**VHSL States 2016-2017 - Round 04 - First Period, Fifteen Tossups**

1. This quantity's namesake quantum mechanical operator is equal to negative i times h-bar times the gradient. Dividing Planck's constant by this quantity gives the de Broglie wavelength. An alternate definition of Newton's second law involves the time derivative of this quantity. This quantity is conserved in both inelastic and elastic collisions, and the change in this quantity is equal to the impulse. For 10 points, name this vector quantity defined as mass times velocity.
ANSWER: linear **momentum** [or **p**; do not accept "angular momentum"]

2. A device used to measure this quantity is commonly calibrated by dipping into red, yellow, and blue calibration solutions. The value of this quantity at which an amino acid carries no net electrical charge is called the iso-electric point. This quantity is calculated using the Henderson-Hasselbalch equation for buffers, which cushion changes in this quantity. This quantity is the negative logarithm of the hydrogen ion concentration, and is also measured using indicators. For 10 points, name this quantity that has a value of seven for a neutral solution.
ANSWER: **pH**

3. The healer Iapyx (aye-AH-pix) removed an arrow from this man's leg. This hero's father is made lame by Zeus' thunderbolt after bragging about having sex with a goddess on Mount Ida. This man becomes enraged after seeing his opponent wearing the belt of Pallas. That opponent of this man was a king of the Rutuli (RUH-too-LEE) named Turnus, who was originally promised this man's wife Lavinia. For 10 points, name this Trojan who becomes the first Roman hero and whose journey is told in an epic by Virgil.
ANSWER: **Aeneas**

4. In a December 1946 meeting in this country, Lucky Luciano hosted a massive conference of American mobsters. An American ship called the *Virginius* was hired in the 1870's to deliver weapons to this modern-day country. The U.S. proposed purchasing this modern-day country in the Ostend Manifesto. It was the subject of the Teller and Platt Amendments. It's not Puerto Rico, but the Battle of San Juan Hill was fought on this island. For 10 points, what Caribbean country was where the U.S.S. *Maine* exploded, leading to the Spanish-American War?
ANSWER: Republic of **Cuba**

5. The lesser shielding effect of electrons in this type of orbital means that 6s electrons are pulled closer to the nucleus and the ionic radii of lanthanide elements is less than expected. The first element to have an electron in this type of orbital in the ground state is cerium, which has an electron in this orbital's *n* equals four subshell. This type of orbital can hold fourteen electrons, the most of the four basic orbital types. For 10 points, what type of atomic orbital can hold more electrons than the s, p, or d orbitals?
ANSWER: 4**f** orbital

6. By a law named for this person, the rate of change in temperature is equal to minus k times the difference in an object's temperature and the temperature of the object's environment. In SI units, a constant approximately equal to 6.67 times 10 to the minus 11th appears in another law named for this man, which posits an inverse-square dropoff in the gravitational attraction between two bodies with distance. For 10 points, name this British physicist who derived a law of universal gravitation and three laws of motion.
ANSWER: Sir Isaac **Newton**

7. While imprisoned in this state, a man wrote what became the book *Soul on Ice*. That future activist in this state was Eldridge Cleaver. Mario Savio's "Free Speech" movement originated at a university in this state, which, in 1969, became the first state to allow true no-fault divorce. Huey Newton worked primarily in this state, co-founding a group that created armed citizen patrols to monitor police activities. That group founded in this state used as its symbol a large cat. For 10 points, the Black Panthers were founded in what state's city of Oakland?
ANSWER: **California**

8. Leontyne Price made her debut at La Scala singing the lead role of this opera. In this opera, a man who is chosen to lead an army in the chorus *Alta cagion v'aduna* confesses his secret love in the recitative *Se quel guerrier io fossi.* This opera's title character sings the aria *O patria mia* on the eve of her lover's wedding to the princess Amneris. The title character of this opera is sealed up to die along with her Egyptian lover Radames. For 10 points, name this Giuseppe Verdi opera about a princess of Ethiopia.
ANSWER: ***Aida***

9. The Afrikaans word for these creatures names the eastern half of the Great Escarpment that runs through South Africa. The king of Bhutan uses a title that mentions this creature, which is also found on Bhutan's flag. A legend states that carp that jumped over a waterfall along the Yellow River would emerge as one of these creatures. It's not a lion, but images of these creatures are often manned by large groups of people during Chinese New Year celebrations. For 10 points, name these serpentine mythological beings that sometimes breathe fire.
ANSWER: **dragon**s

10. After the attempted murder of a ruler of this kingdom, the powerful Tavora family was publicly executed. A myth in this European kingdom claims that the dead king Sebastian will return from his long disappearance and rule again. In the 1500's, it conquered both Goa (GO-uh) and Malacca after battles in the Indian Ocean. In this kingdom, Prince Henry the Navigator spearheaded naval exploration, and explorers from here included Vasco da Gama. For 10 points, what Iberian kingdom suffered a devastating earthquake at Lisbon?
ANSWER: Kingdom of **Portugal** [or **Portuguese** Empire; or Kingdom of **Portugal** and the Algarves; or the United Kingdom of **Portugal**, Brazil, and the Algarves]

11. This goddess tore a patch of hair off the chest of a cyclops in her youth. One of this goddesses' followers gave birth to Arcas before being changed into a bear and placed in the sky, while another of her followers was devoured by a sea monster and was Phaedra's (FAY-druh's) object of affection; those followers are the nymph Callisto and Hippolytus. This goddess, to whom deer were sacred, was born on the island of Delos to Leto, along with her twin Apollo. For 10 points, name this Greek goddess of the hunt.
ANSWER: **Artemis**

12. Two characters on this show met during a game of charades organized by Pepper Saltzman. A character on this show continually shouts "Gotta fix that step!" and is a real estate agent who advocates "peerenting" instead of "parenting." A Facebook campaign about this show demanded that the characters of Cameron and Mitchell be allowed to kiss. On this show, Jay is married to the much younger Gloria, who is played by Sofia Vergara. For 10 points, name this ABC sitcom, a mockumentary about the extended Pritchett family.
ANSWER: ***Modern Family***

13. The speaker of a poem by this author describes how wondering men "try so much but they can't touch my inner mystery." In a book by this author, the main character's mother covers Uncle Willie with layers of potatoes and onions to hide him from the Ku Klux Klan. This poet of "Phenomenal Woman" described five years of self-imposed silence in an autobiography about her childhood in Stamps, Arkansas. For 10 points, name this African American author of *I Know Why the Caged Bird Sings*.
ANSWER: Maya **Angelou** [or Marguerite Annie **Johnson**]

14. In play by this author, a servant dreams about climbing up a tree to steal some golden eggs. In a novel by this author, the young writer Arvid Falk meets with a group of bohemians in the title location. This author of *The Red Room* wrote a play in which the title character fantasizes about opening a hotel on Lake Como with a valet who decapitates her pet finch. In that play by this author, the title aristocratic woman kills herself after consummating her scandalous relationship with Jean. For 10 points, name this Swedish playwright of *Miss Julie*.
ANSWER: August **Strindberg**

15. In this state, an act of vandalism featured the lines "Nazi Republicans get out of town or else" spray painted near a firebombed G.O.P. office in Hillsborough. At an apartment complex in this state, a man was shot to death after leaving his vehicle, even though his family originally claimed he was only reading a book. Keith Lamont Scott was killed by the police in this state. Pat McCrory took almost a month to concede losing to Roy Cooper in the race for governor in this state. For 10 points, what state experienced September 2016 riots around Charlotte?
ANSWER: **North Carolina**

 **VHSL States 2016-2017 - Round 04 - Directed Period**

1A. What rookie successfully replaced Tony Romo as the Dallas Cowboys starting quarterback during the 2016 season?
ANSWER: Rayne Dakota "Dak" **Prescott**

1B. D-Wave Systems makes what types of computers that operate on an ensemble of qubits?
ANSWER: **quantum** computers

2A. Which English actress frequently collaborated with her husband Laurence Olivier and played Scarlett O'Hara in *Gone With the Wind?*
ANSWER: Vivien **Leigh** [or Vivian Mary **Hartley**]

2B. What two-word Latin term literally meaning "dark chamber" is also the name of a device used to project an image onto a screen through a pinhole?
ANSWER: **Camera obscura**

3A. This is a 20-second calculation question. What is the greatest common factor of 723 and 90?
ANSWER: **3** [The prime factorizations are 723=3\*241 and 90=2\*3^2\*5.]

3B. This is a 20-second calculation question. A jar holds 8 yellow balls and 7 red balls. If two balls are drawn randomly without replacement, what is the probability that both are yellow?
ANSWER: **4/15** [The first ball is yellow with probability 8/15, and then the second ball is yellow with probability 7/14, or 1/2. Our answer is (8/15)\*(1/2).]

4A. What two-word Latin phrase describes a listing of the main characters of a play and is often paired with the actors and actresses who portray them?
ANSWER: **Dramatis personae**

4B. What continent is where the alpaca was originally from?
ANSWER: **South America**

5A. What was the first state to ratify the U.S. Constitution?
ANSWER: **Delaware**

5B. The leader of what country was impeached in December 2016 due to charges that she was controlled by Choi Soon-Sil, the daughter of a cult leader?
ANSWER: **South Korea** [or **Republic of Korea**; prompt on Korea do not accept "Democratic People's Republic of Korea"]

6A. Which civilization whose legendary kings include Lars Porsena controlled much of the Italian peninsula before the rise of Rome?
ANSWER: **Etruscan**s

6B. SQL is a computer language used to query and manage what organized collections of data that can be used to store information about books for a library?
ANSWER: relational **database** [or electronic **database**]

7A. Which French king participated in the Third Crusade and later conquered much of western France from King John of England?
ANSWER: **Philip II** [or **Philip Augustus**]

7B. What father of Malcolm and Donalbain is the king of Scotland whom Macbeth murders?
ANSWER: King **Duncan**

8A. This is a 30-second calculation question. What is the volume of the rectangular prism with two faces with area 3, two faces with area 8, and two faces with area 6?
ANSWER: **12** [Using l, w, and h for the dimensions, we have l\*w=3, w\*h=8, l\*h=6. Multiplying them all together gives l^2\*w^2\*h^2=3\*8\*6=144. Taking square roots gives l\*w\*h=12.]

8B. This is a 30-second calculation question. What is the value of the square of the quantity sine of 15 degrees plus cosine of 15 degrees end quantity?
ANSWER: **1.5** or **3/2** or **one and a half** [Expanding the square gives sin(15)+cos(15)+2sin(15)cos(15)=1+2sin(15)cos(15)=1+sin(2\*15)=1+1/2.]

9A. What Christian movement, whose members included both John Adams and John Quincy Adams, preached that God was one entity, as opposed to a Trinity?
ANSWER: **Unitarian**ism

9B. A Robert Burns poem observing that the "best-laid schemes" often go awry is addressed to what type of animal that he dubs a "tim'rous beastie"?
ANSWER: **mouse** [or "To a **Mouse**"]

10A. What American author wrote the novel *Dark Laughter*, which was parodied by Hemingway in *The Torrents of Spring*, and the story collection *Winesburg, Ohio*?
ANSWER: Sherwood **Anderson**

10B. In 2016, the LIGO experiment, which has sites in Hanford, Washington and Livingston, Louisiana, announced the first direct detection of what phenomenon predicted by general relativity?
ANSWER: **gravitational wave**s [or **gravity wave**s]

 **VHSL States 2016-2017 - Round 04 - Third Period, Fifteen Tossups**

1. This compound is stored in namesake plastids in root caps where it is used for gravitropism (gra-vih-TROH-piz-um). A common test for this molecule is looking for a dark blue color after adding Lugol's iodine. Both glycogen and this alpha glucose polymer are broken down by amylase (AM-uh-laze). It is usually a mixture of amylose (AM-uh-lohss) and amylopectin (am-uh-lo-PEK-tin). For 10 points, name this polysaccharide used to store energy in plants that is also used to stiffen clothes.
ANSWER: **starch** [or **amylopectin** before it is read; or **amylose** before it is read; prompt on carbohydrates; prompt on polysaccharides]

2. The Recreation and Amusement Association in this country organized prostitution for the amusement of foreign soldiers. The proposed Operation Downfall was never carried out against this country, which signed an agreement with the U.S. aboard the USS *Missouri*. The Doolittle air raid was directed against this country, which fought the United States in the Battles of Coral Sea and Midway. For 10 points, the U.S. dropped two atomic bombs on what Asian country during World War II?
ANSWER: Empire of **Japan** [or **Nippon**]

3. A mayor of this city was a "Copperhead" during the Civil War and was named Fernando Wood. Reportedly, it was going to be burned by rebellious slaves in the "Great Negro Plot" of 1741. The "Dead Rabbits" was one of many gangs in this city that operated in the Five Points neighborhood and featured mainly Irish-American members. In 1863, massive riots protesting the Civil War's draft took place in this city. For 10 points, what city was the first U.S. capital under the Constitution and was the home of the Tammany Hall political machine?
ANSWER: **New York** City [or **NYC**; or **Manhattan**]

4. A Sophie Germain prime is a prime *p* where one plus this number times *p* is also prime. Prime numbers equal to one less than a power of this number are named for Mersenne. The solution to the Towers of Hanoi problem with *n* rings is one less than the *n*th power of this number. Boolean variables have this many possible values. In the ambiguous case, there are this many triangles with a given combination of angle and sides. A secant line to a function joins this many points on its graph. For 10 points, what number is the base of binary arithmetic and the only even prime number?
ANSWER: **2**

5. This composer commemorated the contemporary siege of Corfu with his only surviving oratorio, *Juditha triumphans.* Much of this composer's music was written for performance at the Ospedale della Pieta, where he served as violin teacher. This composer's set of twelve violin concerti, *The Contest Between Harmony and Invention,* begins with a set of programmatic concerti depicting different times of the year. For 10 points, name this Italian Baroque composer of *The Four Seasons.*
ANSWER: Antonio **Vivaldi**

6. In the *Aeneid*¸ false dreams are said to pass through a gate made of this substance, while true dreams pass through a gate of horn. A being originally made of this substance gave birth to Paphos after falling in love with her creator, Pygmalion (pig-MAIL-ee-unn). After being partly eaten by the gods, Pelops was given a shoulder made of this substance. It was used with gold to make cult statues called chryselephantine (CRISS-uh-ell-uh-FAN-teen) sculptures. For 10 points, name this substance harvested from animal teeth or tusks.
ANSWER: **ivory**

7. The Doppler effect is affected by this other phenomenon when the source is moving at a right angle, or transverse, to the detector. An experimental test of this effect was conducted by Hafele and Keating and involved placing atomic clocks on planes. This effect resolves the twin paradox, in which one twin travels near the speed of light and returns to Earth to find another twin has aged more. For 10 points, name this relativistic effect in which moving clocks run more slowly.
ANSWER: **time dilation** [prompt on special relativity or general relativity]

8. This artist painted an unoccupied execution device in his *Early Electric Chair*. He painted a self-portrait in which a camouflage pattern covers his face. In the program for an exhibition of his work in Stockholm, this artist wrote: "In the future, everyone will be world-famous for 15 minutes." This artist, who worked at a studio called "The Factory," painted silkscreen portraits of icons such as Elvis Presley and Marilyn Monroe. For 10 points, name this Pop Artist known for his depictions of *Campbell's Soup Cans.*
ANSWER: Andy **Warhol** [or Andrew **Warhola**]

9. *ESPN*'s Stephen A. Smith told this NBA player "You don't want to make an enemy out of me" in October 2015. After being drafted in 2007 from Texas, this player's franchise moved from Seattle after his rookie season. This man called his mom "the real MVP" in his acceptance speech. In a December 2016 game, he recorded his first triple-double with his new team in just three quarters. For 10 points, name this NBA player who made headlines in summer 2016 by leaving the Oklahoma City Thunder to join the Golden State Warriors.
ANSWER: Kevin **Durant** [prompt on "KD"]

10. In a novel by this author, a man carrying a letter from Napoleon is sent to prison for treason, after which his fiancee Mercedes marries Fernand Mondego. This creator of Edmond Dantes also wrote a novel in which John Felton is seduced into releasing Milady de Winter. In that novel by this man, the title characters Porthos, Athos, and Aramis are joined by D'Artagnan (dar-TAN-yan). For 10 points, name this French novelist of *The Count of Monte Cristo* and *The Three Musketeers*.
ANSWER: Alexandre **Dumas** (doo-MAH)

11. This character suggests that the Black Man in the forest who writes names in a book is responsible for the minister holding his heart with his hands. She is said to have been plucked from the rose bushes near the jail by her mother. This girl makes a mermaid costume out of seaweed and is amused by her reflection in armor at Governor Bellingham's. She throws flowers at a symbol of guilt on her mother's chest. For 10 points, name this illegitimate daughter of Dimmesdale and Hester Prynne in Nathaniel Hawthorne's *The Scarlet Letter*.
ANSWER: **Pearl**

12. The fake "Shapira Strips" were supposedly found near this body of water. It is near a series of caves where the Essenes of Qumran (KOOM-ron) maintained an extensive library. The ancient palace of Masada overlooks this body of water; that structure was fortified by Herod the Great. Near this place, the Arab Potash company produces millions of tons of potash annually. Texts found in 1946 near this body of water are some of the oldest surviving Biblical texts in the world. For 10 points, name this very salty lake bordered by Jordan and Israel.
ANSWER: **Dead Sea** [or **Salt Sea** until "salty" is read; or **Yam ha-Melah**; or **Al-Bahr al-Mayyit**]

13. The permanent variety of this quantity is central to a hypothesis about spending developed by Milton Friedman. John Maynard Keynes's theory that consumption varies absolutely with this quantity is no longer widely accepted. A 2016 referendum in Switzerland rejected the basic form of this quantity. In the U.S., the median amount of this quantity for a household is approximately fifty thousand dollars. For 10 points, name this quantity of money that one earns from a job.
ANSWER: **income**

14. Two characters in this play plan to go forward with the "Florida Idea," which entails managing the publicity campaign for the sale of sporting goods. A woman in this play reveals that she discovered a piece of rubber hose hidden behind a fuse box by her suicidal husband. In this play, the title character is fired by Howard Wagner and deliberately crashes his car in an attempt to secure a future for his sons Happy and Biff. For 10 points, Willy Loman appears in what play by Arthur Miller?
ANSWER: ***Death of a Salesman***

15. Plays opposing this policy were often staged at Barney Simon's Market Theatre. This policy was first implemented by D.F. Malan's National Party, and required citizens to carry pass books that assigned them to particular homelands. The leaders of a group opposing this policy were arrested at Liliesleaf Farm, subjected to the Rivonia Trial, and imprisoned in Robben Island. F.W. de Klerk ended this policy, which was opposed by the ANC under Nelson Mandela. For 10 points, name this policy of state-imposed racism in South Africa.
ANSWER: **apartheid**

 **VHSL States 2016-2017 - Round 04 - Tiebreaker Questions**

1. One of these values called a Jacobian is multiplied by the integrand when changing variables in an integral. The solution to a system of linear equations is equal to a quotients of these values by Cramer's Rule. This value is generally computed using cofactor expansion, but can be computed by adding products along south-west lines and subtracting them along north-east lines in the 3-by-3 case. If it is non-zero, a matrix has an inverse. For 10 points, name this operation that, for a 2-by-2 matrix with first row a b and second row c d, is defined as a d minus b c.
ANSWER: **determinant**

2. This painting's right side shows a woman hanging from the strings of a harp and a large knife sticking out between two ears. In this painting's center, a man can be seen staring at a rat through a tube. A large pink fountain can be seen on the left side of this painting, with a depiction of God with Adam and Eve in Eden directly below it. This triptych's panels depict Eden, Paradise, and Hell. For 10 points, name this triptych, the most famous work of Hieronymus Bosch.
ANSWER: *The* ***Garden of Earthly Delights***

3. Even though this country's radio network revealed invasion plans on the air, its forces won the Battle of Goose Green. A newspaper here printed the headline "Gotcha" after this country sank an enemy's ship, the *General Belgrano*. Its leader was the target of both the failed Brighton Hotel bombing and Bobby Sands' hunger strike. During the 1980's, this country was led by a Conservative known as the "Iron Lady." For 10 points, what country fought Argentina in the Falklands War under the leadership of Prime Minister Margaret Thatcher?
ANSWER: **United Kingdom** of Great Britain and Northern Ireland [or **UK**; or Great **Britain**; or **England**; prompt on Northern Ireland]

4. This poem's speaker declares, "The snows of the Tyrol, the clear beer of Vienna are not very pure or true." Towards the end of this poem, the speaker notes, "The black telephone's off at the root, the voices just can't worm through." This poem describes the author's husband as "a man in black with a Meinkampf look" and tells the title addressee, "there's a stake in your fat black heart," concluding, "you bastard, I'm through." For 10 points, name this poem by Sylvia Plath addressed to her dead father.
ANSWER: "**Daddy**"

5. In the *Phaedrus* (FAY-druss), this thing is said to be pulled by two chariots, one yoked to a black horse and one yoked to a white horse. In another text, these things travel to a giant shaft of rainbow light called the Spindle of Necessity. The recollection and cyclical arguments are posited by Socrates when arguing with Cebes (SEE-bees) about this thing's immortality. Humans are said to have the rational type of this thing, while animals have the sensitive type, according to Aristotle's *De Anima*. For 10 points, name this immaterial part of a living being.
ANSWER: **soul**

A raffle sells 1000 tickets at five dollars each. Two winning tickets are drawn and each wins a prize of one thousand dollars. What is the expected value of a ticket to this raffle?
ANSWER: **-$3** [or **a loss of three dollars**] [Two tickets make a profit of $995, while 998 tickets make a loss of $5. The weighted average is then 2\*995-998\*5/1000=-3.]

What novelist described a journey to the paradise of Shangri-La in *Lost Horizon* and an aging schoolteacher in *Goodbye, Mr. Chips*?
ANSWER: James **Hilton**