the other hand. Offsides is called by an official aligning his arm horizontally with this line, and occurs when offensive players cross this line before the puck does. There are two red dots just inside this line for faceoffs. Name these lines on ice hockey rinks that are named for their color.	**blue** lines

Question #3: Literature

10 points

In a play by this writer, the slave Myrrha speaks the line "The dust we tread upon was once alive". This author of *Sardanapalus* wrote a poem describing a woman with "a heart whose love is innocent". An epic by this poet begins "I want a hero: an uncommon want." In that epic, which was incomplete when this poet died in 1824, Alfonso discovers that his wife Julia is having an affair with a teenager. Name this father of Ada Lovelace and fighter in the Greek War of Independence who wrote "She Walks in Beauty" and *Don Juan [JOO-un]*.	Lord **Byron** or George Gordon **Byron**

Question #4: Mathematics

10 points

The Kaplan-Yorke Conjecture sets several of these quantities equal to each other, including the capacity type, which is defined as the limit of the ratio of two logs. The type of this quantity named after Georg Hamel [GAY-ork HAH-mul], which is similar to the definition used on Hilbert spaces, equals the cardinality of the basis of a vector space. The Hausdorff version of this quantity can have non-integer values and is used for fractals. This quantity is the number of coordinates needed to locate a point. Name this quantity that is one for lines, two for shapes, three for solids, and four for hypersolids.	**dimension**s

Question #5: Social Studies

10 points

This political movement was precipitated, in part, by a play in which a magistrate complains to an empire and is fired. Early in this movement, a national leader wrote a short document titled *Bombard the Headquarters*. This movement attempted to eliminate old ideas, which were one of the Four Olds. The Red Guard supported this ten-year movement, which ended in 1976 with the arrest of the Gang of Four and the death of Mao Zedong. Name this attack against school leaders and capitalists years after the Great Leap Forward in China.	(Great Proletarian) **Cultural Revolution** [or (Wuchanjieji) **Wenhua Dageming** or (Wu-ch'an Chieh-chi) **Wen-hua Ta Ke-ming**]

Question #6: Science

10 points

Some organisms have difficulty carrying out this process due to a hexokinase ["hex"-oh-KY-nayss] deficiency which leads to hemolysis [hee-MAH-lih-siss], which in turn affects red blood cells and causes anemia. In one step of this process, TPI catalyzes the conversion from DHAP into GADP. The most common method of this process is the Embden-Meyerhof-Parnas pathway. This process creates pyruvate ["pie"-ROO-vayt], which is used for acetyl CoA [uh-SEE-til koh "A"] that goes into the Krebs cycle, and its payoff phase also produces a net two molecules of ATP. Name this process in which a namesake type of sugar is broken down.	**glycolysis** [gly-KAH-lih-siss] or **glycolytic pathway** [accept **Embden-Meyerhof-Parnas** pathway before "Embden"]

Question #7: Mathematics

10 points per part

	This operation on functions is represented by a small open circle.	
1	Name this operation in which a function's output becomes the input to another function.	function **composition** [or **composite** function]
2	This rule is used to find the derivative of a composite function. It can be expressed as "f-prime of g of x [pause] times g-prime of x."	**chain** rule
3	Evaluate the derivative of the following function for x equals 4. The function is "the square root of the quantity $2x$ plus 1".	**1/3** or 0.**3 repeating**

Question #8: Mathematics

10 points per part

	This operation gives the number of arrangements possible of a subset if order matters.	
1	Name this operation that can be contrasted with combination.	**permutation** [prompt on n**P**r]
2	How many permutations are there of 5 items taken 2 at a time?	**20** permutations
3	This name is given to a permutation of an ordered set with no element in its initial position.	**derangement**(s)

Question #9: Literature

10 points per part

	Part of this novel was adapted from its author's earlier story "Enoch and the Gorilla".	
1	Name this novel in which World War II veteran Hazel Motes uses his car to murder a stand-in for Onnie Jay Holy, who promotes the Holy Church of Christ Without Christ.	*__Wise Blood__*
2	This Southern author wrote *Wise Blood*. She also wrote about Julian riding a bus with his mother in "Everything That Rises Must Converge".	(Mary) Flannery **O'Connor**
3	In this other Flannery O'Connor short story, the Misfit murders a family by the side of the road, and says that the Grandmother would have been a good person if she had "somebody there to shoot her every minute of her life."	"A **Good Man is Hard to Find**"

Question #10: Literature

10 points per part

	One character in this novel states "My mother is a fish."	
1	Name this novel in which Anse Bundren leads his children to Jefferson to bury his wife, Addie. This novel is partially narrated by Addie's children, including Cash, who built her coffin.	*__As I Lay Dying__*
2	This author set *As I Lay Dying* in Mississippi. His novel *The Sound and the Fury* is set there too.	William (Cuthbert) **Faulkner** [or William (Cuthbert) **Falkner**]
3	In this Faulkner novel, Boon Hogganbeck steals a car to take Lucius Priest and Ned McCaslin to Memphis to find Miss Corrie, a prostitute.	*The __Reivers__*

Question #11: Science

10 points per part

	Single covalent [koh-VAY-lint] bonds are usually this type of bond.	
1	Name this type of bond formed by end-to-end overlapping of atomic orbitals.	**sigma** bond(s)
2	The number of sigma bonds in a molecule equals the number of atoms plus the number of these structures minus one.	**ring**s [accept **cycle**s]
3	This molecule is the smallest hydrocarbon with a ring. It is both an explosive and an anesthetic, and its chemical formula is C_3H_6.	**cyclo*propane** or **tri*methyl*ene**

Question #12: Science

10 points per part

	The two best-known versions of this concept define it as another quantity minus the quantity temperature times entropy.	
1	Name this general concept. The Gibbs form of it equals enthalpy minus temperature times entropy.	**free energy** [prompt on **energy**; accept Gibbs **free energy**]
2	This German scientist defined a form of free energy equal to internal energy minus temperature times entropy.	Hermann von **Helmholtz** [accept **Helmholtz** free energy]
3	Lev Landau [LAN-dao] used analytic approximations of free energy functions to describe second-order types of this kind of phenomenon.	**phase transition**(s) or **phase change**(s)

Question #13: Social Studies

10 points per part

	This president was the first one to be impeached, and he came within one vote of being removed.	
1	Name this president who took office upon the assassination of Abraham Lincoln.	**A**ndrew **Johnson** [prompt on **Johnson**]
2	Johnson was impeached for violating this 1867 law. It required Senate approval to fire people whose hiring had required the advice and consent of the Senate.	**Tenure of Office** Act
3	Johnson vetoed a Colorado statehood bill and then used a pocket veto against this state, which passed a draft constitution that only allowed white males to vote.	**Nebraska**

Question #14: Social Studies

10 points per part

	Bill Clinton promised to "end" this system "as we have come to know it", leading to the Personal Responsibility and Work Opportunity Act, which was generally known as a reform of this type of system.	
1	Give this general term for government aid to poor people.	**welfare**
2	The Personal Responsibility and Work Opportunity Act was pushed heavily by this Speaker of the House during the 1990s. He tried to run for president in 2012.	Newt(on Leroy) **Gingrich** [or Newton Leroy **McPherson**]
3	The Personal Responsibility and Work Opportunity Act created this welfare program to replace Aid to Families with Dependent Children.	**TANF** or **Temporary Assistance for Needy Families**

Question #15: Fine Arts

10 points

This composer's 13th symphony, which has parts for a bass soloist singer and a bass chorus, criticizes anti-Semitism and is based on the poetry of Yevgeny Yevtushenko [yev-GEN-ee yev-too-SHAYN-koh]. This composer's third symphony includes words by Semyon Kirsanov praising May Day. Another symphony by this composer was completed just after the Siege of Leningrad began and is often used to commemorate it. Name this composer who was fearful after Stalin saw his opera *Lady Macbeth of the Mtsensk [mit-SENSK] District*, leading him to call his fifth symphony "A Soviet Artist's Response to Justified Criticism."	Dmitri **Shostakovich**

Question #16: Social Studies

10 points

The founders of this religion were referred to as The Holy Club. This religion's hymnbook *Singing the Faith* includes many songs written by its founder's brother Charles. Adherents of this religion recite "I am no longer my own, but yours" at the beginning of the Covenant Prayer written by its founder. That founder was an 18th-century Englishman who had been ordained as an Anglican minister and who worked closely with the evangelical preacher George Whitefield. This religion is named for its use of rules. Identify this branch of Protestantism that was started by John Wesley.	**Methodism** or **Methodist** [do not prompt on less specific answers like "Christianity" or "Protestantism"]

Question #17: Literature

10 points

In one story by this author, the title characters hold hands while being executed by a firing squad for not giving up a password. Another of this author's stories was reversed in Henry James' story "Paste". This author wrote about a group of travelers convincing a prostitute to sleep with an officer to allow their passage during the Franco-Prussian War. In the story reversed by "Paste", this author wrote of Mathilde Loisel [mah-teeld lwah-zel] spending ten years working off a debt from buying a piece of jewelry to replace the one she lost that belonged to Madame Forestier [for-est-yay]. Name this French author of "Ball of Fat" and "The Necklace".	(Henri René Albert) Guy de **Maupassant**

Question #18: Science

10 points

A little bit of mercury is combined with this element to form a Jones reductor. Either this element or magnesium can be used to create cobalt green. The genomes of higher organisms can be manipulated using the finger nuclease [nook-lee-"ace"] of this element. This element is combined with pyrithione [peer-ih-THY-ohn] as the active ingredient in some anti-dandruff shampoos. The oxide of this element is the main ingredient in calamine lotion, which is used to treat sunburn. This element is used to prevent rust in the galvanization of iron. Name this element that combines with copper to form brass.	**zinc** [accept **Zn**]

Question #19: Social Studies

10 points

There were riots in this state sparked by police treatment of the cab-driver John William Smith in 1967. The Continental Army often camped in Morristown in this state. Thomas Kean was the governor of this state before chairing the 9/11 commission, Christine Todd Whitman was its governor before heading the E.P.A., and Woodrow Wilson was its governor before becoming president. The *Hindenburg* exploded while attempting to land near Lakehurst in this state. Name this state that George Washington entered by crossing the Delaware River to fight the Battle of Trenton.	**New Jersey**

Question #20: Literature

10 points

A temple to this goddess was established by Iphigenia [if-uh-jin-"EYE"-uh] at Brauron, and girls worked at the temple to prepare for womanhood. When Niobe [ny-OH-bee] bragged about being better than this goddess's mother, this goddess killed Niobe's daughters. During the Trojan War, Hera hit this goddess over the head, causing this goddess to cry and return to Olympus. Zeus disguised himself as this goddess to impregnate Callisto, and then either this goddess or Hera changed Callisto into a bear. This daughter of Leto was the twin sister of Apollo. Name this goddess of the hunt whose Roman equivalent was Diana.	**Artemis** [accept **Diana** before the end]

Question #21: Science

10 points per part

	Answer the following about substances produced by babies and mothers:	
1	This fluid surrounds a fetus in the womb. It can be sampled and tested for genetic abnormalities.	**amniotic** [am-nee-AH-tik] fluid [prompt on **water**s; accept liquor **amnii**]
2	This tar-like substance comprises the first fecal matter passed by a newborn. Failure to pass it is a symptom of cystic fibrosis.	**meconium** [meh-KOH-nee-um]
3	Drinking this early breast milk facilitates passing meconium. It is higher in protein and lower in fat than later lactation products.	**colostrum** [kuh-LAH-strum] [prompt on **beestings** or **bisnings**]

Question #22: Science

10 points per part

	Answer the following about sleep:	
1	Since the processes that occur during sleep largely involve building up tissue, they are classified as this kind of process. This term is contrasted with "catabolic" [KAT-uh-BAH-lik].	**anabolic** [AN-uh-BAH-lik] processes
2	This condition is the interruption of breathing during sleep. It is often accompanied by snoring.	sleep **apnea** [AP-nee-uh]
3	This gland releases melatonin [mel-uh-TOH-nin], a hormone that regulates sleep.	**pineal** [py-NEE-ul] gland [or **conarium** or **epiphysis** cerebri]

Question #23: Fine Arts

10 points per part

	This woman's last name was Testorf, and she lived in Chadds Ford, Pennsylvania.	
1	Name this woman who was painted hundreds of times by the same artist during the 1970s and '80s without the knowledge of her husband or the painter's wife.	**Helga** Testorf
2	This artist painted that extensive series of paintings of Helga Testorf. He depicted another of his neighbors in *Christina's World.*	Andrew (Newell) **Wyeth**
3	*Christina's World* is set in this state. Winslow Homer's *Eight Bells* is also set in this state, and Andrew Wyeth's father named their house in this state after that painting.	**Maine**

Question #24: Fine Arts

10 points per part

	The 20th-century painter Francis Bacon made several paintings based on this artist's *Portrait of Pope Innocent X.*	
1	Name this Spanish painter of *Las Meninas* [lahss may-NEE-nahss].	Diego (Rodríguez de Silva y) **Velázquez** [dee-AY-goh veh-LAHZ-kez]
2	Velázquez made several portraits of this central figure in *Las Meninas.* This daughter of Philip IV of Spain married Holy Roman Emperor Leopold I.	**Margaret Theresa** or **Margarita Teresa** [or the **Infanta Margarita**; prompt on partial answers]
3	After Velázquez met Ambrogio Spinola [ahm-BROH-joh spee-NOH-lah], he painted *Las Lanzas*, which depicts the surrender of this city.	**Breda** [BREH-dah]

Question #25: Literature

10 points per part

	Much of this play takes place while Lovewit is in the country to get away from the plague.	
1	Name this play in which Face and Subtle run a series of scams when they are not fighting with each other. Face is actually Lovewit's butler Jeremy.	*The **Alchemist***
2	*The Alchemist* was completed in 1610 by this playwright who also wrote *Volpone* [vohl-POH-nay].	Ben **Jonson**
3	*Volpone* is set in this city, which is also the setting for Act I of William Shakespeare's *Othello*.	**Venice** [or **Venezia**]

Question #26: Literature

10 points per part

	This play opens with Orsino, the Duke of Illyria [il-EER-ee-uh], saying "If music be the food of love, play on."	
1	Identify this William Shakespeare play named for the end of Christmas.	***Twelfth Night**(, or What You Will)*
2	In *Twelfth Night*, this twin sister of Sebastian disguises herself as a man named Cesario [cheh-ZAR-ee-oh].	**Viola** ["VIE"-oh-luh]
3	During the play, Maria tricks Malvolio [mal-VOH-lee-oh] into wearing this type of clothing with crossed garters.	**yellow stockings** or **yellow socks** [ask "what color?" if not specified]

Question #27: Mathematics

10 points per part

	Every triangle of this type is similar to every other triangle of this type.	
1	Name this type of triangle that can also be called "regular" or "equiangular" [ek-wee-"angular"].	**equilateral** triangle(s)
2	Find the height of an equilateral triangle if its sides are each 2 units long.	the square **root** of **3** (units) [or **radical 3** units]
3	Find the radius of a circle circumscribed around an equilateral triangle if the height of the triangle is 36 units.	**24** units

Question #28: Mathematics

10 points per part

	For the complex number "a plus bi", this corresponding number is a *minus* bi.	
1	Name this relationship between two numbers that have the same real component but opposite imaginary components.	complex **conjugate**s or **conjugation**
2	Multiply the quantity 2 plus $3i$ times its conjugate, 2 minus $3i$.	**13**
3	Divide 39 by the quantity 2 plus $3i$.	$\mathbf{6 - 9i}$ [or $\mathbf{6 + -9i}$ or $\mathbf{-9i + 6}$]

Question #29: Social Studies

10 points

Early in his reign, this leader was rescued by Thomas Larsson while badly losing the Battle of Vittsjö [VEET-ruh]. Soon after that, this leader gave up Älvsborg to end the Kalmar War. This leader defeated Johann Tserclaes [YOH-hahn SUR-klass] at the Battles of Rain and Breitenfeld, helping this leader's House of Vasa against the Catholic League. This person's forces defeated the forces of Albrecht von Wallenstein at the Battle of Lützen, though this person died in that 1632 battle. Name this leader during the Thirty Years' War who succeeded his father Charles IX as the King of Sweden.	Gustavus (II) **Adolphus** [**Gustav II** Adolph; prompt on **Gustav**us]

Question #30: Science

10 points

This phenomenon was explained using the formula "mobility times Boltzmann's constant times temperature equals the diffusion coefficient". A consequence of that relationship allowed Jean Perrin [zhahn pair-an] to confirm the atomic nature of matter and measure Avogadro's constant, which in this phenomenon varies inversely with mean squared displacement. The *annus mirabilis* [AN-uss mir-AB-ih-luss] of Albert Einstein included an explanation of this phenomenon. Name this phenomenon demonstrated by pollen grains moving somewhat randomly in water.	**Brownian motion**

Question #31: Mathematics

10 points

The Farey sequences are ways to order some of these numbers. A congruent number is the area of a right triangle with this kind of number as its side lengths. A diagram that looks like a spiral of lattice points is used to show that this set is countable. Polynomial roots that are this type of number equal a factor of the constant term divided by a factor of the leading coefficient. The functions named after these numbers have polynomial numerators and denominators. Name this subset of the real numbers that can be expressed as a quotient of integers, or as a terminating or repeating decimal.	**rational** numbers or **rationals** [prompt on **Q**; accept answers that additionally mention "positive"; accept answers that additionally mention "between 0 and 1(, inclusive)" before "side"]

Question #32: Literature

10 points

This author wrote about a boy throwing himself in front of train after stealing 2,000 dollars in the short story "Paul's Case", which was part of the collection *The Troll Garden.* One of this author's protagonists is groped at night by his friend's boss, who had come back early from Omaha. In a book by this author, Marie Tovesky and Emil are shot under a mulberry tree by Frank Shabata, who is visited in jail by Alexandra Bergson. This author wrote of the childhood friendship of Jim Burden and the title Bohemian girl in Black Hawk, Nebraska. Name this author of *O Pioneers!* and *My Ántonia [AN-toh-nee-uh]*.	Willa (**Sibert**) **Cather** [accept either underlined name]

Extra Question #1: Social Studies

10 points

This secretary of state was criticized for overscheduling the president after the president fell asleep listening to the pope, soon after which this person was replaced by George Shultz. During much of the 1970s, this person served as Supreme Allied Commander in Europe, surviving an assassination attempt by Rolf Klemens Wagner [VAHG-nur]. This person succeeded H. R. Haldeman as Richard Nixon's chief of staff and was succeeded by Donald Rumsfeld after Watergate. Name this Secretary of State under President Reagan who went to the press room when Reagan was shot and said "I am in control here."	Alexander (Meigs) **Haig** (Jr.)

Extra Question #2: Science

10 points

Before this type of motion becomes steady, there is a bouncing called nutation [noo-TAY-shun]. The apsidal [AP-sih-dul] and axial types of this motion by the Earth over thousands of years explain Milankovitch [mih-LAN-koh-vich] cycles. Objects that are asymmetric about their axis of rotation will exhibit this motion without torque, while any object can exhibit the torque-induced type of this phenomenon. Name this phenomenon in which an object rotates around an axis that is itself rotating.	**precess**ion [or **precess**ing]

Extra Question #3: Fine Arts

10 points

A famous loggia [LOH-jah] designed by this architect has nine bays opening towards the Piazza Santissima Annunziata [pee-AHT-sah sahn-TEE-see-mah ah-noon-zee-AH-tah] and is part of his Hospital of the Innocents. This architect designed a building now decorated by Pontormo works, the Capponi [kah-POH-nee] Chapel. This architect used internal chains and an eight-corner design to plan the largest brick dome ever built, which is on top of the Cathedral of Santa Maria del Fiore [sahn-tah mah-REE-ah del fee-OH-ray]. Name this Florentine architect who was often in competition for projects with Lorenzo Ghiberti [gih-BAIR-tee].	Filippo **Brunelleschi** [fee-LEE-poh broo-neh-LESS-kee]

Extra Question #4: Literature

10 points

This author remembered that "Thou wast on the cross to-day" after noting that he was "fettered by this pitiless chain" in "the eleventh circling year". This writer claimed that he "fell captive, lady, to the gaze / Of your fair eyes" on the day "of his suffering Lord". This poet uses the address "You who hear the sound, in scattered rhymes" to open a collection that is sometimes called *Rime Sparse* [ree-may SPAR-zay]. This poet wrote of his unrequited love for Laura in poems structured as octets followed by sestets, a form of sonnet now named for him. Name this 14th-century Italian poet of *Il Canzoniere* [eel kahn-zohn-YAIR-ay].	**Petrarch** [PET-rark] [or Francesco **Petrarcha**]

Extra Question #5: Mathematics

10 points

The trigonometric identities named for this mathematician involve sums of the sine or cosine of the quantity n times theta. This person proved that every natural number is the sum of four perfect squares. The equation named for this person and Leonhard Euler [OY-lur] is used in the calculus of variations to find stationary values The numbers used to find extrema for functions with constraints are often represented with a lambda and named this person's "multipliers." Identify this scientist who is also the namesake of both the difference between potential and kinetic energy, and of points at which gravitational forces cancel.	Joseph-Louis **Lagrange** [or Giuseppe Lodovico (Luigi) **Lagrangia** or Giuseppe Ludovico De **la Grange** Tournier]

Extra Question #6: Mathematics

10 points per part

	This solid has the most vertices of any Platonic solid.	
1	Name this solid with 20 vertices and 12 faces.	regular **dodecahedron** [doh-DEK-uh-HEE-drun]
2	Unlike any other Platonic solid, the faces of the dodecahedron are this type of polygon.	regular **pentagon** [prompt on **5-gon**]
3	Both the dodecagon and the icosahedron have this number of edges.	**30** edges

Extra Question #7: Mathematics

10 points per part

	In polar coordinates, the equation "r equals theta" generates this kind of curve.	
1	Name this shape generated by an outward spinning motion.	**spiral**(s)
2	A spiral is generated by an equation in which r is an increasing function of theta or a decreasing function of theta. What single word means "a function that is either always increasing or always decreasing, but never switching between them"?	**monotonic** or **monotone** function
3	One way to write the spiral r equals theta in parametric coordinates uses x equals t times the cosine of t and what equation for y?	$y = \boldsymbol{t \sin t}$ ["$\boldsymbol{t}$ (times) (the) **sine** of $\boldsymbol{t}$"]

Extra Question #8: Social Studies

10 points per part

	This country is mostly the same area that was once called British East Africa, and its current name is taken from a mountain.	
1	Name this country where in the 1950s, the Kikuyu [kih-KOO-yoo] people instigated the Mau Mau Uprising.	(Republic of) **Kenya** [or (Jamhuri ya) **Kenya**]
2	What is Kenya's official language other than English? This language is also official in several other East African nations.	**Swahili** or **Kiswahili**
3	This person served as vice president under Jomo Kenyatta and succeeded Kenyatta as president, ruling for 24 years. He was criticized for using the Nyayo [en-YAI-oh] House torture chambers.	Daniel (Toroitich) arap **Moi**

Extra Question #9: Social Studies

10 points per part

	At the end of this war, Gibraltar was given to Great Britain in the Treaty of Utrecht [OO-trekt].	
1	Name this war fought late in the reign of Louis XIV [14]. It was caused, in part, by Charles II Habsburg changing his will shortly before he died.	War of the **Spanish Succession**
2	Part of Louis XIV's claim to the Spanish throne was the fact he was the son of this daughter of Philip III of Spain.	**Anne** of Austria
3	The Duke of Marlborough and Prince Eugene of Savoy won this 1704 battle, a turning point in the War of the Spanish Succession that ended Bavaria's support of France.	Battle of **Blenheim** [BLEN-um] [or Battle of **Höchstädt**]