Question #1: Social Studies

10 points

This country's independence was declared in 1822 by the son of the king they declared independence from. Soon after that, this country lost land in the Cisplatine [sis-PLAH-teen] War. After heading a coup in 1889, Manuel Deodoro da Fonseca [mah-noo-EL deh-oh-DAW-roo dah faw-SEH-kah] became this country's first president. Before that, this country was led by two emperors named Pedro. To Europeans, the discoverer of this country is Pedro Álvares Cabral. Name this country that was once controlled by Portugal and is the largest country, by population and area, in South America.	(Federative Republic of) **Brazil** [or (República Federativa do) **Brasil**]

Question #2: Science

10 points

This molecule's structure is destabilized by the toxin YTM, which prevents efforts to repair this molecule such as BER and NER. Alec Jeffreys developed a "fingerprinting" technique based on characteristics of this molecule. This molecule's spacer region allows it to be edited using CRISPR/Cas9 ["crisper" kass "nine"] technology. This molecule incorporates thymine ["THIGH"-meen] as one of its nucleobases [NOOK-lee-oh-"bases"]. Raymond Gosling and Rosalind Franklin created the diffraction data that allowed James Watson and Francis Crick to identify this molecule's structure. Name this molecule shaped like a double helix.	**DNA** or **deoxyribonucleic acid**

Question #3: Miscellaneous

10 points

One of the major competitions in this sport is the Challenge Roth, which is named after that competition's location in Germany. The first people to win Olympic gold medals in this sport were Brigitte McMahon and Simon Whitfield in 2000, and the first U.S athlete to win gold was Gwen Jorgensen in 2016. The world championship in this sport is held on the Big Island of Hawaii. Two of the formats of this sport are labelled 70.3 and 140.6, based on the total course length in miles. Name this sport whose big race is nicknamed the Ironman and which consists of long distance swimming, biking, and running.	**triathlon**

Question #4: Literature

10 points

In one novel by this author, Edmund helps his cousin write a letter to her brother William, promising that the letter will be franked by Edmund's father Thomas Bertram. In another novel by this author, Harriet Smith refuses a marriage proposal from Robert Martin, and the title character refuses a proposal from Philip Elton before falling in love with George Knightley. In this author's most famous novel, Charles Bingley and Fitzwilliam Darcy marry the sisters Jane and Elizabeth Bennet. Name this author of *Mansfield Park*, *Emma*, and *Pride and Prejudice*.	Jane **Austen**

Question #5: Mathematics

10 points

The size of these entities determines the sum of their rank and their nullity. One of these mathematical things is unitary if its inverse equals its conjugate-transpose. If multiplying one of these entities times a vector is the same as multiplying a number times the vector, then the number is one of its eigenvalues ["EYE-gun-values"]. These things can be used to solve systems of equations by putting them in reduced row echelon form. These entities are also used in Cramer's rule, in which you take quotients of determinants after removing columns from them. Name these rectangular arrays of numbers.	**matrices** or **matrix**

Question #6: Science

10 points

This adjective describes main-sequence stars of luminosity class V [5]. The maximum mass of a star described by this adjective is the Chandrasekhar [shahn-druh-SAY-kahr] limit. An object that orbits the sun and is generally round will earn this adjective if it fails to clear its orbit of other objects. This adjective and "brown" describe a celestial object unable to create helium. This adjective and "white" refer to stars made of electron-degenerate matter. Name this adjective that comes after "yellow" in a description of the Sun and before "planet" in a description of Pluto.	**dwarf**

Question #7: Literature

10 points per part

	This novel was influenced by Gary Snyder having introduced its author to Buddhism.	
1	Name this novel in which the narrator, Ray Smith, learns philosophy from Japhy Ryder. As in its author's later novel *Desolation Angels*, the narrator spends part of his time as a lookout on Desolation Peak.	*The **Dharma Bums***
2	*The Dharma Bums* was this author's follow-up to his first novel, *On the Road.*	Jack **Kerouac** [or Jean-Louis Lebris de **Kerouac**]
3	The Dharma Bums includes a fictionalized scene of the first reading of this poem, whose first line is "I saw the best minds of my generation destroyed by madness."	**"Howl"**

Question #8: Literature

10 points per part

	One character in this novel claims that humans are superior to the phoenix because humanity can remember its mistakes.	
1	Name this dystopian novel by Ray Bradbury about the fireman Guy Montag.	*Fahrenheit 451*
2	The first section of *Fahrenheit 451* is titled "The Hearth and" this animal. These animals appear on the badges of the firemen and are a nickname for the firetrucks.	**salamander**s
3	At the end of the novel, Guy Montag is pursued by a mechanical version of this animal, one of which lives at the firemen's station.	**hound** [accept **dog**]

Question #9: Science

10 points per part

	This is the SI unit for the amount of a substance.	
1	Name this unit. Calculations with it often involve Avogadro's [ah-voh-GAHD-roh'z] constant.	**mole**
2	The formal definition of a mole is based on this most-abundant isotope of carbon.	carbon-**12**
3	The charge of one mole of electrons—a little under 100,000 coulombs—is a constant named for this scientist.	Michael **Faraday** [accept **Faraday**'s constant]

Question #10: Science

10 points per part

	Beryllium [buh-RIL-ee-um] and magnesium are in this group, or column, of the periodic table.	
1	Give the IUPAC ["eye-you-pack"] group number of this group that was once known as alkaline earth metals.	**2**(A)
2	This married couple discovered the heaviest element in group 2, radium [RAY-dee-um].	Pierre **Curie** and Marie Curie [or the **Curie**s; or Pierre **Curie** and Maria Salomea **Skłodowska** [sk'-woh-DOHV-skah]]
3	The group-2 element barium is in YBCO, the first compound shown to have this property above 80 kelvins.	**superconductivity** or **superconduct**ing or **superconduct**or [do not prompt on answers that omit "super"]

Question #11: Social Studies

10 points per part

	Abraham Lincoln issued this executive order on September 22, 1862, and it went into effect on January 1, 1863.	
1	Name this order that freed all slaves in rebelling states once the slaves escaped North or the Union took over their state.	**Emancipation Proclamation**
2	The Emancipation Proclamation was issued five days after this bloody Maryland battle.	Battle of **Antietam** [an-TEE-tum] or Battle of **Sharpsburg**
3	At the end of 1862, a controversial opinion written by this Attorney General was made public, stating that a free black man named David Selsey was a citizen.	Edward **Bates**

Question #12: Social Studies

10 points per part

	This agreement defined the U.S government for much of the 1780s.	
1	Name this agreement that instituted a weak federal government prior to the ratification of the Constitution.	**Articles of Confederation** (and Perpetual Union)
2	The weakness of the Articles was demonstrated by, among other things, the ineffective response to this rebellion in which the Armory at Springfield, Massachusetts was attacked.	**Shays**' Rebellion
3	The 1786 Meeting of Commissioners to Remedy Defects of the Federal Government took place in this city. Its most important recommendation was for a meeting in Philadelphia in 1787 to fix the federal government.	**Annapolis**, Maryland

Question #13: Mathematics

10 points per part

	For variations on trigonometric functions, this property equals half the difference between the greatest output and the least output.	
1	Give this term for the "size" of a wave.	**amplitude**
2	For a sine or cosine function, this quantity equals two pi divided by the coefficient of the input variable. Without context, this quantity is indistinguishable from wavelength.	**period**
3	Find the smallest positive x-intercept of the graph of y equals 3 plus 3 times the sine of x, where x is in radians.	**3 pi / 2** (radians) or **3/2 pi** (radians) [or **1.5 pi** (radians)]

Question #14: Mathematics

10 points per part

	One example of this relationship between functions is the relationship between "x cubed" and "the cube root of x".	
1	Name this relationship between two functions that "undo" each other.	**inverse** functions or **inverse**s
2	A function has an inverse if it has this property, meaning it is both one-to-one and onto.	**bijectivity** or **bijective** or **bijection** [prompt on **one-to-one correspondence**]
3	If f of 6 equals 10, and the derivative of f of x is 3 when x equals 6, find the derivative of the *inverse* of f of x when x equals 10.	**1/3** [accept 0.**3 repeating**]

Question #15: Social Studies

10 points

Some followers of this religion commemorate the Battle of Karbala [KAR-buh-luh] on the Day of Ashura [ASH-oo-rah], and some of the events following the battle are remembered during the month of Safar [suh-FAR]. It is common for adherents of this religion to memorize and display the Throne Verse, and adherents often refer to charitable giving as *zakat* [zah-KAHT] and fasting as *sawm.* This religion's declaration of faith names its messenger of god, is called the *shahada* [shah-HAH-duh], and is the first of its five "pillars". Name this religion whose followers cleansed the Kaaba [KAH-bah] after going from Medina [meh-DEE-nah] to Mecca when they were led by Muhammad.	**Islam** or **Muslim** religion [accept **Shi'a** Islam or **Sunni** Islam]

Question #16: Literature

10 points

One of these creatures defeats a worm under Shinjuku station to prevent an earthquake, thereby saving Tokyo, in a Haruki Murakami story. One of these creatures is the title animal in a story in which the bulldog Andrew Jackson dies fighting a dog with no hind legs and coughs quail shot onto Leonidas W. Smith. One of these creatures causes the sound of water after jumping into a pond in a Matsuo Basho haiku. A group of these animals sings a refrain that annoys Dionysus [die-uh-NIE-sus] in an ancient play. Name these title creatures of an Aristophanes [ar-uh-STOF-uh-neez] play and a Mark Twain short story about a jumping contest in Calaveras County.	**frog**s [prompt on **amphibian**s]

Question #17: Science

10 points

The change in this quantity during constant-pressure heating is equal to constant-pressure molar heat capacity times the natural log of the ratio of final and initial temperatures. J. Willard Gibbs defined this quantity as the opposite of the Boltzmann constant times the sum of probability times the natural log of probability for each microstate. This quantity's units are energy per temperature. This quantity remains constant in reversible processes. Name this quantity, represented by a capital S, that cannot decrease according to the second law of thermodynamics.	**entropy**

Question #18: Fine Arts

10 points

The ending chord of a choral symphony by this composer has a C octave with a high E, and begins with two E-minor triads outside a G octave. That piece is this composer's *Symphony of Psalms.* In a ballet by this composer, Prince Ivan is given a feather by Koschei [kah-SHAY] the Immortal. Another of this composer's ballets ends with the "Chosen One" doing a "Sacrificial Dance" and nearly caused a riot at its 1913 premiere. Name this composer whose works for Sergei Diaghilev [dee-AH-gee-lef] include *The Firebird, Petrushka* [puh-TROOSH-kuh], and *Rite of Spring.*	Igor **Stravinsky**

Question #19: Social Studies

10 points

When this industry was getting started, it was scandalized by the Spoils Conference, leading to charges against William MacCracken. For much of the 20th century this industry was dominated by the Big Four, one of which was called Eastern. A major deregulation of this industry in 1978 eventually led to many bankruptcies, including that of Pan Am. Following deregulation, many companies in this industry moved to a hub-and-spoke route system, one hub in which is called Douglas and is in Charlotte, North Carolina. Name this industry now led by American, Delta, United, and Southwest.	**airline**s or **air travel** [do not accept **airplane**s or **aerospace**]

Question #20: Literature

10 points

One animal of this type in Irish mythology who cries tears of blood and rises out of a grey lake is Liath Macha [LEE-uth MAH-kuh]. Diomedes ["die"-oh-MEE-deez] of Thrace [thrayss] had animals of this type that ate people. Those animals were taken by Heracles as his eighth labor. Loki was the mother of one of these animals owned by Odin that unusually had eight legs, Sleipnir [SLIP-neer]. When Medusa was killed, a winged one of these animals named Pegasus came out of her body. Name this type of animal whose shape was used for a wooden gift that the Greeks used to enter Troy.	**horse**s [accept **mare**s or **steed**s]

Question #21: Mathematics

10 points per part

	This prefix is used because the functions it describes give lengths along a curve.	
1	Give this prefix used for the inverses of trigonometric functions.	<u>arc</u>-
2	Find the principal value of the arctangent of 1, in radians.	<u>pi/4</u> or <u>1/4 pi</u> [accept 0<u>.25 pi</u>]
3	If x is any number between 0 and 1, find the sum—in radians—of the arcsine of x and the arccosine of x. Your answer should be a number not involving x.	<u>pi/2</u> or <u>1/2 pi</u> [accept 0<u>.5 pi</u>]

Question #22: Mathematics

10 points per part

	This property of a polygon is analogous to the circumference of a circle.	
1	Give this term for the sum of the lengths of a poylgon's edges.	<u>perimeter</u>
2	Find the perimeter of the triangle whose vertices are the origin, the point "10 comma 0", and the point "5 comma 12".	<u>36</u> units
3	Find the area of a regular polygon whose perimeter measures 4 root 3 units and whose apothem measures 1 unit.	<u>2</u> times the square <u>root</u> of <u>3</u> square units [or <u>2</u> times <u>radical 3</u> units]

Question #23: Literature

10 points per part

	This text is a collection of stories told by pilgrims to the shrine of Thomas Becket.	
1	Name this collection of stories written by Geoffrey Chaucer.	*The **Canterbury Tales***
2	In *The Canterbury Tales*, this woman tells a story about a knight who is given one year to answer the question, "What is the thing that women most desire?"	the **Wife of Bath** or **Alys**on [prompt on **Wife**]
3	In the tale, this character saves the knight's life by having him answer the question.	the **queen** [accept **Guinevere**]

Question #24: Literature

10 points per part

	The musical *Hamilton* references this play, saying "Madison is Banquo, Jefferson's Macduff, and Birnam Wood is Congress on its way to Dunsinane [DUN-sin-ayn]."	
1	Name this Shakespeare work sometimes called "The Scottish Play".	*(The Tragedy of)* **Macbeth**
2	Macbeth and Macduff both hold this Scottish noble title.	**thane** [rhymes with "main"]
3	When Macbeth learns that his wife has died, he says these five words after starting "She should have died hereafter; there would have been a time for such a word."	"**To-morrow, and to-morrow, and to-morrow,** (Creeps in this petty pace from day to day)" [prompt on partial answers]

Question #25: Science

10 points per part

	This cancer is the most common type diagnosed in children.	
1	Name this cancer in which the bone marrow produces abnormal white blood cells.	**leukemia**
2	Other blood-related cancers such as Hodgkin's lymphoma, as well as mononucleosis, may develop after infection with this virus in the herpes family.	**Epstein-Barr** virus [accept **EBV**; prompt on human **herpes**virus 4 or **HHV**-4]
3	Cancers of the blood may cause enlargement of this organ known for its role in recycling red blood cells and converting iron into bilirubin [BIL-ih-roo-bin].	**spleen**

Question #26: Science

10 points per part

	These features of the human body are attached to small muscles called arrector pili [uh-REK-tur "PIE-lie"].	
1	Name these features that stand on end when those muscles contract, a condition commonly called "goose bumps".	**hair**s [accept hair **follicle**s]
2	These glands next to hair follicles release an oily or waxy substance to help lubricate and waterproof the skin.	**sebaceous** [seh-BAY-shuss] glands [prompt on **sebum**]
3	Hair color is controlled by variants of this natural pigment. Its "pheo-" type lends a reddish color to hair.	**melanin** [accept pheo**melanin**]

Question #27: Fine Arts

10 points per part

	Iktinos [IK-tee-nos] and Kallikrates [kah-lee-KRAH-teez] are generally credited as the architects of this building.	
1	Name this temple to Athena that is part of the Acropolis in Athens.	**Parthenon**
2	This sculptor made statues to Athena both inside and outside the Parthenon. He also made the statue of Zeus at Olympia.	**Phidias** [FID-ee-uss]
3	The bronze Athena Promachos [PROH-muh-kohss] by Phidias was between the Parthenon and this structure, the entrance to Acropolis. This name refers to gateways that are in the Greek architectural style.	**Propylaea** [prah-pih-LEE-uh]

Question #28: Fine Arts

10 points per part

	This structure was built for the 1889 World's Fair, and for a few decades it was the tallest man-made structure in the world.	
1	Name this wrought-iron lattice tower that is still the tallest structure in Paris.	**Eiffel** Tower [or Tour **Eiffel**]
2	Before building the tower, Gustave Eiffel worked with this sculptor to build the Statue of Liberty.	Frédéric (Auguste) **Bartholdi** [fred-er-ik bar-tohl-dee]
3	This American company made the elevators for the Eiffel Tower. It also made elevators for the Burj Khalifa and World Trade Center.	**Otis** Elevator Company

Question #29: Mathematics

10 points

A series is conditionally convergent if applying this function to each term makes it divergent. To calculate the mean deviation, this function is applied to all the deviations before they are added and divided. The graph of this function is continuous over the real numbers and has a derivative of negative one for negative inputs, and positive one for positive inputs. Subtracting two numbers and applying this function gives the distance along the number line between the numbers. Applying this function is equivalent to squaring a number and then taking the square root. Name this function that never outputs a negative number.	<u>**absolute value**</u> [accept <u>**magnitude**</u> or <u>**norm**</u>]

Question #30: Social Studies

10 points

This leader did not give enemy javelin-throwers time to set up at the Battle of Ticinus [tee-KEE-noos]. That battle was fought after his Siege of Saguntum [sah-GOON-toom]. This leader's brother Mago laid a trap against Tiberius Sempronius Longus [ty-BEER-ee-uss sem-PROH-nee-uss LAWN-guss] that helped them win the Battle of the Trebia [TRAY-bee-uh]. This general was then victorious at Lake Trasimene and Cannae. This leader was eventually defeated by Scipio [SKIP-ee-oh] Africanus at the Battle of Zama, ending the Second Punic War. Name this general who crossed the Alps with his elephants while leading Carthage.	<u>**Hannibal**</u> <u>**Barca**</u> [accept either]

Question #31: Literature

10 points

This poet wrote that crows "flap past" the title subject "to the farmer's corn", but men eat the title subject and die, in "Fame is a Fickle Food". The line "I could not see to see" ends this author's poem about a creature that made a "blue — uncertain — stumbling Buzz". This writer stopped before "a House that Seemed / A Swelling of the Ground" in a carriage that held "just Ourselves — and Immortality". Name this reclusive American poet who wrote "I Heard a Fly Buzz When I Died" and "Because I Could Not Stop for Death".	Emily (Elizabeth) **Dickinson**

Question #32: Science

10 points

Richard Feynman described a thought experiment to show that these particles behave like photons with respect to a double slit. The de Broglie [duh BROY-lee] hypothesis was confirmed by aiming these particles at nickel in the Davisson-Germer experiment. This is the lightest particle whose charge is a nonzero integer. Cathode rays consist of these particles, which is how J. J. Thomson discovered them. The antiparticles of these particles are positrons. Name these negatively-charged fundamental particles often found in atomic orbitals.	**electron**s

Extra Question #1: Mathematics

10 points

Give the most specific answer that is true for all the clues. This shape can be graphed as "the absolute value of x plus the absolute value of y equals a constant". If a circle is circumscribed about this shape, the circle's area equals this shape's area times pi over 2. All shapes of this type are similar to each other. This shape is a rhombus with congruent diagonals, and it is a rectangle with perpendicular diagonals. Its area equals its side length raised to the second power. Name this regular quadrilateral that has four congruent sides and four right angles.	<u>**square**</u>

Extra Question #2: Social Studies

10 points

This battle occurred a few days after James Moore was killed aboard the *Margaretta* at Machias [muh-CHY-uss] and a few months before the Burning of Falmouth. A painting of this battle portrays the fatal injury of Colonel James Abercrombie and the deaths of Major John Pitcairn and General Joseph Warren. Thomas Gage was recalled to England after this battle even though the British were able to take Charlestown Peninsula on their third attempt. Name this battle during which, according to Parson Weems, either Israel Putnam or William Prescott stated "Don't fire until you see the whites of their eyes."	Battle of <u>**Bunker Hill**</u> [or Battle of <u>**Breed's Hill**</u>]

Extra Question #3: Fine Arts

10 points

In *The Battle of the Argonne*, this painter showed a cloud and a rock of about equal size in the sky. The center of that painting has a crescent moon in its middle; similarly, this artist's *Sixteenth of September* shows the Moon in the middle of a tree. Crescent moons are above each of the men in this painter's *The Mysteries of the Horizon*, which is one of his many paintings showing men in bowler hats. This artist showed men raining down in *Golconda*. Name this Belgian surrealist who showed an apple in front of a man's face in *The Son of Man*.	René (François Ghislain) **Magritte**

Extra Question #4: Literature

10 points

In one play by this writer, a character notes that his hands are trembling since he has not played billiards in a long time. He says that after his sister gives gold to a tramp. In another work by this writer, the title character steals morphine from Astrov ["AH-strove"] to attempt suicide after learning that Yelena [yeh-LEN-ah] is moving to Finland with Serebryakov [SER-bree-ah-KAWFF]. This playwright created Anya, who falls in love with the "eternal student" Trofimov [TROH-fee-mawff] in a drama ending with trees being cut down after Madame Ranevskaya [rah-nev-SKY-ah] sells her home to Lopakhin [loh-PAH-keen]. Name this Russian playwright of *Uncle Vanya* and *The Cherry Orchard*.	Anton **Chekhov**

Extra Question #5: Science

10 points

A stack of balls named for this person goes from large heavy ones on the bottom to light ones on the top and are known as his "cannon". This person's *Dialogue Concerning the Two Chief World Systems* included the first conception of relativity. The thermometer named for this person contains several containers that rise or drop based on the temperature. This person used a telescope with two lenses to observe the Moon's craters and Jupiter's moons. Name this Italian scientist who supposedly showed that an object's acceleration while falling doesn't depend on its mass [pause] by dropping cannonballs from the Leaning Tower of Pisa.	**Galileo Galilei** [accept either]

Extra Question #6: Social Studies

10 points per part

	These people were called bushi [boo-shee] in Japan, and recent attempts to honor them have referred to the bushido code.	
1	Name these Japanese warriors who declined in significance under Emperor Meiji [may-jee].	**samurai**s
2	The rule that only samurai could bear arms was made by this leader, who had been a servant of Oda Nobunaga. This person is considered the second of Japan's Three Great Unifiers.	**Toyotomi** Hideyoshi [toy-oh-toh-mee hee-deh-yoh-shee] [prompt on **Hideyoshi**]
3	Two years after Toyotomi Hideyoshi died, his followers lost badly at this battle. Ishida Mitsunari [ee-shee-dah meet-soo-nah-ree] was captured and beheaded after this battle.	Battle of **Sekigahara** [seh-kee-gah-hah-rah]

Extra Question #7: Social Studies

10 points per part

	This person sailed from Bristol in 1497 in the ship *Matthew* with his son Sebastian.	
1	Name this explorer, probably the first person to sail from England to North America.	John **Cabot** [or Giovanni **Caboto**]
2	When Cabot reached his destination, he planted flags representing England and this republic that is now part of Italy. Marco Polo was from this republic.	Republic of **Venice** or Repubblica di **Venezia**
3	Cabot was commissioned by this king, the first monarch of the House of Tudor.	**Henry VII** [**7**] [prompt on **Henry**]

Extra Question #8: Mathematics

10 points per part

	An internal angle and external angle at the vertex of a polygon have this relationship.	
1	Name this relationship between angles whose measures add up to 180°.	**supplement**ary angles or **supplement**s
2	A single angle measuring 180° is known by this term.	**straight** angle [accept straight **line** or line **segment**]
3	If an angle measures 10° and 10 minutes, find the measure of its supplement in degrees and minutes.	**169°** and **50** minutes

Extra Question #9: Mathematics

10 points per part

	If this kind of chart has a hollowed-out center, it is called a donut chart.	
1	Name this type of chart that usually is given a different dessert-related name.	**pie** chart or **pie** graph
2	In geometry, the wedge shapes that make up a pie chart are given this name. These shapes have two sides that are radii [RAY-dee-"eye"] of a circle, and the other side is an arc of that circle.	(circle or circular) **sector**
3	If x percent of data are in a category, then you multiply x by this number to find the degree measure of the central angle of the sector representing that category in a pie chart.	**3.6** or **3 3/5** or **18/5**