## Question #1: Social Studies – U.S. History

*10 points*

| | |
|---|---|
| In 1983, this person's sons started an Institute for Management & International Studies that works with the Wharton School at the University of Pennsylvania. This person's uncle developed Dr. Schotz's Viennese Cream, which this person marketed. She worked closely with Arnold L. van Ameringen, and their success exploded with Youth Dew. This person's companies included Origins, Prescriptives and Aramis. This woman's companies were valued at several billion dollars when she died in 2004. Name this cosmetics mogul whose eponymous company markets the Clinique [klin-EEK] brand. | Estée **Lauder** [accept **Joseph Lauder** before "Viennese Cream"] |

## Question #2: Literature – British Literature

*10 points*

| | |
|---|---|
| After being taken in, this character almost drowns in a bathtub, is burned by a cigar, and sticks his nose in an inkwell. This resident of a bungalow in the Segowlee cantonment fought a great war single-handed, or he did all the real fighting while being aided by the tailbird Darzee and the muskrat Chuchundra. This character declines to consume Karait after killing him, because that would slow him down. This character pays back Teddy and his family by killing Nagaina. Name this mongoose in a Rudyard Kipling story. | **Rikki-tikki**-tavi |

## Question #3: Fine Arts – Art History

*10 points*

| | |
|---|---|
| The left side of one painting by this artist shows a woman kissing a pale boy and a kneeling person reaching up to a sad sitting person with a black mustache. That 1824 painting by this artist showed a recent attack by Ottomans against an island. Another painting by this artist, set during the July Revolution, shows a bare-breasted woman climbing dead bodies, holding a bayonet in one hand and a tricolor flag in the other. Name this painter of *The Massacre at Chios [KEE-ohss]* and *Liberty Leading the People.* | (Ferdinand Victor) Eugène **Delacroix** [oo-zhen **deh-luh-kwah**] |

## Question #4: Science – Physics

*10 points*

| | |
|---|---|
| This person showed that glass prevented electromagnetic waves from producing a spark in a coil, which turned out to be a form of the photoelectric effect. That experiment was similar to this scientist's earlier experiments that confirmed Maxwell's theories, and this person added to that confirmation by showing that radio waves have several properties in common with light. This person is the namesake of a unit that is dimensionally equivalent to the becquerel [bek-ur-el]. Identify this namesake of the inverse-second, which measures frequency. | Heinrich **Hertz** |

## Question #5: Literature – World Literature

*10 points*

| This character and her father indicate that she is willing to marry her suitor by opening a window shutter, but she does not get her wish for a midnight wedding with torches. This woman and her husband move to Yonville [yawn-veel] from Tostes ["toast"] when she becomes pregnant. Her daughter Berthe is forced to work in a cotton mill upon the death of this woman's husband, a second-rate doctor. Name this Frenchwoman driven to suicide as a result of debts she racks up in her affairs with Rodolphe Boulanger [roh-dawlf boo-lawn-zhay] and Léon Dupuis [lay-aw doop-wee] in a novel by Gustave Flaubert ["flow-bear"]. | Madame **Emma** **Bovary** [accept either underlined name] |
|---|---|

## Question #6: Mathematics – Math Concepts

*10 points*

| The evolute [ee-VAWL-yoot] of logarithmic spirals and this shape is congruent to the original shape. If the top of a pendulum is hung from a cusp on one of these curves, then the pendulum traces out this shape and its period does not depend on its amplitude. The acceleration of an object moving along this curve is equivalent to the acceleration around a circle, but the velocity has an additional constant term in one direction. This curve solves the tautochrone [TAWT-oh-"crone"] and brachistochrone [bruh-KISS-toh-"crone"] problems, the latter of which means that it is the fastest way to get between two points under the influence of gravity. Name this curve generated by following a point on the rim of a rolling circle. | **cycloid**(s) |
|---|---|

## Question #7: Fine Arts – Classical Music & Opera

*10 points per part*

| | Identify these opera terms. | |
|---|---|---|
| **1** | This is a song in an opera for one character. It often expresses emotion and brings attention to the singer. | **aria**(s) |
| **2** | This technique used by opera singers and string musicians is a rapid variation in pitch while holding a note. Unlike tremolo, in this technique different pitches are used, but only slightly different ones. | **vibrato** |
| **3** | This Italian term refers to comic operas, many of which were written during the 18th and early 19th centuries. One of the last examples was Gaetano Donizetti's ["guy"-TAH-noh doh-nee-ZET-tee'z] *Don Pasquale* [dohn pahss-KWAH-lay]. | opera **buffa** |

## Question #8: Fine Arts – Classical Music & Opera

*10 points per part*

| | Plácido Domingo, José Carreras, and Luciano Pavarotti sang in this vocal range, and formed a group named for it. | |
|---|---|---|
| **1** | Name this male vocal range that is higher-pitched than bass. | **tenor** |
| **2** | Hoffmann is a tenor this composer's opera *The Tales of Hoffmann*. | Jacques **Offenbach** |
| **3** | In this tenor aria from *Rigoletto*, the Duke of Mantua compares women to "a feather in the wind". | "La **donna è mobile**" [lah **DOHN-nah ay moh-BEE-lay**] [prompt on "**Woman Is Fickle**" or similar phrases] |

## Question #9: Mathematics – Geometry

*10 points per part*

| | Answer the following about right triangles: | |
|---|---|---|
| **1** | What term refers to the longest side of a right triangle? | **hypotenuse**(s) |
| **2** | If a right triangle's legs measure 3 units and 4 units, what is the length of the *altitude* to the hypotenuse? | **12/5** or **2.4** or **2 + 2/5** |
| **3** | Consider the same triangle — that is, a 3-4-5 right triangle. Find the length of the diameter of a circle that is circumscribed around it. | **5** |

## Question #10: Mathematics – Geometry

*10 points per part*

| | The diagonals of the parallelograms created using this theorem are the bimedians of the original quadrilaterals. | |
|---|---|---|
| **1** | Identify this theorem, named for an 18th-century Frenchman, stating that connecting the midpoints of the sides of any quadrilateral will always form a parallelogram. | **Varignon**'s [var-een-yawn'z] theorem |
| **2** | If the original quadrilateral is convex and has an area of 36 square units, find the area of its Varignon parallelogram. | **18** square units |
| **3** | If the original quadrilateral has a *diagonal* whose length is 12 units, find the length of a side of its Varignon parallelogram that is parallel to the diagonal. | **6** units |

## Question #11: Literature – British Literature

*10 points per part*

| | After an argument in this play, one character shakes another and screams "The Kettle, you fool!". | |
|---|---|---|
| **1** | Name this play in which two hired killers argue over turns of phrase referring to putting on a kettle to make tea. | *The* **_Dumb Waiter_** |
| **2** | This author of *The Dumb Waiter* wrote about a celebration for the pianist Stanley Webber in *The Birthday Party.* | Harold **Pinter** |
| **3** | At the end of *The Dumb Waiter*, Ben finds out through the speaking tube that this person is to be killed. | **Gus** |

## Question #12: Literature – British Literature

*10 points per part*

| | This essay is set in Moulmein ["mole-main"], and its writer complains that the town has many Buddhist priests who "stand on street corners and jeer at Europeans". | |
|---|---|---|
| **1** | Name this essay in which the author admits he undertook the title action "solely to avoid looking a fool". | **"Shooting an Elephant"** |
| **2** | This author of "Shooting an Elephant" satirized the Russian Revolution and its aftermath in *Animal Farm.* | George **Orwell** [or Eric Arthur **Blair**] |
| **3** | Orwell uses this noun for the person killed by the elephant. This term refers to unskilled laborers in South Asia. | **coolie** |

## Question #13: Science – Biology

*10 points per part*

| | This molecule is a product of glycolysis [gly-KAH-luh-siss], the citric acid cycle, and oxidative phosphorylation ["OX"-ih-day-tiv fahss-FOR-ih-LAY-shun]. | |
|---|---|---|
| **1** | Name this molecule used in RNA synthesis, a major energy source for many biological processes. | **ATP** or **adenosine triphosphate** |
| **2** | In addition to containing phosphate groups and adenine, ATP contains this pentose monosaccharide [PEN-tohss mah-noh-"SACK-uh-ride"]. | **ribose** ["**RYE**"-**bohss**] |
| **3** | ATP is used to facilitate these types of reactions in which the free energy of the reactants is less than that of the products. | **endergonic** [**en-dur-GAH-nik**] reactions |

## Question #14: Science – Biology

*10 points per part*

| | This phylum is named for the rod that supports the backs of its organisms during some stage of their life. | |
|---|---|---|
| **1** | Name this animal phylum that contains vertebrates. | **chordate**s ["**CORE-date**"s] or **Chordata** ["**CORE**"-**DAH-tuh**] |
| **2** | This non-vertebrate subphylum of Chordata contains sea squirts. | **tunicate**s or **tunicata** or **ascidian** |
| **3** | Simple vertebrates are classified as *agnatha* [ag-NATH-uh]; that name means they do not have this body part. | **jaw**s [accept **jaw**bones] |

## Question #15: Social Studies – U.S. History

*10 points*

| | |
|---|---|
| According to this Supreme Court decision, "The word 'among' means 'intermingled with'" when the Constitution uses the phrase "among the several states". Even though this case was not based in New Jersey, the defendant was a former New Jersey governor represented by William Wirt and Daniel Webster, and lost this case based on an argument that Article I, section 8, clause 3 overruled New York law. Name this 1824 decision in which the Supreme Court held that the Commerce Clause gives the federal government the power to regulate navigation. | ___**Gibbons**___ *v.* ___**Ogden**___ [accept either underlined name; accept underlined names in either order] |

## Question #16: Miscellaneous – Popular Culture

*10 points*

| | |
|---|---|
| The third song on this band's second album was originally called "The Lemon Song", but its title was changed to "Killing Floor" after a lawsuit claimed the song was written by blues singer Howlin' Wolf. Another lawsuit established Willie Dixon as the co-writer of this band's "Whole Lotta Love." This group won a 2016 lawsuit from the group Spirit over a guitar part that introduces a song whose first lyrics are "There's a lady who's sure all that glitters is gold." Name this 1960s and '70s band led by guitarist Jimmy Page and Singer Robert Plant, who performed "Stairway to Heaven". | **Led Zeppelin** |

## Question #17:  Literature – U.S. Literature

*10 points*

| | |
|---|---|
| In this work, the people of a society are compared to the water of a wave, whose unity is only phenomenal. This work's last paragraph describes those who "sit hereafter out of fear" of the wheel of fortune. This essay ends with the line "Nothing can bring you peace but the triumph of principles" and advises the reader to "trust thyself". The phrase "a foolish consistency is the hobgoblin of little minds" is in this essay. Name this Transcendentalist essay by Ralph Waldo Emerson. | <u>**"Self-Reliance"**</u> |

## Question #18:  Science – Biology

*10 points*

| | |
|---|---|
| This organ's zona fasciculata [ZOH-nuh fuh-sik-yoo-LAH-tuh] is below its zona glomerulosa [ZOH-nuh gloh-mair-yoo-LOH-suh]. If this organ is overactive, the result can be Conn's syndrome, in which there is too little renin in the body. Abdominal obesity and limb shrinking occur in Cushing's syndrome, in which these glands produce too much cortisol. The cortex of this gland is responsible for producing glucocorticoids [GLOO-tik-oh-KOR-tih-koydz] and some androgens. These glands are named for their location on top of the kidneys. Name these glands that produce epinephrine, which plays a role in the fight-or-flight response. | **adrenal** glands [or **suprarenal** glands] |

## Question #19: Social Studies – World History

*10 points*

| | |
|---|---|
| The remains of this person's settlement were studied by Anne Stine during the 1960s after Stine's husband Helge Ingstad's [HEL-guh EENG-stahd'z] discoveries at L'Anse aux Meadows [lahnss aw "meadow"]. Alternatively, it is possible that the explored site is Thorfinn Karlsefni's [THOR-fin karl-SEF-nee'z] Straumsfjord [STRAWMS-"fjord"] rather than this person's settlement. This person referred to two of his discoveries as Helluland and Markland, which mean "Flat Rock Land" and "Forest Land". There is disagreement as to whether this person's brothers Thorvald and Thorstein came close to his settlement. Around the year 1000, this "lucky" explorer discovered Vinland. Name this son of Erik the Red. | **Leif Erikson** [accept either underlined name; accept Leifr **Eiríksson** or **Leif** the Lucky] |

## Question #20: Science – Astronomy

*10 points*

| | |
|---|---|
| This person's namesake coordinate system uses the multiplier radius minus twice mass, all divided by radius, and is used to find static spherically symmetric solutions in general relativity. Einstein-Rosen bridges, a type of Lorentzian wormhole, are sometimes named for this scientist, since they result from his metric for black holes with no charge or angular momentum. This scientist was the first person to exactly solve the Einstein field equations. Name this astronomer who stated that if a mass $M$ is concentrated within $2GM$ over $c^2$ ["$c$ squared"] of the center of mass, nothing can escape, leading to that quantity being his namesake radius for a black hole. | Karl **Schwarzschild** [sh'VARTS-cheeld] |

## Question #21: Mathematics – Trigonometry

*10 points per part*

| | Find these derivatives involving trigonometric functions. Assume $x$ is always in radians and all derivatives are with respect to $x$. | |
|---|---|---|
| 1 | Find the derivative of the tangent of $x$. | **sec**ant **squared** of $x$ or **sec**ant of $x$, **quantity squared** or the **quantity** **sec**ant of $x$, **squared** |
| 2 | Find the derivative of the arctangent of $x$. | **1 over the quantity** $1 + x^2$ or **1 over the quantity** $x^2 + 1$ |
| 3 | Evaluate the derivative of the secant of $x$ when $x = \pi/4$ ["$x$ equals pi over 4"]. | $\sqrt{2}$ ["the square **root** of **2**" or "**radical 2**"] |

## Question #22: Mathematics – Trigonometry

*10 points per part*

| | This law can be used to find the side length of a triangle if you know at least two angles' measures and at least one other side's length. | |
|---|---|---|
| 1 | Name this law stating that three ratios are equal to each other. | law of **sine**s [do not accept answers containing "cosine"] |
| 2 | In the law of sines, each side is divided by the sine of the angle across from it. This value equals the diameter of what circle related to the triangle? | **circumcircle** or **circumscribe**d circle |
| 3 | Suppose a triangle has a side of length 8 that is across from an angle whose sine is 1/3. Find the length of a side across from a 30° angle in that triangle. | **12** |

## Question #23: Literature – U.S. Literature

*10 points per part*

| | The main characters of this story considered dropping the name "Dillingham" from their mailbox when their income dropped to $20 per week. | |
|---|---|---|
| 1 | Name this story in which one character sells her hair to Madame Sofronie so that she can afford a platinum watch chain. | "The **Gift of the Magi**" |
| 2 | This author wrote "The Gift of the Magi". | **O. Henry** [accept William Sydney **Porter**] |
| 3 | Before selling her hair, Della thrice counts out this amount of money, with which she could not afford a present for James. | $**1.87** |

## Question #24: Literature – U.S. Literature

*10 points per part*

| | Most of the action of this play takes place around the Hotel Costa Verde in Mexico, which the Fahrenkopf family and vocal teacher Judith Fellows visit. | |
|---|---|---|
| 1 | Name this play in which Judith confronts the former Reverend T. Lawrence Shannon, who had an affair with a 17-year-old. | *The **Night of the Iguana*** |
| 2 | *The Night of the Iguana* is by this playwright. He wrote about Laura Wingfield and her collection of figurines in *The Glass Menagerie.* | (Thomas Lanier) "Tennessee" **Williams** |
| 3 | Though Reverend Shannon is leading a tour of Baptist teachers, he was ordained in this denomination. | **Episcopal** Church or **Episcopal**ian [prompt on **Anglican** Communion] |

## Question #25: Social Studies – World History

*10 points per part*

| | Pierre-Charles Villeneuve [pyair sharl veel-noov] and Federico Gravina both died shortly after losing this battle. | |
|---|---|---|
| **1** | Name this decisive 1805 loss of the French and Spanish to the British. | Battle of **Trafalgar** |
| **2** | Horatio Nelson, who was shot dead during the Battle of Trafalgar, commanded this ship during the battle that is now on display in Portsmouth, England. | HMS ***Victory*** |
| **3** | A few weeks after Trafalgar, this British colonel captured four French ships at Cape Ortegal after they escaped from Trafalgar. | (Sir) Richard (John) **Strachan** |

## Question #26: Social Studies – World History

*10 points per part*

| | Name these battles that took place in what is now Belgium. | |
|---|---|---|
| **1** | This 1302 victory of the Flemish over the French was nicknamed for the objects that were collected from the battlefield. | Battle of the **Golden Spurs** [or **Courtrai** or **Guldensporenslag**; prompt on **spur**s] |
| **2** | Napoleon was sent to St. Helena after this loss to the Duke of Wellington. | Battle of **Waterloo** |
| **3** | This battle, known as the Ardennes [ar-den] Counteroffensive to the Allies, was the last offensive launched by the Germans on the Western Front in World War II. | Battle of the **Bulge** |

## Question #27: Science – Physics

*10 points per part*

| | Archimedes' principle states that the magnitude of this force is the same as the weight of the fluid an object displaces when it is immersed. | |
|---|---|---|
| 1 | Name this force that pushes a floating object up. | **buoyant** force or **buoyancy** |
| 2 | Some derivations of buoyancy combine the relationship between depth and fluid pressure with this principle, which states that pressure in a fluid is transmitted to every point in the fluid. | **Pascal**'s principle or **Pascal**'s law |
| 3 | This device uses buoyancy to measure the specific gravity of a fluid. There are specific versions for specific fluids, like saccharometers ["sack"-uh-RAH-mih-turz] to measure sugar water and lactometers [lack-TAH-mih-turz] to measure milk. | **hydrometer**s ["hi"-DRAH-mih-tur z] |

## Question #28: Science – Physics

*10 points per part*

| | This phenomenon explains the creation of rainbows and the separation of white light using a glass prism. | |
|---|---|---|
| 1 | Name this phenomenon in which different wavelengths of light refract at different angles. | (chromatic) **dispersion** [prompt on **chromatic aberration**] |
| 2 | When white light is dispersed, violet curves the most, while this color curves the least among all visible colors. | **red** light |
| 3 | This scientist is the namesake of a measure of dispersion in terms of a ratio of differences between indices of refraction. | Ernst (Karl) **Abbe** [accept **Abbe** number] |

## Question #29: Literature – World Literature

*10 points*

| In a story told within this novel, a man with a Tartar's beard serves as a gatekeeper and denies a man entry to "the law". This novel opens on "one fine morning," the protagonist's 30<sup>th</sup> birthday. Near the end of this novel, the protagonist sees somebody who might be Fräulein Bürstner. In another scene, the protagonist encounters the flogging of two men who had asked him for bribes, Willem [VIL-elm] and Franz. This novel is about a chief cashier who is arrested for reasons he does not understand. Name this Franz Kafka novel in which Joseph K. [YOH-seff KAH] is the defendant in the title proceeding. | ***The Trial*** [or *Der **Prozess**]* |
|---|---|

## Question #30: Social Studies – U.S. History

*10 points*

| This ship was credited for destroying the USS *Congress* and the USS *Cumberland.* John Mercer Brooke redesigned this ship under the orders of Stephen Mallory after it was destroyed, leaving only its lower hull and machinery at Norfolk Navy Yard. This ship was supposed to attack the USS *Minnesota* to stop a blockade, but another ironclad warship got in its way. It engaged that ship at an inconclusive battle known as the Battle of Ironclads or the Battle of Hampton Roads. Name this Confederate ship that was slowed by the USS *Monitor.* | CSS ***Virginia*** [or USS ***Merrimac****k*] |
|---|---|

## Question #31: Science – Chemistry

*10 points*

| This law, which does not have volatility or solubility constants, is followed perfectly when the activity coefficient of each component is 1 and the enthalpy of mixing is 0. Those characteristics, which occur when a plot of total vapor pressure versus constituent composition is linear, are the characteristics of an ideal solution. This law is often combined with Dalton's law of partial pressures to find total vapor pressure. Identify this law, named for a Frenchman, which states that partial vapor pressure equals pure vapor pressure times mole fraction. | **Raoult**'s law |
|---|---|

## Question #32: Mathematics – Math Concepts

*10 points*

| When three congruent examples of these shapes intersect at right angles, the result is called a Steinmetz solid. Removing this shape from a sphere produces a shape whose volume — surprisingly — only depends on the height of the intersection, and which is often described as a "napkin ring". The coordinate system based on this shape is equivalent to adding a $z$-coordinate to 2D polar coordinates. This shape can be produced by dragging a circle in a line through space, or by rolling up a piece of paper. Name this shape that consists of two circular bases and the surface between them. | **cylinder**s [accept answers that additionally contain "right" or "circular"] |
|---|---|

## Extra Question #1: Literature – World Literature

*10 points*

| | |
|---|---|
| This character's fiancé abandoned her when she attempted to make him jump over a riding crop. This woman's dog Diana gets sick after running around with mongrels. A sermon about John the Baptist leads to the revelation of this woman's affair with a valet. This title character walks out at the end of her play after her lover tells her "But there is no other way. Go!", encouraging her to commit suicide. Name this woman who says "Kill me too!" after Jean [zhahn] decapitates her canary in a play by August Strindberg. | Miss **Julie** [or Froken **Julie**] |

## Extra Question #2: Fine Arts – Art History

*10 points*

| | |
|---|---|
| For this country's Gardens By The Bay, the British sculptor Marc Quinn made a boy who seems to be floating, with his right hand on the ground. By this country's namesake river, the sculpture *First Generation* by Chong Fah Cheong portrays children jumping into the water. This country's Suntec City mall features an enormous bronze circular fountain, the *Fountain of Wealth*. The Colombian artist Fernando Botero sculpted a fat bird that sits in this country's United Overseas Bank Plaza, which along with Republic Plaza and One Raffles Place contains its tallest buildings. Name this small country at the end of the Malay Peninsula. | **Singapore** |

## Extra Question #3: Mathematics – Math Concepts

*10 points*

| | |
|---|---|
| If this number equals 2 for a knot, then it is a rational knot. For a knot, this number is the minimal number of arcs either above or below a plane intersecting the arc. In graph theory, this term is equivalent to "isthmus", "cut-edge", or "cut-arc". If an undirected connected graph has this type of edge, then Robbins' theorem does not apply to it. This term describes an edge of a connected graph that needs to exist for the graph to be connected. Give this term that can refer to a physical object, seven of which led to Leonhard Euler's original formulations of graph theory when he tried to solve a problem in Königsberg. | <u>**bridge**</u>s |

## Extra Question #4: Science – Biology

*10 points*

| | |
|---|---|
| A class of proteins originally found in this structure, and now named for it, include a treatment for hepatitis B and a protein that is combined with interferon ["interfere-on"] in some cancer treatments. This structure is sometimes removed in patients with myasthenia gravis [my-uss-THEN-ee-uh GRAH-viss]. This structure is located near the superior vena cava [VEE-nuh KAY-vuh], behind the sternum. It is active during childhood and atrophies in adults. This structure uses autoimmune regulator to remove cells that attack the body's own proteins. Name this organ that allows cells to mature into helper or killer lymphocytes that are used by the immune system. | <u>**thymus**</u> |

## Extra Question #5: Social Studies – World History

*10 points*

| | |
|---|---|
| The town of Mana in this territory considers Anne-Marie Javouhey [zhah-voo-hay] its mother because she set up an educational system for freed slaves in it. This territory now contains the European Space Agency's primary spaceport. René Belbenoît [ren-ay bel-ben-wah] and Albert Londres [al-bair lawn-druh] criticized the harsh conditions in the penal colony in this territory, which was described in Henri Charrière's [awn-ree shar-yair'z] memoir *Papillon* [pah-pee-law]. That penal colony in this territory, which for a time housed Alfred Dreyfus, was called Devil's Island. This territory is the largest part of the European Union outside Europe. Name this territory in South America whose major settlement is Cayenne. | **French Guiana** or **Guyane francaise** [prompt on **Guiana** or **Guyane** but do not prompt on "Guyana"] |

## Extra Question #6: Science – Physics

*10 points per part*

| | A very early type of this device was a rotating arrow called a versorium [vur-SOR-ee-um]. | |
|---|---|---|
| **1** | Name these devices used to detect static electricity. They often use a hanging pith ball, or two very thin metal leaves. | **electroscope**s |
| **2** | Electroscopes were used in early experiments to detect charge stored in these devices. They are made by coating the inside and outside of an insulating container with conducting foil. | **Leyden jar**s [prompt on **capacitor**s or **condensor**s] |
| **3** | This effect is the building of static charge by rubbing two objects together. | **triboelectric** ["TRY"-boh-"electric"] effect or **triboelectricity** |

## Extra Question #7: Science – Physics

*10 points per part*

| | The only quarks lighter than this one are the up and down quarks. | |
|---|---|---|
| **1** | The second generation of quarks are the charm quark and which other quark? | **strange** quark |
| **2** | These mesons were the first particles discovered that included a strange quark. These particles contain an up or down anti-quark, and they decay into two or three pions ["PIE"-ahnz]. | **kaon**s [**KAY-ahn**z] or **K** mesons |
| **3** | Kaon decay violates this type of symmetry represent by two letters. This symmetry cannot be violated if it is combined with time reversal. | **CP** symmetry [or **charge-parity** symmetry] |

## Extra Question #8: Social Studies – World History

*10 points per part*

| | Forces supporting this leader defeated forces supporting Mark Antony and Cleopatra at the Battle of Actium ["ACT"-ee-um]. | |
|---|---|---|
| 1 | Name this first emperor of Rome, who ruled until he died in 14 CE. | **Augustus** Caesar or **Octavian**(us) [or Gaius **Octavius**; do not accept or prompt on "Caesar"] |
| 2 | Augustus and Mark Antony were in the Second Triumvirate with this leader. He was exiled by Augustus after the Sicilian revolt. | Marcus (Aemilius) **Lepidus** |
| 3 | Augustus's attempts to control Germania were ruined when this leader lost three legions because Arminius tricked him at the Battle of Teutoburg [TOY-toh-burg] Forest. | Publius Quinctilius **Varus** |

## Extra Question #9: Social Studies – World History

*10 points per part*

| | The first African leaders to be guests at the White House were this country's Edwin Barclay and William Tubman, the latter of whom oversaw its economic growth during the mid-20th century. | |
|---|---|---|
| 1 | Name this country that declared independence from the American Colonization Society. | (Republic of) **Liberia** |
| 2 | This person was elected president in 1997 after the First Liberian Civil War, but was exiled in the Second Civil War. He was convicted of war crimes and is now a prisoner in the UK. | Charles (McArthur) G(hankay) **Taylor** |
| 3 | This American company ran an enormous rubber plantation in Harbel, Liberia, and has been criticized for its deals with Charles Taylor. | **Firestone** Tire and Rubber Company [prompt on **Bridgestone**] |