



1. Lead acid batteries commonly contain a salt of lead with this anion, which is ionic-bonded to copper in blue vitriol. Although it normally forms soluble compounds, a white precipitate of this ion with barium is used in X-ray imaging. This polyatomic ion is found in gypsum and Epsom salts. It is the anion of the only common diprotic strong acid. For 10 points, name this anion with a minus-two charge and formula SO_4 .

ANSWER: sulfates [or SO4- before mention]

190-12-70-03101

2. This poet exclaimed “Flood-tide below me! I watch you face to face” in his poem “Crossing Brooklyn Ferry.” He asked, “And if the body were not the Soul, what is the Soul?” in “I Sing the Body Electric.” This poet, who served as a nurse during the Civil War, wrote “I am large, I contain multitudes” in a lengthy poem in which he sounds a “barbaric yawp.” For 10 points, name this American poet who included “Song of Myself” in the many editions of his collection *Leaves of Grass*.

ANSWER: Walt Whitman [or Walter Whitman]

015-12-70-03102

3. One method of deriving this law uses the calculus of variations to find the path of least action between two points, one in each region, or by finding the stationary point of the path length. This law thus follows from Fermat's principle of least time. It can be derived by analyzing wavefronts using Huygens (HOI-gens) principle. This law also gives the critical angle at which total internal reflection occurs. For 10 points, name this law which relates the angles of incidence and refraction for a ray of light passing from one medium to the other.

ANSWER: Snell's law

048-12-70-03103

4. One character in this work disguises himself as a gypsy to tell the fortunes of his guests, in which persona he deters Blanche Ingram from marrying him. The protagonist of this work saves her employer from a fire that later revelations explain was set by his mad wife, Bertha Mason, who he keeps locked in the attic of Thornfield Manor. At the end of this novel, the title orphan marries her former employer, Mr. Rochester. For 10 points, name this novel by Charlotte Bronte.

ANSWER: Jane Eyre

014-12-70-03104

5. One work by this writer opens by asking questions such as “When is there to be an end of that unbridled audacity of yours?” and “How long must you abuse our patience?” This writer's works include the philosophical dialogue *De Re Publica*, and he wrote a series of denunciations of the conspirator Catiline. He drew on the tradition of Demosthenes (deh-MOSS-thuh-nees) in his own series of *Philippics* attacking Mark Antony, on whose orders he was killed. For 10 points, name this Roman writer known for his legendary skills as an orator.

ANSWER: Marcus Tullius Cicero [or Tully]

014-12-70-03105

6. With the giantess Jarnsaxa (yarn-SAX-uh), this god has children named Magni, Modi, and Thrud. This god is married to the golden haired fertility deity Sif. The *Prose Edda* relates the story his fishing trip being sabotaged by Hymir. He rides a chariot pulled by goats which regenerate after being eaten. At Ragnarok, he will kill and be killed by the Midgard Serpent. For 10 points, name this son of Odin, a Norse storm god who wields a hammer named Mjollnir (mee-YOL-near).

ANSWER: **Thor**

015-12-70-03106

7. In the battle fought here, John Brown Gordon attempted to break through to the supply depot at Lynchburg, but retreated upon seeing that Sheridan's cavalry was backed by infantry. This location is the site of a house purchased by Wilmer McLean after he had moved from Manassas in 1861. The deal reached at this location guaranteed no treason prosecutions and allowed farmers to keep their horses and mules. For 10 points, name this Virginia site of Lee's surrender to Grant.

ANSWER: **Appomattox** Courthouse

015-12-70-03107

8. This title's current holder beat Boris Gelfand, the winner of the 2011 Candidates Tournament, to defend it. Since 2007, Viswanathan Anand has held this title that was unified with a "Classical" variety in 2006. Boris Spassky and Anatoly Karpov held this FIDE title that is not always held by the player with the highest ELO rating. Its holder must face biennial challengers in a series of matches. For 10 points, name this prestigious title formerly held by Garry Kasparov and Bobby Fischer.

ANSWER: FIDE **World Chess Champion** [or in different word orders such as **World Champion of Chess**; do not accept "Classical World Chess Champion"]

153-12-70-03108

9. Radios in this country issue notices of "ghost drivers" going against the direction of traffic. Its highways experience huge traffic jams called *staus*, which is the only time when drivers can pass on the right. This country uses a circular traffic sign with 4 diagonal lines from the bottom left to top right to signify the "end of all restrictions," meaning that there is a recommended top speed of 130 kilometers per hour, but no speed limit. For 10 points, name this country whose highways are called *autobahns*.

ANSWER: Federal Republic of **Germany** [or Bundesrepublik **Deutschland**]

080-12-70-03109

10. The entropy of one of these objects is proportional to the third power of the speed of light and proportional to its area. They can be described by only mass, charge, and angular momentum according to the no-hair theorem. The Schwarzschild radius determines the event horizon of these objects. They are thought to emit Hawking radiation, and can be formed following the collapse of large stars. For 10 points, identify these very dense objects in space, from which light cannot escape.

ANSWER: **black holes**

189-12-70-03110

11. These people worshipped a group of nine gods called the Ennead which included an earth god named Geb and a sky goddess named Nut. They believed in a snake god named Apep which harassed the solar barge as it made its way across the sky. One of their gods is cut into fourteen pieces by his brother Seth before being reassembled by his wife Isis. For 10 points, name these people who wrote about the underworld god Osiris in hieroglyphics.

ANSWER: Ancient **Egyptians**

015-12-70-03111

12. People with this disease are susceptible to salmonella osteomyelitis, and it is often treated with hydroxyurea. One effect of this disease is the eventual infarction and destruction of the spleen. Heterozygotes for this disease have increased resistance to malaria, which is why it is prevalent in African Americas. This disease is caused by a glutamic acid to valine mutation in the beta-chain of hemoglobin. For 10 points, name this genetic disease in which red blood cells take on a curved shape.

ANSWER: **Sickle-cell anemia**

048-12-70-03112

13. This author was financially ruined by the poor sales of his *A Week on the Concord and Merrimack Rivers*. One of his works describes a game of hide and seek with a loon, an encounter with a French woodchopper, and a battle between red and black ants. He described his imprisonment after refusing to pay a poll tax in his essay "Civil Disobedience." For 10 points, name this man who described planting beans and living in solitude by the title pond in *Walden*.

ANSWER: Henry David **Thoreau**

015-12-70-03113

14. One of this leader's invasions was prompted by a plea from Honoria, the sister of Valentinian III. This man came to power after killing his brother Bleda. According to legend, he was turned from one invasion by a plea from Pope Leo I. The Visigothic king Theodoric I allied with the Roman general Flavius Aetius on the Catalaunian Plains to defeat this man at the Battle of Chalons. For 10 points, name this "Scourge of God" known for his harassment of the Romans and his leadership of the Huns.

ANSWER: **Attila** the Hun

015-12-70-03114

15. Guillaume Apollinaire and Pablo Picasso were questioned after this painting was stolen in 1911. Marcel Duchamp added facial hair to this painting in a work titled *L.H.O.O.Q.*. Since it is thought to depict the wife of Francesco del Giocondo, it is known as *La Gioconda* in Italian. The subject of this portrait wears a translucent veil and holds her right hand over her left. It is permanently displayed in the Louvre. For 10 points, name this Leonardo da Vinci portrait of a woman with an enigmatic smile.

ANSWER: **Mona Lisa** [accept *La Gioconda* before it is mentioned]

015-12-70-03115



1A. Name the French Dada artist whose avant-garde works include *The Bride Stripped Bare by Her Bachelors, Even* and *Nude Descending a Staircase, No. 2*.

ANSWER: Marcel **Duchamp**

1B. What period of Japanese history following the Tokugawa Shogunate saw the namesake emperor come to power and bring in Western influence?

ANSWER: **Meiji Restoration** [or **Meiji Ishin**]

2A. What 1966 Supreme Court case required arresting officers to read rights to arrested individuals?

ANSWER: **Miranda** v. Arizona [or Arizona v. **Miranda**; prompt on **Arizona**]

2B. In what Richard Connell short story does General Zaroff hunt men on his private island?

ANSWER: “The **Most Dangerous Game**”

3A. Propagated by John B. Watson and B. F. Skinner, what school of psychology scientifically studied the effects of classical and operant conditioning on organisms?

ANSWER: **behaviorism** [or obvious equivalents]

3B. This is a 20-second calculation question. What is the slope of the line perpendicular to the line described by the equation $3x - y = 5$?

ANSWER: **-1/3**

4A. This is a 20-second calculation question. What is the area of a triangle with vertices at the points (2,3), (8,3), and (2,11).

ANSWER: **24** square units

4B. What term refers to the set of elemental isotopes that do not decay, so called because they form a diagonal line when atomic number is plotted against mass number?

ANSWER: **band of stability**

5A. The motion of what liquid layer composed of iron and nickel is responsible for generating the magnetic field of the Earth?

ANSWER: **outer core** [prompt on **core**; do not accept "inner core"]

5B. Hector Berlioz composed what programmatic symphony with movements such as “March to the Scaffold” and “Dream of a Witches’ Sabbath”?

ANSWER: ***Symphonie Fantastique***

6A. In Spring 2012, what man, successor to Jacques Chirac, was defeated by Francois Hollande in his bid for a second term as President of France?

ANSWER: Nicolas Paul Stéphane **Sarkozy** de Nagy-Bocsa

6B. In 2012, boycotts were organized of what fast-food chain, whose President, Dan Cathy, condemned gay marriage?

ANSWER: **Chick-fil-A**

7A. This is a 30-second calculation question. If A is a second-quadrant angle with sine equal to .6, what is the cosine of the angle two times A?

ANSWER: **0.28** or **[7/25]**

7B. This is a 30-second calculation question. Given the data set 4, 12, 8, 9, 6, 6, 3, 10, what is the positive difference between the median and mode of the following data set?

ANSWER: 1

8A. The fundamental theorem of calculus links the concept of the derivative with what other concept from calculus?

ANSWER: **integral** [accept word forms]

8B. The heir apparent to the throne of the United Kingdom is known as the "Prince of" what constituent country?

ANSWER: **Wales**

9A. What 1977 Steven Spielberg movie includes Francois Truffaut as a UFO scientist and also features Richard Dreyfuss' character Roy Neary making a mashed potato sculpture of Devils Tower?

ANSWER: ***Close Encounters of the Third Kind***

9B. What NFL team that plays at EverBank Field was purchased by Shad Khan in 2011?

ANSWER: Jacksonville **Jaguars** [or **Jacksonville** Jaguars]

10A. ? The Portuguese word "ter" and the imperfect forms of "haber" in Spanish are auxiliary verbs that signal what verb tense, which indicates an action already complete in reference to some past time?

ANSWER: **pluperfect** tense

10B. What grandson of Queen Victoria and last emperor of Germany was forced into exile in the Netherlands following Germany's defeat in World War I?

ANSWER: **Wilhelm II** [or **William II**; or **Friedrich Wilhelm Viktor Albert**; prompt on **Wilhelm**; prompt on **William**]



1. Rudolf Mossbauer discovered a form of this phenomenon which occurs when nuclei absorb gamma rays and hardly recoil. In astronomy, this phenomenon occurs when two bodies' orbital periods are in a small whole-number ratio. In chemistry, this phenomenon is depicted in Lewis diagrams with double-headed arrows. NMR depends on nuclei demonstrating it in a magnetic field. It is often blamed on the collapse of the Tacoma Narrows Bridge. For 10 points, name this phenomenon in which mechanical oscillation increases at certain frequencies.

ANSWER: **resonance**

190-12-70-03117

2. The companion piece to this poem asks the addressee, "Dost thou know who made thee?" This poem asks its own subject, "what shoulder, and what art, could twist the sinews of thy heart?" This "Song of Experience" is contrasted with its author's poem "The Lamb," asking "What immortal hand or eye could frame thy fearful symmetry?" For 10 points, name this poem about a creature "burning bright in the forests of the night" written by William Blake.

ANSWER: "The **Tyger**"

014-12-70-03118

3. The most common method for doing this relies on ddNTP molecules which are fluorescent at four different wavelengths. Craig Venter developed another method for accomplishing this process, called the "shotgun method," which uses restriction enzymes to cut the parent material. Frederick Sanger invented the chain-termination method for this process. In 2000, the HGP announced that this process had been accomplished for human cells. For 10 points, name this process which involves finding the order of nucleotides in the genetic material.

ANSWER: **DNA sequencing** [or **deoxyribonucleic acid sequencing**; or same-knowledge equivalents]

190-12-70-03119

4. The Gospel of John relates that this man at first refused to let Jesus wash his feet. With James and John, he witnessed the Transfiguration. The gospels tell of how this man began to sink after walking towards Jesus on the water. He was the brother of Andrew. The flag of the Vatican City depicts the "keys" of this man, as he became the first pope. Before the crowing of the rooster, this disciple denied Jesus three times. For 10 points, name this fisherman and disciple of Jesus.

ANSWER: Simon **Peter**

015-12-70-03120

5. Jan Hus was burned at the Council of Konstanz for his heretical teachings in this city. This city became capital of the Holy Roman Empire under Charles IV. A 1968 Soviet invasion was launched in response to a series of liberal reforms known as this city's "Spring." Many of this city's leaders were thrown out of windows in a 1618 "defenestration" that helped spark the Thirty Years' War. For 10 points, name this cultural center of Bohemia that is the capital of the Czech Republic.

ANSWER: **Prague** [or **Praha**]

015-12-70-03121

6. Some versions of this compound are distinguished by having a long phytol side chain, and variations in its fluorescence properties are the subject of the Kautsky effect. Removing the central metal of this compound gives pheophytin. This compound, which typically contains a magnesium atom coordinated to a porphyrin ring, is present in the reaction centers of photosystems I and II of the chloroplast. For 10 points, name this pigment used to absorb light, that gives plants its green color.

ANSWER: **chlorophyll**

048-12-70-03122

7. This country's oldest national park is at Banff. The Ambassador and Peace Bridges connect this country with its southern neighbor that disputes its claims in the Beaufort Sea. This country's Confederation Bridge in the Gulf of St. Lawrence links New Brunswick to Prince Edward Island. The most populous city in this second largest country in the world is on the shores of Lake Ontario; that city is Toronto. For 10 points, name this country that shares its long southern border with the United States.

ANSWER: Dominion of **Canada** [or *le Dominion du Canada*]

153-12-70-03123

8. Gas metal arc welding typically uses this gas to shielding the welding from contaminants. The Bohr effect describes how the concentration of this substance in the blood limits hemoglobin's ability to bind to oxygen. Like water, it is produced in all complete combustion reactions of hydrocarbons. Dry ice is composed of the solid form of this compound. For 10 points, name this triatomic greenhouse gas produced in cellular respiration, which has chemical formula CO₂.

ANSWER: **carbon dioxide** [or **CO₂** until it is read]

190-12-70-03124

9. The protagonist of this novel is disturbed by another character's warning, "I will be with you on your wedding night." That warning comes true when that character is seen grinning and pointing outside the window of the protagonist's house at the corpse of Elizabeth Lavenza. The protagonist is picked up by Captain Robert Walton in the Arctic, where he travels in pursuit of a self-loathing giant. For 10 points, name this Gothic novel in which Victor unwittingly creates a monster, a work by Mary Shelley.

ANSWER: **Frankenstein**

014-12-70-03125

10. One of the biggest disasters suffered by this program was the loss of Roger Chaffee, Edward White, and Gus Grissom in a fire. One participant in this program hit a golf ball for "miles and miles and miles." Another participant in this program was Jack Swigert, who relayed the message "Houston, we've had a problem" after an explosion. The eleventh mission in this program was led by Michael Collins, Buzz Aldrin, and Neil Armstrong. For 10 points, name this NASA program that landed on the moon.

ANSWER: **Apollo** 1 [or **Apollo** 14; or **Apollo** 13; or **Apollo** 11; prompt on **NASA**; prompt on **space program**]

015-12-70-03126

11. In one novel by this author, gold cyanide vapors are inhaled by the photographer Jeremiah de Saint-Amour. In another of his novels, Remedios the Beauty ascends to heaven while folding a sheet. That novel, set in a fictional town first presented in *Leaf Storm* named Macondo, follows many men named Jose Arcadio and Aureliano in tracing the history of the Buendia (bwen-DEE-uh) family. For 10 points, name this magical realist Colombian author of *Love in the Time of Cholera* and *One Hundred Years of Solitude*.

ANSWER: Gabriel **Garcia Marquez**

014-12-70-03127

12. One variation of this law is used to show that, for a smaller body inside a larger body, only the mass below the smaller body pulls on it gravitationally. This law can be stated as the divergence of E equals ρ divided by ϵ_0 . Another variation of this law, for magnetism, is used to show that there are no magnetic monopoles. This law makes use of namesake surfaces with symmetries that match the surface of interest. For 10 points, name this law that relates the electric flux through a surface to the charge enclosed.

ANSWER: **Gauss's** law

048-12-70-03128

13. The narrator of one poem by this man notes that “On the faces of women and children I have seen the marks of wanton hunger.” This author of the *Rootabaga Stories* and a biography of Abraham Lincoln wrote about a phenomenon that “sits looking over harbor and city on silent hunches and then moves on.” In addition to writing that the fog “comes on little cat feet,” this poet described a city as “hog butcher for the world, tool maker, stacker of wheat.” For 10 points, name this author of “Chicago.”

ANSWER: Carl **Sandburg**

015-12-70-03129

14. One factor in the performance of this technology is the timing of the RAS and CAS signals. In smartphones, this technology is what is usually stacked on top of a SoC to make a PoP. This technology is composed of constantly refreshing capacitor containing cells. This computer component is based on the DDR family of standards and comes in physical DIMMs. Unlike SSDs or hard drives, this subsystem forgets its content when shutdown. For 10 points, name this computer component used to store active information and programs.

ANSWER: **DRAM** [or dynamic **random access memory**; prompt on partial answer]

001-12-70-03130

15. This man included his compositions “Budo” and “Deception” on an album he recorded along with Gil Evans, Gerry Mulligan, and the other members of his namesake nonet. In addition to recording *Birth of the Cool*, with a sextet including Cannonball Adderley, he recorded an album featuring his compositions “Flamenco Sketches” and “Freddie Freeloader.” For 10 points, name this jazz trumpeter of the seminal album *Kind of Blue*.

ANSWER: Miles **Davis**

014-12-70-03131



1. Tests to measure the function of this pathway include the PT and PTT. This process, which can be triggered by both the intrinsic and extrinsic pathways, uses proteins like von Willebrand factor and factor VIII. This process results in the creation of a cross-linked fibrin mesh, is non-functional in people with hemophilia, and is assisted by platelets. For 10 points, name this biological process triggers by cuts, which prevents bleeding.

ANSWER: blood **clotting** [accept **coagulation**; do NOT accept “agglutination”]

048-12-70-03132

2. In one work by this man, the title character is replaced by a panther after failing to draw crowds by starving himself for a record period of time. In another of his stories, residents of the title institution have their sentences inscribed on their bodies by a torture and execution machine. This author of “A Hunger Artist” and “In the Penal Colony” also created a salesman named Gregor Samsa, who awakens to find he has become a giant insect. For 10 points, name this Czech-born author of “The Metamorphosis.”

ANSWER: Franz **Kafka**

014-12-70-03133

3. In *Song of Myself*, Walt Whitman wrote "the hundred and fifty are dumb yet" at the site of this battle. One side's forces in this battle were led by William Travis, who apocryphally drew a line in the sand. Casualties of this battle include knife-inventor Jim Bowie and outdoorsman Davy Crockett. It was a total but costly victory for the Mexican army under Santa Anna. For 10 points, name this Texas Revolution battle that resulted in the death of all the defenders of a San Antonio mission.

ANSWER: Battle of the **Alamo**

015-12-70-03134

4. Unlike its counterpart, this substance's monomers do NOT have 2-prime hydroxyl groups. This substance was revealed by Avery to be the “transformative agent” in Griffith's experiments, and it was labeled with 32-P in an experiment that used a blender to show that bacteriophages transfer it to E. coli. It was labeled with nitrogen-15 in the Meselson-Stahl experiment to show that its replication was semiconservative, and this substance is wrapped around histones and usually found in the nucleus. For 10 points, name this genetic material.

ANSWER: **DNA** [or **deoxyribonucleic acid**]

048-12-70-03135

5. The protagonist of this novel is impressed by the praise that the housekeeper Mrs. Reynolds bestows on her master while showing them his portrait. In this novel, after the absurd clergyman who will inherit the central family's property is rejected by the protagonist, he marries her friend Charlotte Lucas. The central family is almost scandalized when the soldier Wickham elopes with the youngest daughter, Lydia. At the end of this novel, Mr. Bingley marries Jane and Mr. Darcy marries Elizabeth. For 10 points, name this novel about the Bennet family by Jane Austen.

ANSWER: ***Pride and Prejudice***

014-12-70-03136

This is a calculation question. What are the x-intercepts of the function $f(x) = 2x^2 - 12x + 18$?

ANSWER: (**3**, 0) [or (**3**,0) and (**3**, 0); or $x = \mathbf{3}$]

Halogens have the largest value for what quantity equal to the amount of energy given off when an electron is added to a neutral atom?

ANSWER: **electron affinity**