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Tossups

1. Luigi Cherubini [kair-oo-BEE-nee] wrote two compositions of this type, the first of which Robert Schumann [SHOO-mon] called "without equal in the world". Gabriel Fauré [gah-bree-el foh-ray] wrote a work of this type that is unusual because it omits some traditional sections such as the *Tuba mirum*. This type of work usually contains a *Dies irae* [DEE-ess EE-ray] and *Kyrie eleison* [KEER-ee-ay eh-LAY-uh-sahn], and it typically ends with an *In paradisum* section. Wolfgang Mozart died while working on one of these compositions, so Franz Xaver Süssmayr [SOOSS-"my"-ur] finished it. Name these pieces often written to comfort mourners at a funeral.
Answer: **requiem** masses or **requiems** [prompt on **mass**es for the dead]

2. One novel written and set in this country is about a woman who repeatedly turns down marriage proposals from Harold Beecham because she thinks she is ugly. That novel about Sybylla [sib-ILL-uh] Melvyn is *My Brilliant Career*. Another novel written and set in this country is written as though it is an autobiography until the end, when a man known as S. C. narrates the protagonist getting into a gunfight and being hanged. Another novel by the same author is about an attempt to move a glass church from one part of this country to another. Name this country that was the birthplace of Miles Franklin and the author of *True History of the Kelly Gang* and *Oscar and Lucinda*, Peter Carey.
Answer: (Commonwealth of) **Australia**

3. The legendary Anglo-Saxon brothers who took over Britain in the 5th century were both named for this type of animal. Ancient Vikings in Iceland were sometimes buried with these animals, and so were some people from ancient China, most notably Duke Jing of Qi [chee]. Some of the best known examples of these animals in U.S. history are Sergeant Reckless, Traveller, and Comanche. One of these animals named Marengo is pictured with Napoleon in a Jacques-Louis David [zhahk loo-ee dah-veed] painting. Name these animals that have traditionally been used by cavalry fighters and to pull chariots.
Answer: **horse**s [accept **stallion**s]

4. This set of numbers satisfies the least-upper-bound property, which is part of the reason that this set is considered complete. The floor and ceiling functions map this set of numbers into the integers. In high school-level math, this set is the range—but not the domain—of logarithmic functions. Complex numbers are often defined using two of these numbers as components, one of which is multiplied by i. Pi and -2 are both in this set. The number line represents this set. Name this set of numbers that includes all rational and irrational numbers.
Answer: **real** numbers or **real**s [prompt on ***R***]

5. Foraminifera [for-a-muh-NIFF-ur-uh] are this type of protist. The largest known examples of these protists live in the Mariana Trench and are about four inches across. These organisms have much in common with Sarcodina [sar-koh-"DIE"-nuh] but do not form a clade with them. These organisms are part of the Tubulinea [toob-yoo-LIN-ee-uh] class, including the *Chaos carolinense [car-oh-LIN-enss]*. There is some debate as to whether or not *Naegleria fowleri* [nay-"GLARE"-ee-uh FOW-luh-"rye"] is this type of organism; its popular name states that it is the "brain-eating" type of this organism. Name these single-cell organisms that can change shapes using their pseudopods.
Answer: **amoeba** or **ameba**e [or **amoeboid**s or **Amoebidae**]

6. On the television show *Gossip Girl*, Nelly broke up with her boyfriend at a concert by this rapper. A 2012 song by this rapper begins by sampling the Etta James song "Something's Got a Hold on Me," followed by him singing the lyrics "Yes I can, doubt better leave, I'm running with this plan." Another song by this rapper has an opening by Sia [SEE-uh] followed by the lyrics "I like crazy, foolish, stupid, party-going-wild, fist-pumping music." Kesha's [KESH-uh'z] career took off after she was featured on this rapper's song "Right Round". Name this rapper who sang "Good Feeling" and "Wild Ones" and whose stage name reflects the state he is from.
Answer: Flo **Rida** [or Tramar Lacel **Dillard**]

7. A failed assassination attempt against this person is portrayed in the book *The Day of the Jackal*. This politician resigned after a referendum to set up regional councils and reform his country's senate was voted down in 1969. As this person rose to power earlier, he was very critical of his former boss Philippe Pétain [peh-tan]. After a referendum supported the Évian Accords, this person granted independence to Algeria. This person's Appeal of 18 June was given from London to inspire French resistance. Name this politician who led the Free French Forces against Nazi Germany and later became the president of France.
Answer: Charles **de Gaulle** [sharl duh **"goal"**] [prompt on **Gaulle**]

8. In a play by this writer, Louka [LOH-kuh] says, "You have the soul of a servant, Nicola [ni-KOH-luh]", which prompts the reply "Yes: that's the secret of success in service." Louka is the servant of Raina Petkoff in a play this writer set during the Serbo-Bulgarian War. In another play by this writer, two major characters are at first referred to as "the gentleman" and "the note-taker". The female lead in that play is at first called "the flower girl", but is later called by her name Eliza. This person wrote that play about a bet as to whether the men could get Eliza to behave like a duchess [DUCH-ess]. Name this Irish playwright of *Arms and the Man* and *Pygmalion*.
Answer: George Bernard **Shaw**

9. One rule for this process states that the gradient of chemical potential equals temperature times the gradient of the natural log of activity. That rule is the Maxwell–Stefan [STEH-fahn] rule. Other laws for this process say that accumulation is proportional to the second derivative of concentration with respect to length, and flux is proportional to the product of concentration times mass fraction. Those two rules were discovered by Adolf Fick. When this process involves the movement of a solvent such as water, it is called osmosis. Name this process, caused by molecular motion, that is a net flow of molecules from higher concentrations to lower concentrations.
Answer: **diffusion** [accept **diffusing**; do not accept "effusion"]

10. A holiday honoring this person occurs on March 19, and in the 20th century Catholics provided an alternative to May Day by celebrating this person on May 1. Accounts differ as to whether this man was the son of Heli [HEH-lee] or the son of Jacob. This man decided to divorce his wife quietly, but he did not follow through after an angel in a dream told him not to fear keeping his wife. In a later dream, this man was told, "Rise, take the child and his mother, and flee to Egypt, and remain there until I tell you." He was later told to take his wife to Israel, but he took her to Nazareth. Name this husband of Mary in the New Testament.
Answer: **Joseph** [or **Yoseif**]

11. One painting by this artist shows a huge army of skeletons partly blocked by wooden slabs with crosses, but in the center of the painting the skeletons are knocking over the slabs and attacking people. This painter of *The Triumph of Death* made another work that depicts three people trudging downward towards some skating rinks. This painter depicted one of those people carrying a fox carcass, and the three people are followed by several dogs. Name this Dutch Renaissance painter of *The Hunters in the Snow* whose son was also a prominent painter.
Answer: Pieter **Bruegel** [**BROH-gull**] the Elder [accept Peasant **Bruegel**]

12. This leader's career ended when he was put under house arrest by Ta Mok. While in power, this person used the phrase "Brother Number Two" to refer to Nuon Chea [nohn chay]. Under this person's leadership, people from cities were referred to as "New People", and the slogan used on them was "To keep you is no profit; to destroy you is no loss." After Prince Sihanouk [SEE-uh-nook] was overthrown by Lon Nol, this person led a civil war effort that resulted in him becoming the Prime Minister. He lost that title after a series of border fights with Vietnam. Name this Khmer Rouge [k'mair roozh] leader blamed for killing one-fourth of his country in the Killing Fields in Cambodia.
Answer: Pol **Pot** or **Saloth** Sar

13. The federal government cannot forcibly remove this status according to the *Afroyim [uh-FROY-im] v. Rusk* decision. This status can be granted according to the doctrines of *jus sanguinis* ["use" "SAN"-gwin-iss] and *jus soli* ["use" SOH-lee], the latter of which has been used in the U.S. since a court decision involving Wong Kim Ark. The first clause of the 14th Amendment of the Constitution nullified the *Dred Scott v. Sanford* ruling, which had said Dred Scott did not have this status. People who hold a green card can apply for this status after five years. Name this status that, in the U.S., a person can achieve by being native-born or being naturalized.
Answer: **citizen**ship [or being a **citizen**]

14. In response to another character mentioning respect after saying "I never boast, and I never tell lies", this character says "Respect was invented to cover the empty place where love should be." After that argument with her lover, this character visits her brother Stiva's [STEE-vuh'z] wife, Dolly. This character becomes distraught when she receives a telegram from Vronsky saying that he cannot return to her quickly. This woman is the title character of a novel that states "All happy families resemble one another; each unhappy family is unhappy in its own way." Name this woman who throws herself in front of a train in a novel by Leo Tolstoy.
Answer: **Anna Karenina** [accept either]

15. The carriers of this force are represented by a 3-by-3 matrix of complex numbers with 10 conditions on it, which explains why there are eight types of this force. The carrier of this force is affected by this force, and as a result, at very small distances this force increases with distance. The lack of effect of this force at extremely small distances is asymptotic ["ass-imp"-TAH-tik] freedom. This fundamental force is described in the theory of quantum chromodynamics ["CHROME-oh-dynamics"], and it is carried by gluons ["glue-ons"]. Name this fundamental force that binds quarks together to form hadrons [HAY-drahnz], and which binds protons and neutrons together to form an atomic nucleus.
Answer: **strong** nuclear force or **strong** interaction

16. Mills Godwin held this position in the 1960s as a Democrat and in the 1970s as a Republican. The only African-American person to hold this position was Douglas Wilder, who did so during the 1990s. The person who held this position from 2010 to 2014 was convicted on federal corruption charges after receiving gifts from the CEO of Star Scientific, though those charges were later overthrown. That person was Bob McDonnell. In 2019, the holder of this position was discovered to have worn blackface based on photos in his medical-school yearbook. Name this position in which Ralph Northam was recently replaced by Glenn Youngkin.
Answer: **Governor** of **Virginia** [prompt on **Governor**]

17. During the 21st century there has been debate over the extreme warp in this location's stellar disk, which is likely caused by satellite galaxies. Observations of several novas in this location by Heber [HAY-bur] Curtis led to the Great Debate between Curtis and Harlow Shapley. Edwin Hubble used images of Cepheid [SEH-fee-id] variable stars in this location to demonstrate that it is not part of the Milky Way. This galaxy is the largest galaxy in the Local Group, about twice as large as the Milky Way but with about the same mass. Name this galaxy that within the next five billion years will collide with us.
Answer: **Andromeda** Galaxy [prompt on **Local Group** before the first "galaxy"]

18. One poem by this writer states "This is Number Three. What a trash, to annihilate each decade." This writer put those lines after stating: "I am only thirty. And like the cat, I have nine times to die." Another poem by this writer states "I have always been scared of you, with your Luftwaffe [LOOFT-vah-fuh], your gobbledygoo." A novel by this writer is about an intern at *Ladies' Day* magazine who goes through electroconvulsive therapy as treatment for depression. Name this poet of "Lady Lazarus" and "Daddy" who wrote about Esther Greenwood in *The Bell Jar*.
Answer: Sylvia **Plath**

19. This U.S. president tried to encourage people to save more money by promoting buttons that said "W.I.N.", which stood for "Whip Inflation Now." There were two assassination attempts against this president, by Sara Jane Moore and by Charles Manson follower "Squeaky" Fromme. When this person became president, he stated "Our long national nightmare is over." This person is the only person to serve as both vice president and president without being elected to either job; he replaced Spiro Agnew as vice president. This person lost the election of 1976 to Jimmy Carter. Name this president who pardoned Richard Nixon after succeeding him.
Answer: Gerald R(udolph) **Ford** (Jr.) [or Leslie Lynch **King** Jr.]

20. Acyl ["ASS-ill"] groups in this organelle can be transformed into triglycerides ["try-GLISS-uh-rides"]. The lumen of this organelle is capable of transmitting an unfolded protein response that can lead to apoptosis [ay-pahp-TOH-siss]. In animal cells, this organelle takes up more space than other organelles and is attached to the outer nuclear membrane. Like the Golgi [GOHL-jee] apparatus, this organelle has several flattened sacs called cisternae [siss-TER-nee]. This organelle is next to the Golgi apparatus, which receives proteins from it. This organelle is classified based on whether it is covered with ribosomes ["RYE"-bih-sohmz]. Name this organelle that is classified as smooth or rough.
Answer: **endoplasmic reticulum** or **ER** [accept "smooth" or "rough" as additional information]

21. Routh's [raoth's] theorem gives the ratio of two instances of this quantity. Vertices are counted to find this quantity when applying Pick's theorem. Coordinates are placed into a matrix with the number 1 along a row or column to find this quantity when using the shoelace formula. The square root of the quantity "semi·perimeter times the differences between the semi·perimeter and side lengths" gives this quantity in Heron's formula. A definite integral gives the "signed" version of this quantity between a function's graph and the x-axis. Name this quantity that, for a triangle, equals 1/2 times base times height.
Answer: **area** [accept **area** of a polygon or triangle]

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Bonuses

1. Identify these sexually transmitted diseases:

A. The human immunodeficiency virus, HIV, causes this disease when the patient's T-cell count falls below 200 cells per micro·liter.

Answer: **AIDS** or **acquired immune deficiency syndrome**

B. This virus is the most common sexually-transmitted infection in the U.S. The Gardasil [GAHR-duh-sil] vaccine decreases the chance of it causing cancer.

Answer: **HPV** or **human papillomavirus**

C. This disease is the most common disease caused by protozoans. Most men have no symptoms, but it can cause pain and shortened pregnancies in women.

Answer: **trich**omoniasis [TRIK-uh-muh-NY-uh-siss]

2. This shogunate and its historic period are sometimes named for Edo [EH-doh], which was the name of Tokyo at the time.

A. Name this shogunate that ruled Japan from 1600 until 1868.

Answer: **Tokugawa** shogunate

B. Tokugawa Ieyasu [ee-eh-ah-soo] gained control after winning this massive battle in 1600.

Answer: Battle of **Sekigahara**

C. The Tokugawa shogunate ended with this war, as Edo was surrendered.

Answer: **Boshin** War

3. The experiment named for this scientist supported the wave theory of light.

A. Name this English scientist who found an interference pattern when he performed a double-slit experiment in 1801.

Answer: Thomas **Young**

B. Young's theory about vision was later improved by this German scientist. The form of free energy named for this scientist equals internal energy minus temperature times entropy.

Answer: Hermann von **Helmholtz**

C. Carl Gauss unified the work by Young and this French scientist on capillary pressure. The operator named for this scientist is the divergence of the gradient.

Answer: Pierre-Simon **Laplace** [pyair see-mohn **lah-plahss**] [prompt on **Laplacian**]

4. This poem observes "What mighty contests rise from trivial things."

A. Name this poem about a "dire offense" by the Baron against Belinda.

Answer: *The* ***Rape of the Lock***

B. This satirist wrote *The Rape of the Lock*, *The Dunciad ["DUNCE"-ee-ad]*, and *An Essay on Criticism*.

Answer: Alexander **Pope**

C. Finish the line from *An Essay on Criticism* that begins "For fools rush in…"

Answer: "For Fools rush in **where Angels fear to tread**."

5. In this opera, the Duke of Mantua sings the aria "La donna è mobile" [lah DAW-nah eh MAW-bee-leh].

A. Name this opera whose title character is the Duke's cursed hunch-backed court jester.

Answer: ***Rigoletto***

B. This composer wrote *Rigoletto* and *Aida*.

Answer: Giuseppe (Fortunino Francesco) **Verdi** [joo-ZEP-peh **VAIR-dee**]

C. For this opera, Verdi wrote "Va, pensiero", which is nicknamed "Chorus of the Hebrew Slaves".

Answer: ***Nabucco***

6. This god used the hammer Mjölnir [mee-YOHL-neer].

A. Name this god of thunder in Norse mythology.

Answer: **Thor**

B. Thor was the enemy of this creature also known as the Midgard Serpent.

Answer: **Jörmungand**r [**YOR-mun-gahnd**-ur] [prompt on **World Serpent**]

C. Thor caught Jörmungandr while fishing with this giant and using this giant's ox as bait. This giant cut the line, so they will fight again at Ragnarök.

Answer: **Hymir**

7. In *The Adventures of Tom Sawyer*, this character is first described as a juvenile pariah and the son of the town drunkard.

A. Name this character. In another novel, he travels with Jim on the Mississippi River.

Answer: **Huckleberry** "**Huck**" **Finn** [accept any underlined name]

B. This woman, who lives with her sister Miss Watson, adopts Huckleberry Finn.

Answer: the Widow **Douglas** [prompt on the **Widow**]

C. At the end of *The Adventures of Huckleberry Finn*, Tom Sawyer wears this item around his neck with a watch-guard after Jim helps out a doctor.

Answer: a **bullet**

8. Answer the following about transforming graphs of functions.

A. This type of transformation produces a mirror image of the original, sometimes by multiplying the x- or y-coordinate by -1.

Answer: **reflect**ion or **reflect**ing

B. Find the angle between the axis of reflection and the x-axis if a transformation consists of changing x-coordinates into y-coordinates and vice versa. Give your answer in degrees.

Answer: **45** degrees

C. Find the area of a transformed shape if the original area is 6 square units and the transformation consists of multiplying all lengths by 3.

Answer: **54** square units

9. This play includes both a logical argument as to whether Socrates is a cat [pause] and a housewife announcing that her cat has been trampled.

A. Name this play about an unusual epidemic. It begins with an argument between Bérenger [bair-en-zhay] and Jean [zhahn], and it ends with an argument between Bérenger and Daisy.

Answer: ***Rhinoceros*** [or ***Rhinocéros***]

B. This author wrote *Rhinoceros* as well as *The Bald Soprano*.

Answer: Eugène **Ionesco** [oo-zhen **yawn-ess-koh**] [or Eugen **Ionescu**]

C. *The Bald Soprano* is set in the suburbs of this city.

Answer: **London**, England, United Kingdom

10. For an ellipsoid, this quantity equals 4/3 times pi times the product of the three radii [RAY-dee-"eye"].

A. Name this quantity that for a rectangular prism equals length times width times height.

Answer: **volume**

B. Name the type of product used to find the volume of a parallelepiped [par-uh-lel-uh-PIE-pid]. This product combines a cross product and dot product.

Answer: (scalar) **triple** product

C. Find the volume of a sphere whose radius is 3 units, in terms of pi.

Answer: **36** (times) **pi** cubic units [do not accept or prompt on partial answers]

11. Answer the following about paintings that show apples:

A. This surrealist painter placed a green apple in front of a person's face in *The Son of Man*.

Answer: René (Fran cois Ghislain) **Magritte** [ren-ay **mah-greet**]

B. This French Post-Impressionist artist painted *The Basket of Apples*, *Still Life with Apples*, and *The Plate of Apples*.

Answer: Paul **Cézanne**

C. In *The Three Graces*, this artist had each grace hold an apple with one hand and put the other hand on the shoulder of another grace. Over 100 years later, Peter Paul Rubens painted the same subject without apples.

Answer: **Raphael** [or **Raphaello Sanzio** da Urbino or Raphael **Santi**; accept any underlined name]

12. The relativistic form of this effect uses the equation square root of the entire quantity, the quantity c plus v, end quantity, divided by the quantity c minus v.

A. Name this effect in which frequencies and wavelengths change due to relative motion between the source of a wave and the observer.

Answer: **Doppler** effect

B. Doppler red-shifts were used to find this value. It represents the speed galaxies are moving outwards divided by their distance from the center of the universe.

Answer: **Hubble** constant

C. Objects moving away from us are red-shifted. What similar term refers to the Doppler effect on objects moving towards us?

Answer: **blueshift**ed

13. Near the end of this play, Emily asks "Do any human beings ever realize life while they live it?—every, every minute?".

A. Name this play that begins with the Stage Manager announcing that it is set in Grover's Corners, New Hampshire.

Answer: ***Our Town***

B. *Our Town* was written by this playwright who also wrote *The Skin of Our Teeth*.

Answer: Thornton (Niven) **Wilder**

C. Simon Stimson directs this group in *Our Town*. Dr. Gibbs says that he does not know why his wife belongs to this group.

Answer: Congregational Church **choir** [do not accept or prompt on "chorus"]

14. This person was the first woman to hold federal office in the United States.

A. Name this person who was elected to the U.S. House of Representatives in 1916 and 1940.

Answer: Jeannette **Rankin**

B. Rankin was one of 50 representatives to vote against declaring war on Germany in 1917, and she was the *only* representative to vote against war on this country in 1941.

Answer: (Empire of) **Japan** [or **Nihon**-koku or **Nippon**-koku or Dai **Nippon** Teikoku or (Greater) **Japan**ese Empire]

C. This woman, who represented Maryland in the House for 10 years and in the Senate for 30 years, now holds the record for being the longest-serving U.S. Congresswoman.

Answer: Barbara (Ann) **Mikulski**

15. One way to carry out this process is the McCabe Thiele [THEE-lee] method.

A. Name this process in which components of a mixture are separated by boiling and condensation.

Answer: **distill**ation [or **distill**ing]

B. These mixtures are very difficult to separate by distillation because their vapor has the same concentration as their liquid.

Answer: **azeotrope**s [**AY-zee-oh-"trope**s"]

C. This class of hydrated alumino·silicate [uh-LOO-mih-noh-SILL-ih-kut] minerals can be used to separate many azeotropes by using these minerals as molecular sieves.

Answer: **zeolite**s [ZEE-uh-**"light**s"]

16. In this poem's section about Byblis [bub-LEESS] and Caunus [KAW-nuss], it states "The gods have their own laws."

A. Name this Latin narrative poem, written in the first decade after the birth of Jesus, that covers from the time of Chaos before Earth's creation until the death of Julius Caesar.

Answer: ***Metamorphoses***

B. This author wrote *Metamorphoses* as well as *Ars Amatoria*.

Answer: (Publius) **Ovid**(ius Naso) [**AH-vid**]

C. James George Frazer translated this Ovid work whose title is sometimes given as *The Book of Days* or *On the Roman Calendar*. The part describing the second half of the calendar was either lost or never written.

Answer: ***Fasti*** or ***Fastorum*** *Libri Sex*

17. This person led the Redshirts during the Expedition of the Thousand.

A. Name this general who helped unify Italy.

Answer: Giuseppe (Maria) **Garibaldi** [joo-ZEP-pay **gar-ee-BAHL-dee**]

B. Garibaldi helped this person become the king of Italy.

Answer: **Victor Emmanuel II** [or **Vittorio Emanuele II**; prompt on partial answers]

C. Before leading the Redshirts in Italy, Garibaldi led them in this country's civil war, where his opponents wore white armbands.

Answer: (Oriental Republic of) **Uruguay** [or (República Oriental del) **Uruguay** or (Eastern Republic of) **Uruguay**]

18. These plants bear flowers and have stamens with pollen sacs.

A. Name these plants that enclose their seeds within fruit, unlike gymnosperms [JIM-no-"sperms"].

Answer: **angiosperm**s or **Angiospermae**

B. Angiosperms are typically placed at this taxonomic [tak-soh-NAH-mik] rank that is equivalent to an animal phylum.

Answer: **division**(s)

C. This type of branching in angiosperms occurs when lateral growth patterns are more significant than the central shoot. This branching is contrasted with monopodial [mah-noh-POH-dee-ul] branching.

Answer: **sympodial** branching

19. The mathematics describing these shapes was developed starting with a paper titled "How Long Is the Coast of Britain?".

A. Name these shapes that exhibit self-similarity.

Answer: **fractal**s

B. The article was written by this mathematician, the namesake of a set generated by repeatedly squaring a complex number and adding a constant.

Answer: Benoît **Mandelbrot** [ben-wah **man-dul-brawt**]

C. The Cantor set has fractal properties and is generated by repeatedly removing the middle third from a set of numbers. Find the ratio of the remaining set to the original set after the middle third is removed twice.

Answer: **4/9**

20. This person described the psyche [SY-kee] as being broken into the id, ego, and super-ego.

A. Name this Austrian thinker considered the founder of psychoanalysis.

Answer: Sigmund **Freud** [or Sigismund Schlomo **Freud**]

B. Freud titled one of his books *Totem and* this concept. This concept means an action that a culture does not allow, such as incest.

Answer: *Totem and* ***Taboo***

C. In *Totem and Taboo*, Freud referred to this scientist's "conception of the primal horde," but many critics believe that Freud misinterpreted this scientist's work.

Answer: Charles (Robert) **Darwin**