1. A variant of this experiment known as the "quantum eraser" demonstrates entanglement. The "which way" variations on this experiment involve measuring which path a photon took in order to avoid the interference pattern that this experiment usually creates. The interference pattern produced by this experiment disproved Newton's corpuscular theory of light. For 10 points, the wave nature of light was first demonstrated by what experiment, conducted by Thomas Young, in which light was shone through two namesake openings?
ANSWER: Young's **double slit** experiment [or **Young**'s double slit experiment until "Young" is read]

2. This city's Ahwatukee **(AH-wuh-TUCK-ee)** Foothills neighborhood, one of its fifteen "urban villages," is separated from the rest of the city by South Mountain. A suburb of this city is home to the winter home of Frank Lloyd Wright, Taliesin **(tah-lee-ESS-en)** West. Tent City Jail was built in this city by a man who calls himself "America's toughest sheriff," Maricopa County's Joe Arpaio **(ar-PIE-oh)**. Scottsdale is east of this city, whose Sky Harbor Airport is on the bank of the Salt River. For 10 points, name this city in the Valley of the Sun, the capital of Arizona.
ANSWER: **Phoenix**

3. LIGO **(LIE-go)** may have discovered "waves" due to this force. This force is balanced by outward radiation at the Eddington limit, while tidal forces overcome this force at the Roche **(ROASH)** limit. If M is an object's mass and R its distance from a point, then the potential due to this force is equal to negative GM over R, while acceleration is inversely proportional to R squared, according to Newton's law describing it. For 10 points, name this weakest fundamental force, which causes objects to accelerate downward at 9.8 meters per second on Earth.
ANSWER: **gravity** [or **gravitation**al force]

4. A member of this family is convinced of the "sentience of all living things" because of the "gray stones" outside. That member of this family sings a song called "The Haunted Palace" and is read a novel about a knight named Ethelred called *The Mad Tryst* **(TRIST)**. A hypersensitive member of this family buries his twin sister alive after she falls into a death-like trance. Those twins from this family, Roderick and Madeline, both die as their home breaks apart. For 10 points, what family is the subject of an Edgar Allan Poe story about the "fall" of its house?
ANSWER: the **Usher** family

5. A character who resolves the central dilemma of this movie announces "I need more coffee" right before falling down. This film moved its plot-triggering event twelve days later than the book on which it is based, in order to provide a plausible amount of fertilizer for potatoes. In this movie, the *Hermes* performs the "Rich Purnell maneuver," a gravity-assisted rendezvous with a rocket containing Mark Watney. For 10 points, name this 2015 Ridley Scott film in which Matt Damon plays an astronaut stranded on the Ares 3 mission.
ANSWER: *The **Martian***

6. This artist collaborated with Mary Hunter Austin on his first book, which depicted life and landmarks in Taos, New Mexico. This man recorded life among internees at Manzanar **(MAN-zuh-nar)** in *Born Free and Equal* and developed the zone system with Fred Archer. Famous images by this man include one of a winter sunrise over El Capitan and one of Old Faithful erupting. For 10 points, name this American photographer best known for his images of Yosemite National Park, which include *Moon and Half Dome*.
ANSWER: Ansel **Adams**

7. Adherents of this religion practice "dead agenting" and tactics labeled "Fair Game" against perceived enemies. Thousands of its most dedicated members sign billion-year, low-paying contracts to work in the "Sea Org." Members of this religion use "E-meters" as part of a process called "auditing." This religion, the subject of the book *Going Clear*, had its tenets detailed in the 1950 book *Dianetics*. For 10 points, name this religion founded by L. Ron Hubbard, whose members include celebrities such as John Travolta and Tom Cruise.
ANSWER: Church of **Scientology**

8. Events in this city resulted in a major escalation in Operation Chammal **(shah-MAHL)**. A Twitter hashtag translated as "OpenDoor" trended after events in this city, where the merchandise manager of the band Eagles of Death Metal died. Eighty-nine people were killed in this city while attending a concert at the Bataclan **(BAH-ta-clahn)** theatre as part of attacks called an act of war by President Francois Hollande **(FRAHN-swah oh-LOND)**. For 10 points, what French city was the site of Islamic terrorist attacks in November 2015?
ANSWER: **Paris**

9. This poem may have been intended as a general mockery of another poet, Edward Thomas, who was inspired by it to enlist in World War I. The speaker of this poem describes one of his subjects as "having perhaps the better claim," then immediately contradicts it. The speaker of this poem looks forward to how "somewhere ages and ages hence" he "shall be telling this with a sigh." It begins with the speaker in a "yellow wood" suffering from indecision, and ends with the ironic line, "And that has made all the difference." For 10 points, name this frequently misunderstood poem by Robert Frost.
ANSWER: "The **Road Not Taken**"

10. During the reign of this house, the harsh Anti-Sacrilege Act was passed. A ruler of this house was noted for having mistresses such as Madame du Barry and Madame de Pompadour **(PAHMP-uh-door)**. This house temporarily came back in power during its restoration period after the War of the Sixth Coalition, which featured rulers like Charles X. A ruler of this house had his title abolished by the National Assembly in 1792. For 10 points, name this royal house of Louis XVI, who was overthrown in the French Revolution.
ANSWER: House of **Bourbon** [prompt on **Capet**ian]

11. In this character's first appearance, he tells the story of his servant fighting a bear while crossing the Pyrenees **(PEER-uh-nees)** Mountains. This character befriends a boy named Xury **(ZOO-ree)**, who helps him escape from Moorish slavery. This character was based on a real-life Scotsman named Alexander Selkirk. This character, a Brazilian plantation owner, ends up surrounded by penguins and seals and fights off cannibals to rescue a man he names "Friday." For 10 points, name this Daniel Defoe title character, a man who is shipwrecked on a tropical island.
ANSWER: Robinson **Crusoe** [or **Robinson** Crusoe]

12. A double row of fencing can be seen holding back wild roses in the lower left of this painting. A tiny, curly-haired white dog barks up at a woman in this painting. Two putti **(POO-tee)** play on what may be a fish or a beehive in a sculpture in this painting. Another putto **(POO-toh)** holds a finger to his lips conspiratorially toward the pink-clad central woman in this painting, who kicks off her slipper in the direction of her hidden lover. For 10 points, name this rococo **(ruh-KO-ko)** painting of a two-timing woman being pushed by an older suitor on the title conveyance, by Jean-Honore Fragonard.
ANSWER: The **_Swing_**

13. The losing side of this war reportedly committed atrocities after the Battle of Camp Hill. The winning side of this war passed the Self-Denying Ordinance to reorganize its armies, and the losing side had a German cavalry commander named Prince Rupert of the Rhine. It featured the Battle of Naseby **(NAYS-bee)**, which was won by the New Model Army under Sir Thomas Fairfax. This war was fought between the Cavaliers and Roundheads. For 10 points, name this conflict that ended when Parliamentarians under Oliver Cromwell successfully overthrew Charles I.
ANSWER: **English Civil** War

14. The "power-of-a-point" is defined for a point near one of these figures, and the power-of-a-point with respect to two of these figures is equal along the radical axis. Apollonius of Perga showed that these figures could be defined using a constant ratio. The area of a quadrilateral enclosed in one of them is given by Brahmagupta's **(BROM-uh-GUP-tuhs)** formula. They are equivalent to an ellipse with zero eccentricity. These figures are the conic section for a plane parallel to the base of the cone. For 10 points, name these geometric figures whose area is given by pi times their radius squared.
ANSWER: **circle**

15. This leader's "Sinews of Peace" speech claimed that "from Stettin...to Trieste...an Iron Curtain has descended." One of this man's speeches claimed that he had "nothing to offer but blood, toil, tears, and sweat," and another one noted that "Never was so much owed by so many to so few." This man did not attend the Potsdam Conference since he had been replaced by Clement Attlee. After the evacuation of France, this leader declared, "we shall fight on the beaches." For 10 points, name this British prime minister during World War II.
ANSWER: Winston **Churchill** [or Winston Leonard Spencer-**Churchill**]

1A. In what Christopher Marlowe play are Lodowick and Mathias tricked into killing each other by the wealthy merchant Barabas?
ANSWER: *The **Jew of Malta***

1B. What scientist discovered the ground-breaking "mould juice" in his investigation of the staphylococci **(STAFF-uh-lo-KOK-"eye")** bacteria, as well as the enzyme lysozyme **(LIE-so-zime)**?
ANSWER: Sir Alexander **Fleming**

2A. What ballet position requires the performer to stand on one leg while extending the other leg backwards, usually so that the two legs are perpendicular?
ANSWER: **arabesque**

2B. What Dutch scientist names the mathematical transformations between reference frames which explain length contraction in Einstein's theory of special relativity?
ANSWER: Hendrik **Lorentz (lor-ENTS)**

3A. This is a 20-second calculation question. Find all values, real and complex, that satisfy the equation: x squared over the quantity x minus 7 equals 49 over the quantity x minus 7.
ANSWER: **{-7}** [or **x equals -7**; do not accept answers with more than one value]

3B. This is a 20-second calculation question. Alice is taller than 90 percent of the girls in her class, and 60 percent of the boys. If her classmates are 60 percent female and 40 percent male, what percentage of classmates is she taller than?
ANSWER: **78** percent

4A. What type of graph, commonly used in statistics, plots a number of points on a suitably constrained x-y plane?
ANSWER: **scatter** plot [or **scatter** chart; or **scatter** graph; or **scatter** diagram; or **scattergram**]

4B. What Holy Roman Emperor, the son of Henry the Fowler, defeated a Magyar **(MAG-yar)** invasion at the Battle of Lechfeld **(LECK-feld)**?
ANSWER: **Otto I** [or **Otto the Great**; prompt on **Otto**]

5A. What English king opposed Stephen Langton's appointment as Archbishop of Canterbury and met with some rebels in the meadow of Runnymede **(RUN-ee-meed)**?
ANSWER: King **John** [or **John** Lackland; or **John** Softsword; or **John** I]

5B. After a December 2015 meeting chaired by Janet Yellen, the Federal Reserve announced plans to perform what anti-inflationary monetary policy action for the first time since 2008?
ANSWER: **raising interest rate**s [accept synonyms for "raise" such as **hike**; accept **federal funds** rate for "interest rates"]

6A. What religion believes in 24 tirthankaras **(TEER-tahn-KAH-rahz)**, people who have overcome samsara **(som-SAR-uh)** and help others leave it so they can attain moksha **(MOAK-shuh)**?
ANSWER: **Jain**ism

6B. Michael Jordan and an Oakland police officer were among the people targeted by a 2015 Internet meme in which what three-word phrase is yelled at unfashionable shoes?
ANSWER: "**What are those**?"

7A. What 18th-century movement of religious revival spread through the American colonies thanks to preachers such as George Whitefield **(WIT-feeld)** and Jonathan Edwards?
ANSWER: **First Great Awakening** [prompt on Great **Awakening**]

7B. The sentence, "Happy families are all alike; every unhappy family is unhappy in its own way," opens what Leo Tolstoy novel?
ANSWER: *Anna Karenina*

8A. This is a 30-second calculation question. Suppose that cosine of x, raised to the fourth power, minus sine of x, raised to the fourth power, equals 1/4. Find all possible values of sine of 2x. Express your answer in simplest radical form.
ANSWER: square **root** of **15, over 4** and **negative** square **root** of **15, over 4** [or **rad**ical **15, over 4** and **negative rad**ical **15, over 4**; or **plus or minus** square **root of 15, over 4**; or **plus or minus rad**ical **15, over 4**; or **divided** by instead of "over"; do not accept answers with more or fewer than two values]

8B. This is a 30-second calculation question. A 144-degree sector of a circle with radius 5 is cut out, and the remainder is curved to make a cone, whose vertex is the center of the original circle. What is the cone's volume, in terms of pi?
ANSWER: **12 pi** [the base radius is 3, the slant height is 5]

9A. What vehicle is called Flugzeug **(FLOOK-zoyk)** in German and avion **(ah-vee-OHN)** in both French and Spanish?
ANSWER: **airplane** [or **aeroplane**; or **plane**; prompt on **aircraft**]

9B. The ancient Plain of Jars is located in what landlocked country of Southeast Asia, found to the north and east of Thailand?
ANSWER: **Laos** [or **Lao** People's Democratic Republic; or Sathalanalat Paxathipatai Paxaxon **Lao**; or Pathet **Lao**]

10A. What word referred to a country landowner in early modern England, and a member of the nobility who was apprenticed to a knight in medieval England?
ANSWER: **squire**

10B. What Wallace Stevens poem states that "a man and a woman and" the title bird "are one"?
ANSWER: "**Thirteen Ways of Looking at a Blackbird**"

1. A story in this book describes Abraham's conversion to Christianity despite witnessing the debauchery of the Church. In the first story in this book, the wicked Ciapelletto **(chah-peh-LET-oh)** convinces a friar he is a virtuous man before dying and being revered as a saint. In another story in this book, a woman is eventually made Marchioness after being told that Gualtieri killed her children. This collection, which includes the story of patient Griselda, is narrated by characters fleeing Florence to escape the Black Death. For 10 points, name this collection of stories written by Giovanni Boccaccio.
ANSWER: *The **Decameron***

2. Twenty-eight of these people were killed in the Rock Springs massacre. Denis Kearney gave numerous speeches denouncing these people in support of the Workingmen's Party. Many of these people were known as "Celestials." Despite their labor, none of these people were allowed to be in an 1869 photograph taken at Promontory Point, Utah. An 1882 "exclusion" law curtailed immigration of these people. For 10 points, what group of Asian immigrants was a major labor source for the Central Pacific Railroad's transcontinental project?
ANSWER: **Chinese**-Americans [prompt on **Asian** Americans until mentioned]

3. This man was the first to demonstrate molecular chirality while investigating the issue of light rotating its plane of polarization when passing through a solution of tartaric acid. In the city of Alais **(ah-LIE)**, this scientist helped fight parasitic diseases that targeted and killed many silkworms. In an experiment, this man disproved the theory of spontaneous generation and showed that biogenesis was the cause of bacterial development in nutrient broths. For 10 points, what scientist gives his name to a process that kills bacteria in beverages like beer and milk?
ANSWER: Louis **Pasteur**

4. This body of water's Proval Bay was created by an 1862 earthquake. A cryptid allegedly resembling a giant armored sturgeon is known as this non-Scottish body of water's namesake monster. Species unique to this body of water include a fish known as the golomyanka **(goh-lee-MAHN-kuh)** and its main predator, a namesake type of freshwater seal. The Angara River is this body of water's only outlet. This body of water is located between Irkutsk Oblast and the Buryat Republic. This lake holds one fifth of the world's liquid fresh water. For 10 points, name this lake in Siberia, the world's deepest.
ANSWER: Lake **Baikal**

5. In the Heliopolitan Cosmogony **(HEE-lee-oh-POL-ih-tun coz-MAH-guh-nee)**, this god is portrayed as the brother and husband of Nephthys **(NEF-this)**. As lord of the red land, this deity reigned over the desert which served as a foil to the lord of the black land and helped preserve Ma'at. In one legend he serves the sun god in a solar boat to help defeat the evil serpent Apep **(AH-pep)**. This god is more famous for killing his brother and cutting him into pieces which were scattered all over Egypt. For 10 points, identify this brother of Osiris and rival of Horus from Egyptian mythology.
ANSWER: **Set** [or **Seth**; or **Setekh**; or **Sutekh**]

6. In 1879, a man with this name became the first prince of modern Bulgaria. A monarch with this name was opposed in the January Uprising. On a raft in the middle of the Neman **(NAY-mahn)** River, a non-French monarch with this name signed the treaty of Tilsit **(TILL-sit)** after the Battle of Friedland. The second monarch with this name was killed by a bomb thrown by a People's Will member, and the first fought at the Battle of Austerlitz **(OW-ster-lits)** against Napoleon. For 10 points, give this name of three Russian tsars **(ZARS)**, the second of whom emancipated the serfs.
ANSWER: **Alexander**

7. This character can jump the highest in a video game set in the "dreamland" of Subcon that is ruled by the villainous Wart. In a final boss battle, he is sucked into a painting by King Boo. In that game, this character wins a house in a contest, meets Professor E. Gadd, and is given the Game Boy Horror and Poltergust 3000, which is a high-powered vacuum cleaner. This character appeared in 3DS and GameCube games titled for his "mansion." For 10 points, name this green-clad plumber, the brother of Mario in Nintendo games.
ANSWER: **Luigi**

8. Alfred Young wrote about this event using the story of George Robert Twelve Hewes, a shoemaker. The law this event targeted lowered the price of Bohea **(BO-hee-uh)** to two shillings per pound. This event resulted in the passing of the Coercive Acts, which were approved by Governor Thomas Hutchinson. This event was carried out against the East India Company by Sons of Liberty members dressed as American Indians. For 10 points, name this December 1773 protest in New England in which shipments of the namesake beverage were thrown into the namesake city's harbor.
ANSWER: **Boston Tea Party**

9. Systems used for this activity can be classified into categories such as abugidas **(ah-BOO-gih-dahs)** and abjads **(AHB-jahds)**. The Pahawh **(PAH-haw)** system for doing this was invented by Shong Lue Yang in 1959, and spread as part of a religious movement among the Khmer that believed this activity brought salvation. Another system for doing this was given to the Cherokee by Sequoyah. This activity is done without vowels in Semitic languages such as Hebrew and Arabic. For 10 points, name this activity in which a syllabary or an alphabet is used to transcribe a language on a screen or paper.
ANSWER: **writing**

10. An eccentric author from this country compiled his works into the collection *The Daughters of Fire* and was known for keeping a pet lobster on a leash. Another author from this country is credited with coining the phrase "art for art's sake." The poem *A Season in Hell* was written by a poet from this country who was the lover of Paul Verlaine. A poem addressed to the "hypocrite reader" opens a collection from this country which includes the sections "Wine" and "Spleen and Ideal." For 10 points, name this country home to the author of *The Flowers of Evil*, Charles Baudelaire **(BO-duh-lair)**.
ANSWER: **France**

11. Functions of this type are used as integrating factors to solve first order ordinary differential equations. On the complex plane, a fundamental function of this type maps onto the unit circle. This is the only type of function that can be its own derivative. Functions of this type have horizontal, but not vertical, asymptotes. This type of function models the accrual **(uh-KROO-ul)** of compound interest. Logarithmic functions are inverses of this class of functions. For 10 points, name this class of functions exemplified by y equals two to the x.
ANSWER: **exponential** functions

12. This composer depicted a water nymph's love for a human prince in the soprano aria "Song to the Moon" from his opera *Rusalka* **(roo-SAHL-kuh)**. Popular concert pieces by this composer include his eight Humoresques for piano and his Cello Concerto in B minor. An English horn solo introduces the main melody of the *Largo* second movement of a symphony by this composer whose Native American and African-American musical influences stem from his 1893 visit to the United States. For 10 points, name this Czech composer whose final symphony is titled *From the New World*.
ANSWER: Antonin **Dvorak** **(DVOR-zhahk)** [or Antonin Leopold **Dvorak**]

13. These structures are labeled as either bonding or antibonding depending on the molecule's MO diagram. LCAO theory describes how these structures add together to form their molecular version. Elements in the copper family break the aufbau **(OWF-bow)** principle while filling these structures. The principal and angular quantum numbers describe the size and shape of these things, and the Pauli exclusion principle requires that the two particles inside them have opposite spins. For 10 points, name these regions where electrons travel around the nucleus, which include s and p.
ANSWER: atomic **orbital**s [or molecular **orbital**s]

14. While on his way to propose to a woman from Timnah **(TIM-nuh)**, much to his parents' dismay, this man is attacked by a lion. This man makes up a riddle after seeing bees nesting in the lion's body, which temporarily stumps his groomsmen until his bride tells them the solution. This man killed a thousand of his enemies using the jawbone of a donkey. This Nazirite **(NAH-zeer-ite)** is blinded by the Philistines, although God gives him the power to destroy their temple as he dies. For 10 points, what biblical Judge has his hair cut off by Delilah?
ANSWER: **Samson** [or **Shamshoun**]

15. This phenomenon occurs four residues apart in alpha helices, between an amine **(AY-meen)** and a carbonyl **(CAR-bun-ill)** group. Three instances of this phenomenon stabilize cytosine-guanine **(SIE-toh-zeen GWAHN-een)** base pairing in DNA, linking the two strands. Every hydride of the oxygen family has a low boiling point except for water because they lack this intermolecular force, which also produces a decrease in density when water freezes into ice. For 10 points, identify this weak attractive force between either oxygen, nitrogen, or fluorine and the element with atomic number one.
ANSWER: **hydrogen bond**ing

1. This director made a film in which a man takes a car trip to receive a special degree from Lund University. That movie by this director is about Professor Isak **(EE-sahk)** Borg. In another of this man's films, Antonius Block returns from the Crusades to a plague-ridden country and is told, "No one escapes me," by an allegorical man who ultimately claims him. In this director's best-known film, a medieval knight plays chess with Death. For 10 points, name this Swedish director of *Wild Strawberries* and *The Seventh Seal*.
ANSWER: Ingmar **Bergman** [or Ernst Ingmar **Bergman**]

2. When Odr **(OH-der)** is away, this deity cries tears of red gold out of loneliness. The sun, the moon, and this deity are all demanded as payment by a giant who is hired to build a wall. This deity owns a bountiful meadow home to half of all dead soldiers. This deity sleeps with four dwarves over four consecutive nights in order to obtain her most prized possession, the necklace Brisingamen **(brih-sin-GAH-men)**. After a war, she moves to Asgard with her father Njord **(rhymes with "fjord")** and her similarly named twin brother, Frey. For 10 points, name this Norse goddess of love and beauty.
ANSWER: **Freya** [or **Freyja**; do not accept "Frey" or "Freyr"]

3. The central family of this novel is estranged by all their neighbors except for the handyman Uncle Venner. A shop in this novel is frequented by a boy named Ned Higgins who buys all the gingerbread animals. In this novel, Judge Jaffrey dies in an old oak chair in front of a portrait that, when moved, reveals the missing deed to the title location. In this novel, Mr. Holgrave falls in love with Phoebe and is revealed to be the descendant of the original owner of the deed, Matthew Maule. For 10 points, what Nathaniel Hawthorne novel follows the Pyncheon family, who live in the title building?
ANSWER: The *House of the Seven Gables*

4. This monarch was shot at by the deranged poet Roderick McLean. Many women in this ruler's household were replaced with Conservatives during the Bedchamber Crisis. This monarch mythically only gave four pounds in aid to the Irish during the potato famine and greatly preferred the Conservative Prime Minister Benjamin Disraeli over his Liberal rival William Gladstone. This wife of her cousin, Prince Albert, celebrated her Diamond Jubilee in 1897. For 10 points, name this British queen from 1837 to 1901.
ANSWER: **Victoria** [or Alexandrina **Victoria**]

5. The coefficients of these functions can be written in terms of elementary symmetric functions using Vieta's **(vee-ET-uhs)** formulas. Dividing one of these things by a linear factor can be done via synthetic division. They have a number of complex roots equal to their degree according to the fundamental theorem of algebra, and methods of factoring them include completing the square. For 10 points, name these functions which consist of a sum of terms with coefficients and variables with non-negative integer exponents.
ANSWER: **polynomial**s

In what British novel does the shattering of the conch show how the chaos of Jack and Roger has won out?
ANSWER: _**Lord of the Flies**_

This is a calculation question. How many regular polygons have integer interior angle measures?
ANSWER: **22**