Question #1: Science

10 points

Edwin Krebs, who is not related to Hans Krebs, shared a Nobel Prize for describing how these enzymes add mass and negative charge to proteins. This class of enzymes adds a particular ion to serine [SAIR-een], threonine [THREE-uh-neen], tyrosine [TY-ruh-seen], or histidine [HISS-tuh-deen] amino acids. The mitogen-activated protein type of these enzymes has variants whose names repeat the name of these enzymes several times. Two of these enzymes that work on tyrosine were originally named "just another" but are now named "Janus". The work of these enzymes is reversed by phosphatase ["phosphate-ace"]. Name these enzymes that move phosphate groups.	**kinase**s ["**KINE-ace**s"]

Question #2: Mathematics

10 points

A formula with a triangle side length in the numerator and this function in the denominator is used to find twice the circumradius. Another formula multiplies the complex modulus times this function to find the imaginary component of a complex number. This function equals the infinite polynomial that begins x, minus x cubed over 3 factorial, plus x to the fifth over 5 factorial, et cetera. The reciprocal of this function is the cosecant function. On the unit circle, this operation gives the y-coordinate. Name this operation equal to opposite-side length divided by hypotenuse length in a right triangle.	**sin**e [do not accept "cosine"; accept answers that additionally mention a variable, such as **sin**e x or **sin**e theta]

Question #3: Social Studies

10 points

The southeast part of this state has a dry lake bed called Alvord Desert, near Steens Mountain. This state also has several large national forests, including Deschutes [duh-SHOOTS], Malheur [mal-"HEAR"], and one named for this state's tallest mountain, Mount Hood. There was a controversy over protections for the northern spotted owl in this state's Willamette [wih-LAM-it] National Forest. This state's two biggest college towns are Corvallis and Eugene. Like Maine, this state's most populous city is named Portland. Name this state between Washington and California whose capital is Salem.	**Oregon**

Question #4: Literature

10 points

This type of clause can often be classified as future real, present unreal, or past unreal. According to the Oxford English Dictionary, the word "agreeable" is used primarily in this type of clause. On a traditional flow-chart, a step equivalent to this type of clause is represented by a diamond. This type of clause can begin with the four-word phrase "were it not for", the three-word phrase "as long as", the two-word phrase "in case", or the one word "unless". The latter part of this type of clause sometimes begins with the word "else". Name this type of clause characterized by an "if-then" statement.	**conditional** clause [prompt on **if then** clause]

Question #5: Miscellaneous

10 points

The cover art for a remix of this song shows a circular arrangement of pictures of the singer and DJ so that the singer can be seen at the bottom and the DJ can be seen upside down at the top. That remix of this song was released in January 2022 by Kungs. At the end of the video for this song, a dancing woman dressed in blue turns into the silhouette of a rose. The real name of the DJ who recorded this 2021 hit is Felix De Laet. The lyrics of this song state "You're just like my favorite song going round, round in my head." Name this song featuring the singer Calum Scott that is by the DJ Lost Frequencies.	"**Where Are You Now**"

Question #6: Science

10 points

Metal alkyl [AL-kul] complexes often undergo the beta hydride ["HIDE-ride"] type of this reaction, which turns them into metal alkene complexes and creates a pi bond. One example of this type of organic chemical reaction is dehydrogenation [DEE-"hi"-DRAH-juh-NAY-shun]. These reactions are sometimes called degradations, including the types named for Alfred Wohl and August Wilhelm von Hofmann. This type of reaction often follows an addition reaction, combining to create a substitution. Name this class of chemical reactions in which atoms are removed from a molecule.	**elimination** reactions [or **elimination**s]

Question #7: Social Studies

10 points per part

	This person was re-elected to the U.S. Senate by the Illinois General Assembly after engaging in seven debates with Abraham Lincoln in 1858.	
1	Name this Democrat who then finished fourth in the 1860 Presidential Election.	Stephen A(rnold) **Douglas**
2	During the debate, Lincoln contrasted this 1854 law drafted by Douglas with the *Dred Scott* decision. This law gave two territories the ability to apply for statehood and determine their own slavery policy.	**Kansas–Nebraska** Act
3	At the debate in this town, Douglas said "No matter what the decision of the Supreme Court may be on that abstract question, still the right of the people to make a Slave Territory or a Free Territory is perfect and complete under the Nebraska bill."	**Freeport**, Illinois [accept **Freeport** Doctrine]

Question #8: Social Studies

10 points per part

	This person wrote five of the *Federalist Papers*.	
1	Name this person who was the first Chief Justice of the United States and who negotiated a major treaty with Great Britain.	John **Jay**
2	Supporters of Jay's Treaty formed this political party. The only U.S. president who belonged to this party was John Adams.	**Federalist** Party [accept the **Federalist**s]
3	This case, issued while Jay was Chief Justice of the United States, decided that states do not have sovereign immunity from citizens of other states.	***Chisholm** v. Georgia* [either order; prompt on **Georgia**]

Question #9: Science

10 points per part

Like gluons ["GLUE"-ahnz], these particles carry color charge.		
1	Name this type of elementary particle whose flavors are up, down, charm, strange, top, and bottom.	**quark**s
2	These particles have an equal number of quarks and anti-quarks. They usually have one of each.	**meson**s [**MEH-zahn**z]
3	List the three color charges.	**red**, **green**, and **blue** [any order]

Question #10: Science

10 points per part

These particles were observed in the Rossi–Hall experiment in 1940 and the Frisch–Smith experiment in 1962, which were tests of relativistic time dilation.		
1	Name these particles that have a mean lifetime of 2.2 microseconds.	**muon**s [**MYOO-ahn**z]
2	Muons are 207 times more massive than these particles but otherwise very similar to them. J. J. Thomson is credited with discovering these negatively charged particles by showing that cathode rays consist of them.	**electron**s
3	Muons, electrons, taus, and their neutrinos are all classified as this type of particle.	**lepton**s

Question #11: Mathematics

10 points per part

	This adjective describes the part of a surface area equal to the total surface area minus the area of the base or bases.	
1	Give this adjective that describes the part of a cone's surface other than the circular base.	**lateral** [accept **lateral** surface area]
2	Find the lateral surface area of a cone if the radius is 3 units and the height is 4 units.	**15 pi** square units [do not prompt on partial answers]
3	Find the lateral surface area of a cylinder if the radius is 3 units and the height is 4 units.	**24 pi** square units [do not prompt on partial answers]

Question #12: Mathematics

10 points per part

	In a triangle, these segments intersect at the centroid.	
1	Name these segments that connect a vertex of a triangle to the midpoint of the opposite side.	**median**s
2	An isosceles ["eye"-SAH-suh-leez] triangle has side lengths of 12 units, 10 units, and 10 units. Find the length of the median to the base of the triangle.	**8** units
3	A right triangle has side lengths of 10 units, 24 units, and 26 units. Find the length of the median to the hypotenuse of the triangle.	**13** units

Question #13: Literature

10 points per part

In this novel, Jake Blount says "The don't-knows have lived with that lie so long they just can't see it."	
1 Name this novel in which Jake Blount hangs out at the New York Café and has many conversations with John Singer.	*The* **_Heart Is a Lonely Hunter_**
2 This author wrote *The Heart Is a Lonely Hunter* and *The Member of the Wedding.*	Carson **McCullers**
3 In the middle of writing *The Member of the Wedding*, McCullers wrote this novella about Amelia Evans taking in the hunchbacked man Cousin Lymon.	*The* **_Ballad of the Sad Café_**

Question #14: Literature

10 points per part

This object was supposedly built by the Knights of Malta for Emperor Charles V.	
1 Name this object sought by Brigid O'Shaughnessy, Joel Cairo, and Casper Gutman.	Maltese **Falcon**
2 The Maltese Falcon was also sought by Sam Spade in a novel by this author.	(Samuel) Dashiell **Hammett**
3 Dashiell Hammett also wrote this novel about Nick and Nora Charles.	*The* **_Thin Man_**

Question #15: Literature

10 points

This person was inspired by people continuing to work during the Blitz to write the song "London Pride", and he wrote the music and lyrics for the operetta *Bitter Sweet*. A play by this writer begins with Edith carrying in a large tray and being told to fetch the ice bucket. In that play, this writer uses the song "Always" to invoke the ghost of Elvira after she has been dead for seven years, but the ghost mistakenly causes the death of Ruth. Both of those women are invoked by Madame Arcati and were married to Charles Condomine. Name this 20th-century English playwright and humorist who wrote *Blithe Spirit*.	Noël (Pierce) **Coward**

Question #16: Social Studies

10 points

Like Cuthbert and Oswold, there is a shrine to this person at Durham Cathedral. This person praised Pope Gregory I in a letter he wrote to Egbert of York, who claimed to be this person's student and who in turn taught Alcuin [al-kwun]. This person's text *On the Reckoning of Time* was largely concerned with calculating the date of Easter. This person played a major role in popularizing the numbering of years from the supposed birth of Jesus. Name this 7th- and 8th-century writer who described the conversion of Anglo-Saxons to Christianity in the *Ecclesiastical History of the English People*.	The Venerable **Bede** or St. **Beded** [or **Baeda** or **Bede** the Venerable]

Question #17: Science

10 points

Acetylcholine [uh-SEE-tul-KOH-leen] receptors are classified based on whether they accept muscarine [MUSS-kuh-reen] or this chemical. This liquid alkaloid has pyridine [PIR-uh-deen] and pyrrolidine [puh-RAW-lih-deen], and its molecular formula is $C_{10}H_{14}N_2$ ["C ten H fourteen N two"]. This chemical is now often taken into the body along with propylene glycol or glycerin. People dependent on this chemical can use lozenges, chewing gums, or skin patches to help quit. Because of the way it is taken in, dependence on this chemical often leads to lung cancer. Name this addictive chemical in e-cigarettes and tobacco products.	**nicotine**

Question #18: Fine Arts

10 points

One pair of paintings by this artist is based on a story from Ovid's [AH-vid'z] *Metamorphoses*, with the first painting showing a hunter finding some bathing goddesses and the second showing him in the form of a stag being attacked by wolves. The first of those paintings is *Diana and Actaeon [ak-TEE-un]*. Another painting by this artist shows a woman dressed primarily in white on the left and Cupid in the middle reaching down into some water. Yet another painting by this artist is similar to a painting showing a nude woman in bed that this artist worked on with Giorgione [jor-JOH-nay]. Name this Venetian painter of *Sacred and Profane Love* and *Venus of Urbino*.	**Titian** [**TEE-shun**] [or Tiziano **Vecelli** or Tiziano **Vecellio**]

Question #19: Social Studies

10 points

This person was the early frontrunner in the 1992 and 1998 New York Senate Democratic primaries but lost to Robert Abrams and Chuck Schumer. This candidate was criticized because of charges against her husband John Zaccaro, who was a real estate developer eventually found innocent of bribing the Queens Borough President. This person told George H. W. Bush, "I almost resent, Vice President Bush, your patronizing attitude that you have to teach me about foreign policy" during a 1984 debate. Name this congressperson who was the 1984 Democratic vice-presidential running mate of Walter Mondale.	Geraldine (Anne) **Ferraro**

Question #20: Literature

10 points

In one play by this writer, one of the characters is referred to as "The Dead Man" in Act I but is referred to as "The Warrior" in Act II, which is set eight centuries earlier. That play was viewed as a political statement by this writer because the Forest Head learns that humans repeat past mistakes. In another play by this writer, Simon Pilkings prevents the ritual suicide of Elesin following the death of the king, as called for in Yoruba [YOR-uh-buh] traditions. Name this playwright of *A Dance of the Forests* and *Death and the King's Horseman* who was from Nigeria.	(Akinwande Oluwole Babatunde) "Wole" **Soyinka** [WAW-leh **shoh-YEEN-kah**]

Question #21: Fine Arts

10 points per part

	The final section of this composition uses a female chorus that has a wordless part. The conductor said that a door between the orchestra and chorus should be closed at the end of this piece.	
1	Name this work with seven sections that premiered in 1918.	*The **Planets***
2	This composer wrote *The Planets*.	Gustav(us Theodore von) **Holst**
3	A theme from *Jupiter* in *The Planets* was adapted to make the tune "Thaxted" and was adapted again by Holst to make this British patriotic hymn.	"**I Vow to Thee, My Country**"

Question #22: Fine Arts

10 points per part

	This symphony repeatedly has six staccato eighth notes followed by a quarter note.	
1	Give the common nickname of this symphony, which comes from a sudden fortissimo chord near the beginning of the second movement.	"**Surprise**" Symphony [prompt on Symphony No. **94**; accept answers that also include, but do not otherwise reveal, (Franz) Joseph Haydn]
2	This composer wrote the "Surprise" Symphony as well as the "Farewell" and "Palindrome" symphonies.	(Franz) Joseph **Haydn**
3	Haydn wrote over 100 pieces involving this instrument. It has six or seven strings that can be bowed and additional strings that can be plucked by the left hand.	**baryton**

Question #23: Literature

10 points per part

	This fictional king says "Nothing can come of nothing."	
1	Name this father of Goneril, Regan, and Cordelia.	King **Lear**
2	What royal title is held by Cordelia's eventual husband?	**King of France** [prompt on **king**]
3	The King of France agrees to marry Cordelia after the Duke of which place states "I am sorry then you have so lost a father that you must lose a husband"?	Duke of **Burgundy**

Question #24: Literature

10 points per part

	This novel states "Brahms, for all his grumbling and grizzling, had never guessed what it felt like to be suspected of stealing an umbrella."	
1	Name this novel in which Helen Schlegel [SHLAY-gul] calls the umbrella "appalling", which embarrasses Leonard Bast.	***Howards End***
2	This author wrote *Howards End*, *A Room with a View*, and *A Passage to India*.	E(dward) M(organ) **Forster**
3	The Howards End estate eventually gets passed to the Schlegel family after belonging to this family that includes Henry, Charles, and Paul.	the **Wilcox** family or the **Wilcox**es

Question #25: Social Studies

10 points per part

	The founder of this religion declared "There is no Hindu, there is no Muslim."	
1	Name this religion based on the teachings of Guru Nanak.	**Sikh**ism
2	This central Sikh text is treated like a person, including being put to bed each night in temples.	**Guru Granth Sahib** [accept **Adi Granth**; prompt on partial answers]
3	This Sikh holiday that takes place in April celebrates the new year and the creation of the Khalsa warrior order.	**Vaisakhi** [accept **Baisakhi**]

Question #26: Social Studies

10 points per part

	Name these Catholic holidays:	
1	This day is the first day of Lent. Its name reflects the mark that many people make on their foreheads.	**Ash Wednesday**
2	This holiday is sometimes called Three Kings' Day or Little Christmas, and it is often celebrated on January 6.	**Epiphany** [accept **Theophany**]
3	This holiday is the day after All Saints' Day. It is sometimes called the Commemoration of All the Faithful Departed or the Day of the Dead, and it is supposed to help people in purgatory.	**All Souls**' Day

Question #27: Science

10 points per part

	These molecules are classified as homonuclear [HOH-moh-NOO-klee-ur] or heteronuclear.	
1	Give this term for molecules that consist of two atoms. Many elemental gases, but not noble gases, commonly occur as this type of molecule.	**diatomic** ["die-atomic"] molecules
2	This halogen is a liquid at room temperature, but with a little bit of heat, it becomes a diatomic gas.	**bromine** [accept **Br**]
3	This element, similar to tungsten, sometimes forms diatomic molecules with sextuple bonds. This element is used to harden steel and is a catalyst in nitrogen fixation.	**molybdenum** [prompt on **Mo**]

Question #28: Science

10 points per part

	This type of bond is sometimes called an electrovalent ["ELECT-row"-VAY-lint] bond.	
1	Name this type of bond characterized by large differences in electronegativities.	**ionic** bonds
2	This one-word term is used for the atom that, in an ionic bond, loses an electron to become positively charged.	**cation**(s) [**"CAT-ion"**]
3	The defect in an ionic crystal consisting of both a missing cation and an extra nearby cation is named for this scientist. This scientist and his assistant Tatiana Kontorova modeled crystal lattices near a dislocation.	Yakov (Ilyich) **Frenkel**

Question #29: Literature

10 points

In this author's first novel, a bird is able to quote W. H. Auden and the King James Bible. That bird belongs to Lenore Stonecipher Beadsman of Shaker Heights, Ohio in this author's *The Broom of the System.* Another novel by this author begins with the narrator being interviewed at the University of Arizona, and much of that novel is set at the Enfield Tennis Academy. This author set most of that novel during the Year of the Depend Adult Undergarment. This author titled that novel based on a phrase that Hamlet said about Yorick. Name this American author of *Infinite Jest.*	David Foster **Wallace**

Question #30: Social Studies

10 points

While serving as U.S. Secretary of State, this person negotiated a series of treaties—including the Washington Naval Treaty—that prevented an arms race with Great Britain, France, Italy, and Japan. While serving as Chief Justice, this person wrote the *NLRB v. Jones & Laughlin Steel* decision that upheld the Wagner Act, and he also wrote the *Schechter Poultry v. U.S.* decision that struck down the National Industrial Recovery Act. This person was the Chief Justice when President Franklin Roosevelt proposed his court-packing plan. Name this successor to Taft as Chief Justice, who earlier narrowly lost the presidency to Woodrow Wilson in the election of 1916.	Charles Evans **Hughes**

Question #31: Mathematics

10 points

The type of this thing named for E. A. Dinic is a slightly more sophisticated example than the one named for Jack Edmonds and Richard Karp, both of which are used to find maximum flow. If the goal is to find a minimum spanning tree, then the two most useful examples of these things are named for Joseph Kruskal and Robert Prim. One of these things that finds the shortest distance between two vertices is named for Edsger Dijkstra ["DIKE"-struh]. Those examples are all greedy examples of these things. These procedures can be expressed in pseudocode or flowcharts. Name these formal methods that are followed to solve a problem.	greedy **algorithm**s

Question #32: Science

10 points

Some relations named for this scientist set partial derivatives of temperature or entropy equal to partial derivatives of pressure or volume and to second derivatives of potentials. When quantum effects are negligible, the statistics named for this scientist and an Austrian scientist describe the energy distribution of particles. A thought experiment with a door between two gas containers is named for this scientist's "demon". Name this scientist who combined Ampére's law with Faraday's law and two of Gauss's laws to give a four-equation summary of electromagnetism.	James Clerk **Maxwell**

Extra Question #1: Fine Arts

10 points

One set of variations by this composer is based on rising quarter notes followed by falling dotted eighth, sixteenth, and quarter notes. Those variations are based on Frédéric Chopin's [shoh-pan'z] *Prelude in C minor*. This composer used a theme that was not actually written by Arcangelo Corelli in his *Variations on a Theme of Corelli*. This composer's works generally focused on the piano, including a set of 24 variations based on the 24th and final part of a set of difficult violin pieces. Name this Russian-born pianist and conductor who used the *24 Caprices for Solo Violin* for his *Rhapsody on a Theme of Paganini*.	Sergei (Vasilyevich) **Rachmaninoff**

Extra Question #2: Literature

10 points

In one novel by this author, the protagonist goes to Calais [kuh-lay] and meets two people who "would be so far from being happy" even if they were given the "happiest mansion in heaven". Those people, Mundungus and Smelfungus, are in this author's novel narrated by Reverend Mr. Yorick. In another work by this author, there are many speeches by Corporal Trim, who is friends with Uncle Toby. The narrator of that very long novel criticizes his mother for asking about winding clocks while he was being conceived. Name this 18th-century Anglo–Irish novelist who wrote *A Sentimental Journey Through France and Italy* and *Tristram Shandy*.	Laurence **Sterne**

Extra Question #3: Social Studies

10 points

This cabinet-level department oversees the Fostering Access, Rights, and Equity grant program through the United States Women's Bureau. This department's bureau of statistics publishes the Consumer Price Index and unemployment rate. Several laws that protect whistleblowers are overseen by this department's Occupational Safety and Health Administration. This department is headquartered in the Frances Perkins Building. Name this department that has a Benefits Review Board and an Employee Benefits Security Administration, and which is responsible for overseeing regulations regarding jobs.	United States Department of **Labor** [accept **Labor** Department; prompt on **DoL**]

Extra Question #4: Mathematics

10 points

This word followed by the word "equation" forms a synonym of "recurrence relation". This word followed by the word "quotient" means an expression for the average rate of change of a function, and a limit of such an expression is used to define derivatives. The word "divided" followed by this word means an algorithm used to compute logarithms and trigonometric functions, which is why this word followed by "engine" refers to a machine to evaluate polynomials that was invented by Charles Babbage. As a noun, this word is synonymous with "residual" and "deviation". Give this word that means the answer of a subtraction problem.	**difference**(s) [accept **difference** equation or **difference** quotient or divided **difference**s algorithm or **difference** engine]

Extra Question #5: Science

10 points

In the 1930s, this man's son John designed a wedge that makes it easier to observe the Sun; a few years later, John invented blueprints. This person worked closely with his younger sister, who discovered at least five comets and improved on the works by Flamsteed and Messier [mes-see-ay] by writing a catalogue of nebulas. This person discovered the moons Titania [tih-TAH-nee-uh] and Oberon [OH-buh-rahn], and he also discovered infrared radiation. This person gained fame when he became the first person since ancient times to discover a new planet. Name this German-born British astronomer who discovered Uranus.	(Frederick) William **Herschel**

Extra Question #6: Mathematics

10 points per part

	The graphs of these functions have the same shape as the graph of the hyperbolic tangent function.	
1	Name this class of functions generated by a constant divided by the quantity 1 plus e raised to the negative kx power.	**logistic** functions [accept **logistic** curves]
2	In population modeling, the upper limit of a logistics function represents this concept.	**carrying capacity** [prompt on **maximum** population]
3	Give the carrying capacity of the function 10 divided by the quantity 1 plus e to the negative $3x$ power.	**10**

Extra Question #7: Mathematics

10 points per part

	This name is given to a line that intersects two other lines.	
1	Name this type of line. When it intersects parallel lines, congruent alternate interior angles are formed.	**transversal** line [accept **transversal**s]
2	A transversal segment plays a central role in Euclid's parallel postulate, which was his last one. How many postulates did Euclid use?	**five** postulates [accept **fifth** postulate]
3	If a transversal goes through two parallel lines, and one of the interior angles measures 53 degrees, then what is the measure of the consecutive interior angle across from it?	**127** degrees

Extra Question #8: Literature

10 points per part

	In this novel, King Henry VIII [8] tries to have the Duke of Norfolk executed, but he cannot do so because he cannot find the Great Seal of England.	
1	Name this novel about Henry's son Edward Tudor and Tom Canty.	*The* **Prince and the Pauper**
2	*The Prince and the Pauper* was written by this author of *The Adventures of Tom Sawyer*.	Mark **Twain** [or Samuel (Langhorne) **Clemens**]
3	Twain also wrote about switched identities in this novel in which Tom Driscoll and Chambers are switched in their cribs. The title character of this novel collects fingerprints.	**Pudd'nhead Wilson**

Extra Question #9: Literature

10 points per part

	The wife of this play's protagonist says "He's not the finest character that ever lived. But he's a human being, and a terrible thing is happening to him. So attention must be paid."	
1	Name this play in which Linda Loman is married to Willy Loman, who is frustrated with his sons Biff and Happy.	**Death of a Salesman**
2	This playwright wrote *Death of a Salesman* and *The Crucible*.	Arhur (Asher) **Miller**
3	In *The Crucible*, this reverend—who is the father of Betty and uncle of Abigail Williams—supports the investigations by Reverend Hale.	**Samuel Parris** [accept either]