Question #1: Science

10 points

A project to detect these particles consists of a one-cubic-kilometer observatory under the South Pole called "IceCube". During the past decade, that observatory found that a gamma-ray flare from a blazar [BLAY-zahr] is a source of these particles. During electron capture, a neutron and one of these particles are created. The 2015 Physics Nobel Prize was given to the Super-Kamiokande [KAH-mee-oh-KAN-day] and Sudbury Observatories for proving that these particles have mass and can change their leptonic [lep-TAH-nik] flavor. These particles come in three leptonic flavors, making them three of the six types of lepton. Name these particles that correspond to electrons, muons ["MEW"-ahnz], and taus.	**neutrino**s [prompt on **lepton**s]

Question #2: Literature

10 points

In one play by this writer, the line "tale-bearers are as bad as the talemakers" is spoken by Mrs. Candour. In that play, this author had Sir Oliver Surface disguise himself as Mr. Stanley. Another author wrote an epilogue for that play that is spoken by Lady Teazle. In another play by this writer, Captain Jack Absolute pretends to be poor to win the love of Lydia Languish. For that play, this writer created a character famous for sayings like "She's as headstrong as an allegory on the banks of the Nile." That character is Mrs. Malaprop. Name this Irish playwright who wrote *The School for Scandal* and *The Rivals*.	Richard Brinsley **Sheridan**

Question #3: Fine Arts

10 points

| The spiral associated with this person is a twisted torso that is used to make works look more three-dimensional. This person often combined contrasting motions, such as "fall and recovery", and "contraction and release". Before employing Louis Horst, this person worked closely with him on projects such as *Primitive Mysteries* and *El Penitente [pen-ee-TEN-tay]*. This person collaborated with Samuel Barber on *Medea* [meh-DEE-uh]. This person's most cherished work was with Aaron Copland on *Appalachian Spring*. Name this person who worked with Rudolf Nureyev [NYOO-ree-eff] and Mikhail Baryshnikov [bah-REESH-nee-kawff], and who played a major role in developing modern dance through her choreography. | Martha **Graham** |

Question #4: Social Studies

10 points

| This person was found guilty after Austrian actress Hede [HAY-duh] Massing testified against him. Later evidence from the writings of Noel Field pointed towards this person's guilt on two charges of perjury. Dean Acheson [ACH-eh-sun] was heavily criticized for saying that he would not turn his back on this person. During an earlier House subcommittee hearing, this person was told "I was a Communist and you were a Communist" by Whittaker Chambers. Some of the evidence used against this person was taken from a hollowed-out pumpkin. Name this State Department official who was believed to be a spy for the Soviet Union. | Alger **Hiss** |

Question #5: Science

10 points

An international timing array named for these objects searches for gravitational waves. That project includes the Parkes Observatory in Australia, which has discovered most known examples of these objects. Classification as this type of object requires having the right combination of magnetic field strength and spin frequency. Because of the effect that these astronomical objects are named for, it is very easy to determine their period of rotation. Identify these rotating neutron stars named for the fact that the streams of particles coming from them alternately point towards and away from Earth, which makes them appear to turn on and off.	**pulsar**s

Question #6: Literature

10 points

In one type of grammar error that usually refers to adverbs, this type of word is said to be "squinting" because its role is ambiguous. That grammar error is a consequence of the grammar error from misplacing this type of word. When this type of word is used in a sentence without being able to play the role it is supposed to play, then this word is called "dangling". Name this type of word that is sometimes a noun but is more often an adjective that changes, clarifies, qualifies, or limits another word in a sentence.	**modifier**s

Question #7: Social Studies

10 points per part

	Name these tributaries that flow into the Mississippi River from the west.	
1	This river travels over 2,000 miles before meeting the Mississippi River near St. Louis. It goes through Bismarck, North Dakota and Pierre ["peer"], South Dakota.	**Missouri** River
2	This river forms much of the border between Texas and Oklahoma. It used to feed the Mississippi River directly, but it now goes into the Atchafalaya [uh-CHAFF-uh-"LIE"-uh] River.	**Red** River of the South
3	This river starts near Fayetteville, Arkansas, then goes up into Missouri, and then returns to Arkansas.	**White** River

Question #8: Social Studies

10 points per part

	The TV show *The Office* and the Billy Joel song "Allentown" are both set in this state.	
1	Name this state whose second-most-populous city is Pittsburgh.	**Pennsylvania**
2	This name is shared by Pittsburgh's county, the national forest in Pennsylvania, and the mountains that are part of the Appalachians in Pennsylvania, West Virginia, and Maryland.	**Allegheny** or **Alleghenies**
3	This river is the biggest river in eastern Pennsylvania. Its north branch starts in Cooperstown, New York, and it empties into the Chesapeake Bay in Maryland.	**Susquehanna** River

Question #9: Science

10 points per part

	These relationships are classified based on whether the two species involved receive benefit, are harmed, or neither.	
1	Name this type of close interaction between two organisms.	**symbiosis**
2	In this type of symbiosis, both species benefit.	**mutual**ism [or **mutual**istic symbiosis]
3	Spider crabs exhibit mutualism with these organisms that are in divisions such as Chromophyta ["CHROME-oh-FIGHT-uh"] and Cryptophyta ["CRYPT-oh-FIGHT-uh"].	**alga**e

Question #10: Science

10 points per part

	Errors in this process lead to aneuploidy [AN-yoo-ploy-dee].	
1	Name this cell division process that produces either four sperm cells or a total of one egg cell and three polar bodies.	**meiosis** [**my-OH-siss**] [prompt on **reduction division**]
2	This general, non-sex-specific term is used for the sex cell that results from meiosis. Sperm cells and ova are this type of cell.	**gamete**s
3	A cell goes through phases when it is not going through mitosis or meiosis. Which phase is between G1 phase and G2 phase?	**S** phase [accept **synthesis** phase]

Question #11: Literature

10 points per part

	The title of this novel refers to a woman that Herbert Stencil is searching for.	
1	Name this novel that includes many episodes with Benny Profane and the Whole Sick Crew.	***V.***
2	*V.* was the debut novel by this novelist who also wrote *Gravity's Rainbow.*	Thomas (Ruggles) **Pynchon** (Jr.)
3	Much of *Gravity's Rainbow* is set around the end of this war.	**World War II** [accept **WW2**]

Question #12: Literature

10 points per part

	The title story in this collection is about Lieutenant Jimmy Cross, who often reads letters written by a junior at Mount Sebastian College.	
1	Name this collection of connected stories that ends with a story about Linda, who died from a brain tumor.	*The **Things They Carried***
2	This Vietnam War veteran wrote *The Things They Carried.*	(William) Tim(othy) **O'Brien**
3	This author's novel *The Quiet American* is set in Vietnam as American involvement is growing. This author also wrote *The Power and the Glory.*	(Henry) Graham **Greene**

Question #13: Mathematics

10 points per part

	This mathematician developed a summation technique in which the sum of all the positive counting numbers seems to equal $-1/12$.	
1	Name this mathematician from India who worked closely with G. H. Hardy.	Srinivasa **Ramanujan** [SRIN-ih-vah-suh **rah-MAH-noo-jahn**] (Aiyangar)
2	Ramanujan summation assigns a value to this type of series whose partial sums do not have a finite limit.	**divergent** series [or **diverging** series or a series that **diverge**s]
3	The idea of taxicab numbers was developed after Ramanujan told Hardy that this number equals 1 cubed plus 12 cubed, and it also equals 9 cubed plus 10 cubed.	**1729**

Question #14: Mathematics

10 points per part

	The theorems named for this mathematician can be expressed as "surface area equals arc length times distance traveled by the centroid" and "volume equals area times distance traveled by the centroid".	
1	Name this ancient mathematician.	**Pappus** (of Alexandria)
2	Pappus's theorem is used to find the surface area and volume of these donut-like solids created by rotating a circle about an axis in the same plane as the circle.	**torus**es [or **tori** or **toroid**s]
3	Find the volume if a square with a side length of 3 units is rotated around an axis that is 10 units from the center of the square.	**180 pi** cubic units [do not prompt on partial answers]

Question #15: Social Studies

10 points

This leader supposedly bought a vase so that it could be returned to Remigius [ray-MEE-jee-uss] of Reims [reemz], but a soldier smashed it first; a year later, this leader smashed the soldier's head. This leader expanded his territory by defeating Syagrius [sy-AG-ree-us] at the Battle of Soissons [swah-sawn]. This leader made a pledge to convert to Christianity if he defeated the Alemanni [al-uh-MAN-ee] at the Battle of Tolbiac ["toll"-bee-ak], and he followed through with the support of his wife Clotilda. This son of Childeric I is sometimes considered the founder of the Merovingian [mair-oh-VIN-jee-un] dynasty. Name this 5th- and 6th-century leader who is considered the first ruler of what would become France.	**Clovis I** or **Clovis the Great** or **Clovis Magnus** [prompt on **Clovis**]

Question #16: Literature

10 points

In one novel by this author, the title character goes to a speakeasy called Delehanty's, where he is called "morbid" by his boss, Shrike. This author ended that novel with a fight between the title character and Mr. Doyle after the title character has had an affair with Mrs. Doyle. In another novel by this author, Harry Greener gets sick while attempting to sell silver polish to a man who had recently moved from Iowa to Hollywood. In that novel, this author described a character's attempt to paint *The Burning of Los Angeles*. Name this author of *Miss Lonelyhearts* who wrote about Tod Hackett and Homer Simpson in *The Day of the Locust*.	Nathanael **West** [or Nathan **Weinstein**]

Question #17: Mathematics

10 points

The Fourier [foor-yay] series of this type of function consists entirely of cosine terms. If the Maclaurin series of this type of function is expressed in sigma notation with n as the counting variable, then each term has a coefficient times x raised to the $2n$ power. The integral of this type of function from the opposite of a to a is twice the integral from zero to a for any value of a. The cosine function has this property, but the sine function does not. Name this type of function for which f of x always equals f of negative x, which makes the graph symmetric about the y-axis.	**even** functions

Question #18: Social Studies

10 points

A notable protest in favor of passage of this law was nicknamed the "Capitol Crawl". This law was used to win a suit about football stadium renovations at the University of Michigan. The interpretation of this law in *Toyota v. Williams* led to 2008 amendments to this law defining what a "major life activity" is. This 1990 law requires reasonable accommodations for employees [pause] and accessibility requirements for public accommodations. Name this law that helps many Americans, including those who are deaf, blind, or in a wheelchair.	**Americans with Disabilities Act** (of 1990) or **ADA**

Question #19: Science

10 points

These hydro·carbons are usually the second-most abundant class in crude oil, between naphthenes [NAFF-theenz] and aromatics. The difference between alcohols—such as methanol and ethanol—and these hydrocarbons is that the alcohols have an extra oxygen atom. A scale named for one of these hydrocarbons is used to rate the resistance to engine knock in gasoline. The simplest member of this group is the simplest hydrocarbon. If the number of carbon atoms in one of these hydrocarbons is n, then the number of hydrogen atoms is $2 n$ plus 2. Name this class of acyclic [ay-SIK-lik] saturated hydrocarbons that includes butane, propane, and methane.	**alkane**s [accept **paraffin**s]

Question #20: Miscellaneous

10 points

In a television series based on this movie, a demon named Zhan Tiri tries to get control of the Sundrop and Moonstone. In a short-film sequel to this major motion picture, Pascal and Maximus lose wedding rings just before a wedding. Those two characters are a chameleon and a horse. In this movie, Donna Murphy voiced Mother Gothel, who imprisoned this movie's protagonist in a tower for 18 years. The protagonist of this movie falls in love with Flynn Rider, who was voiced by Zachary Levi [LEE-vy]. This movie featured the song "I See the Light." Name this animated Disney movie starring Mandy Moore as Rapunzel.	***Tangled***

Question #21: Science

10 points per part

	The Apollo program sent Americans to the Moon.	
1	This project came before Apollo and after Project Mercury. Ten flights from this project included two astronauts each.	Project **Gemini**
2	This Apollo flight was supposed to land on the Moon, but when an oxygen tank failed, it looped around the Moon and returned safely to Earth.	Apollo **13**
3	Name any one of the three astronauts who died in the cabin fire on Apollo 1.	(Virgil Ivan) "Gus" **Grissom** Ed(ward Higgins) **White** (II) Roger B(ruce) **Chaffee**

Question #22: Science

10 points per part

	This object was the first object, other than planets, that was shown to orbit the Sun.	
1	Identify this comet named after the person who, in 1705, correctly predicted that it would next be sighted in 1758.	**Halley**'s comet
2	Edmond Halley funded and edited this scientist's work *Principia [prin-SIP-ee-uh] Mathematica*.	Isaac **Newton**
3	Observations of Halley's comet in 1986 supported aspects of this theory, proposed by Fred Whipple, stating that comets are made of ice and dust.	**dirty snowball** theory

Question #23: Fine Arts

10 points per part

	Name these artists who painted trees:	
1	This Austrian artist painted *The Tree of Life*, *Beech Forest*, and *Spruce Forest*.	Gustav **Klimt**
2	This Dutch artist painted *Trees in Moonrise*, *The Red Tree*, and *Gray Tree* before joining the De Stijl ["duh style"] movement and moving to the United States.	Piet(er Cornelis) **Mondrian** [peet **MAHN-dree-ahn**]
3	This German artist painted barren trees in *Raven Tree* and *The Oak Tree in the Snow*.	Caspar David **Friedrich**

Question #24: Fine Arts

10 points per part

	Name these artists who set paintings in Paris:	
1	This pointillist painted *A Sunday Afternoon on the Island of La Grande Jatte*.	Georges (Pierre) **Seurat** [zhorzh **soo-rah**]
2	This artist painted a green lamp post in the middle of his *Paris Street; Rainy Day*.	Gustave **Caillebotte** [**ky-boht**]
3	This artist, who painted part of the ceiling of the Paris Opéra, also made the painting *Paris Through the Window*.	Marc **Chagall** [or Moishe **Shagal**]

Question #25: Literature

10 points per part

	This poem states "Brute beauty and valour and act."	
1	Name this poem whose title animal is described within it as a "dapple-dawn-drawn Falcon."	"The **Windhover**"
2	This English poet who was a Jesuit priest wrote "The Windhover" and *The Wreck of the Deutschland [DOYCH-land]*.	Gerard Manley **Hopkins**
3	Gerard Manley Hopkins wrote three curtal sonnets, which have 11 lines including a very short last line. Give the short last line of the curtal sonnet "Pied Beauty".	"**Praise him**."

Question #26: Literature

10 points per part

	The last three words of this poem are "better after death".	
1	Name this poem that uses the phrases "freely, as men strive for Right", "purely, as they turn from Praise", and "with the breath, Smiles, tears, of all my life".	"**How Do I Love Thee?** Let me count the ways." or **Sonnet 43**
2	"How Do I Love Thee?" is in this poet's *Sonnets from the Portuguese.*	**E**lizabeth Barrett **Browning** [or Elizabeth **Moulton-Barrett**; prompt on **Barrett** or **Browning**]
3	Give the first five words of Elizabeth Barrett Browning's *Sonnet 14*. The next five words are "let it be for nought."	"**If thou must love me**"

Question #27: Social Studies

10 points per part

	This country lost control of Schleswig [shless-vik], Holstein ["HAUL"-shtyn], and Lauenburg in the Second Schleswig War.	
1	Name this country that still controls the territories of the Faroe Islands and Greenland.	(Kingdom of) **Denmark** [or (Kongeriget) **Danmark**]
2	During the 15th century, Denmark, Norway, and Sweden belonged to this entity ruled by a single monarch.	**Kalmar** Union
3	This former part of Denmark signed a 1918 agreement that it would be independent but recognize the Danish king. This location cut ties with the Danish monarchy when Denmark was occupied in 1944.	(Republic of) **Iceland** [or Lydveldid **Ísland**]

Question #28: Social Studies

10 points per part

	When Suetonius Paulinus [sweh-TOH-nee-uss paw-LEE-nuss] was away, this person led a rebellion against the Romans.	
1	Name this queen in Britain during the 1st century CE.	**Boudica** [**BOO-dik-uh**] [or **Boadicea**]
2	Boudica belonged to this tribe that had been ruled by her husband Prasutagus [prah-soo-TAH-guss].	**Iceni** ["eye-SEEN-eye"] [prompt on **Celt**s]
3	This historian, who wrote the *Annals* and the *Histories*, described Boudica's revolt.	(Publius Cornelius) **Tacitus** [**TASS-ih-tuss**]

Question #29: Mathematics

10 points

The axiom schema of specification states that any of this type of mathematical object's subclass defined by a predicate is also this type of object. These objects are the subject of the well-ordering theorem, which was proven by the axiom of choice, which in turn uses the Cartesian product of these objects. Zermelo–Fraenkel theory is an axiomatic system describing these mathematical objects. The complement of one of these objects contains everything in the universe except what is in the original. Two of these objects can be combined using either union or intersection. Name these unordered collections of elements that are often written as a list inside curly braces.	**set**s

Question #30: Literature

10 points

One novel by this author ends with the title character dying from smallpox while a crowd outside chants "To Berlin!". This author wrote that novel about a prostitute who ruins the lives of many men, including Count Muffat and Steiner. In another novel by this writer, Souvarine's [soo-vuh-reen'z] sabotage kills Catherine and Chaval [shuh-vahl]. The protagonist of that novel, who goes to Montsou [mawn-soh] and gets a job from Maheu [mah-hoo] working in a coal mine, is Étienne Lantier [et-yen lahn-tyay]. Name this French author whose *Les Rougon-Macquart* [luh roo-gawn mah-kar] series includes *Nana* and *Germinal* [zhair-mee-nahl].	Émile (Édouard Charles Antoine) **Zola**

Question #31: Science

10 points

This chemical comes from dopa·quinone [doh-puh-KWY-nohn], which in turn usually comes from tyrosin·ase ["TIE"-roh-sin-"ace"] acting on L-DOPA [ell DOH-puh]. Both caffeic acid and ferulic acid inhibit tyrosinase from producing this chemical. Cells that specialize in transporting this chemical share it with keratin·o·cytes ["care-uh-TEEN-oh-sites"]. The increase of this chemical in some peppered moths is given as an example of evolution. An abundance of this chemical makes it more difficult for the skin to produce vitamin D. When this chemical is not produced enough, the result is albinism. Name this pigment that makes skin and other features darker.	**melanin**

Question #32: Social Studies

10 points

This event occurred soon after Mayor Carter Harrison left the location. Seven people were sentenced to death because of this event, though Governor Richard Oglesby commuted two of the sentences. This event occurred the day after an attempt to secure an eight-hour workday from McCormick Harvesting Machine Company. This event happened at the end of a police brutality protest that was organized by anarchists. Name this 1886 event that took place in Chicago, in which somebody threw a bomb at police and the police responded with gunfire.	**Haymarket** Square affair [accept "massacre" or "riot" in place of "affair"]

Extra Question #1: Mathematics

10 points

Odd examples of these numbers can either be expressed as the difference of non-consecutive perfect squares or *are* perfect squares. Carmichael numbers are this type of number even though they satisfy the modular arithmetic congruence relation. These numbers are crossed out in the sieve of Eratosthenes ["air-uh-TOSS-the-knees"], which is used to find other numbers. These numbers can be expressed as the product of other numbers according to the fundamental theorem of arithmetic. All even numbers greater than 2 are this type of number. Name this type of number that is not prime.	**composite** numbers [accept **composites**]

Extra Question #2: Literature

10 points

One novel by this author begins with a a quote from *Robinson Crusoe* after a brief four-part prologue in which this author said he was writing the novel to explain the dislike of his cousin John Herncastle. That prologue refers to the storming of Seringapatam [see-RIN-gah-pah-TOM]. In another novel by this author, Walter Hartright notices a strong similarity between Laura Fairlie and a woman he had seen earlier walking through London lost. That novel is about the identities of Laura Fairlie and Anne Catherick, and the novel's title refers to what the lost woman was wearing when she escaped from an asylum. Name this author of *The Moonstone* and *The Woman in White*.	(William) Wilkie **Collins**

Extra Question #3: Fine Arts

10 points

This painter's best known works are in a chapel that also contains several Masolino da Panicale [mah-zoh-LEE-noh dah pah-nee-KAH-lay] paintings. One of those paintings by this artist shows a floating cherub wearing red and holding a black sword, forcing a naked Adam and Eve to go away from an archway. That painting is *The Expulsion from the Garden of Eden.* Another painting by this artist in Florence's Brancacci [brahn-KAHT-chee] Chapel depicts on the right side Peter paying a tax collector and on the left side Peter reaching down into the mouth of a fish. Name this Italian Renaissance painter of *The Tribute Money.*	**Masaccio** [**mah-SAHT-choh**] [or Tommaso di Ser Giovanni di Mone **Cassai**]

Extra Question #4: Social Studies

10 points

This king's Lord High Treasurer of the Exchequer, Richard FitzNeal, wrote *Dialogus de Scaccario*, which is the earliest administrative handbook in English history. Because this king wore a short robe, he was nicknamed "Curtmantle". Clergy could be tried in royal courts after this king passed the Constitutions of Clarendon. This king was the second husband of Eleanor of Aquitaine, and the father of Richard I and John. According to legend, resistance to this king by the clergy led him to ask "Will no one rid me of this turbulent priest?". Name this king whose followers then murdered the Archbishop of Canterbury, Thomas Becket.	**Henry II** [accept **Henry FitzEmpress** or **Henry Plantagenet**; accept **Henry Curtmantle** before "Curtmantle"; prompt on **Henry**]

Extra Question #5: Science

10 points

Though this atmospheric layer generally does not have clouds, it is the primary location of nacreous [NAY-kree-uss] clouds that appear over the poles. Even though this layer has a significant amount of air, it has very little convection, which explains why it has less turbulence than the layer below it. This layer includes the ozone layer, and the absorption of ultraviolet light by ozone explains why this is the lowest layer in which temperature increases with height. This atmospheric layer extends upward from the tropo·pause, and it is between the tropo·sphere and the meso·sphere. Name this layer whose lower parts are often used for plane flights.	**stratosphere**

Extra Question #6: Social Studies

10 points per part

	In the election of 1864, this person won only Delaware, Kentucky, and New Jersey—a landslide loss to President Lincoln.	
1	Name this Union general who commanded the Army of the Potomac early in the Civil War.	George B(rinton) **McClellan**
2	McClellan was criticized for not being aggressive after his victory at this battle, the bloodiest day in U.S. military history.	Battle of **Antietam** [**an-TEE-tum**] [or Battle of **Sharpsburg**]
3	McClellan was unable to capture Richmond during this campaign that included the Seven Days Battles.	**Peninsula**r Campaign

Extra Question #7: Social Studies

10 points per part

	Name these politicians from New Hampshire:	
1	This congressman from New Hampshire later became a congressman from Massachusetts and Secretary of State. He argued several Supreme Court cases and delivered the *Second Reply to Hayne* speech.	Daniel **Webster**
2	This president from Nebraska signed the Kansas–Nebraska Act. He did not stop tensions building towards a Civil War and was succeeded by James Buchanan, who did even worse.	Franklin **Pierce**
3	This person succeeded Schuyler [SKY-lur] Colfax as Ulysses Grant's vice president. Both Colfax and this person had their reputation harmed by the Crédit Mobilier [moh-beel-yay] scandal.	Henry **Wilson** [or Jeremiah Jones **Colbath**]

Extra Question #8: Mathematics

10 points per part

	If graphing a system of equations produces two parallel lines, the system is this type of system.	
1	Give this term for a system with no solutions.	**inconsistent** system
2	Find the slope of both lines in the inconsistent system "$3x$ minus $12y$ equals 5" and "$5x$ minus $20y$ equals 7".	**1/4** [or 0.**25**]
3	Find the determinant of a matrix whose entries are the coefficients of an inconsistent system. Assume that the coefficients are in the equations and the matrix in the same order, and the constant terms are excluded.	**0**

Extra Question #9: Mathematics

10 points per part

	This function gives the product of a counting number with all of the counting numbers less than the given number.	
1	Name this function often represented by an exclamation point.	**factorial** function
2	Find the number of permutations of 5 items taken 2 at a time, which equals 5 factorial divided by 3 factorial.	**20**
3	What number's factorial equals 5,040?	**7** [accept **7** factorial]