

## Harvard Fall Tournament XIV

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Packet 3

Tossups

1. Hilbert’s basis theorem states that any ring of these objects over a Noetherian [“nur-THEAR-ian”] ring is Noetherian. Formal derivatives can check if these objects have distinct linear factors. The Stone–Weierstrass theorem describes how these objects can approximate continuous functions. An orthonormal set of these functions is named for Legendre [“luh-JON-druh”]. The roots of a (\*) “characteristic” one of these functions define a matrix’s eigenvalues [“EYE-ghen-values”]. Each term in one of these functions can be differentiated by the “power rule.” Rational functions are quotients of these functions, which can be divided using synthetic division. For 10 points, name these functions, whose degree-two types are quadratic.

ANSWER: polynomials

<R. Li, Math>

2. In a film, a stoic member of this profession visits a “comfort room” after failing a psychological evaluation. A Natalie Portman-played member of this profession notably doesn’t wear a diaper in a Noah Hawley film. Peculiar dust patterns near a bookshelf indicate the presence of a member of this profession. 23 years of messages are received by (\*) Cooper, a man with this profession, in a film produced by Nobel laureate Kip Thorne. *Ad Astra* and *Lucy in the Sky* depict this profession. After a gas tank explodes, a member of this profession notes “Houston, we have a problem.” For 10 points, name this profession depicted in films like *Interstellar* and *Apollo 13*.

ANSWER: astronaut (accept cosmonaut; prompt on answers mentioning NASA)

<R. Li, Trash>

3. In this work, a “poet filled with Kantian truth” reads Friedrich Schiller the night before his death. Vikram Seth’s novel *The Golden Gate* was inspired by this work, and Nabokov published a very literal translation of it. A character in this work asserts that he finds marriage boring and rejects a woman after reading her love letter. That character is arguably the earliest example of a (\*) “superfluous man.” Zaretsky delivers a challenge to the title character of this work after he dances with Olga at a name-day party. The title character of this work shoots Lensky in a duel and is loved by Tatiana. For 10 points, name this verse novel by Alexander Pushkin about the title dandy.

ANSWER: Eugene Onegin (or Yevgeniy Onegin)

<Yue, European Literature>

4. An artist from this country depicted a newspaper-clutching man with a teacup on his head in *The Pillars of Society*. A painter from this country used primary colors to depict animals in paintings like *The Yellow Cow* and *The Fate of the Animals*. That artist co-founded a movement in this country with the Russian author of (\*) *Concerning the Spiritual in Art*, who painted *Improvisations* and *Compositions*. This country was home to The Blue Rider and The Bridge, art movements that were both associated with this country’s “Expressionism.” For 10 points, name this country, where art was labeled as “degenerate” by the Nazis.

ANSWER: Germany (or Deutschland)

<Gioia, Painting>

5. This character is called a “demon” in a Kafka parable titled for “The Truth about” a companion of this character. This character accuses a puppetmaster of consorting with the Devil due to his clairvoyant ape. An “infinitely richer” reconception of this character is created by Pierre Menard. After refusing to pay an innkeeper, a friend of this character is tossed in a blanket. This character meets (\*) Cardenio after freeing some galley slaves. This character returns home after losing to the Knight of the White Moon, and he is served by his squire Sancho Panza. For 10 points, name this windmill-tilting knight-errant, a creation of Miguel de Cervantes.  
ANSWER: Don Quixote (or Alonso Quixano) [*Writer’s note*: The first clue refers to Franz Kafka’s “The Truth about Sancho Panza” and the third refers to Jorge Luis Borges’s “Pierre Menard, Author of the *Quixote*.”]  
<R. Li, World Literature>

6. In these systems, the classical Laplace–Runge [“RUN–guh”]–Lenz vector is conserved. Bertrand’s theorem gives two possible conditions in which these systems are closed. A “halo” one of these systems can be unstable. A Hohmann [“HOE–man”] transfer moves between two of these systems, which often feature a central inverse-square force. These (\*) paths, which have mean and true anomalies, are characterized by eccentricity. In these systems, the semi-major axis cubed is proportional to the period squared. These elliptical paths are described by Kepler’s laws. For 10 points, name these paths exemplified by the motion of the Earth around the Sun.  
ANSWER: orbits (accept orbital motion; accept two-body problems; prompt on planetary motion or elliptical motion or word forms of these answers; prompt on inverse-square problems)  
<Yue, Physics>

7. An empress of this non-European country may have illegitimately given birth to the French military commander Maxime Weygand. That empress of this country went insane after her husband’s execution on the Hill of the Bells. A “reform law” passed in this country confiscated all Catholic Church property. France first invaded this country in the (\*) Pastry War, and again after it announced a two-year moratorium on repayment of European debt. Napoleon III installed Maximilian I as the ruler of this country. For 10 points, name this North American country whose past leaders include Benito Juárez [“HWAH–rez”] and Antonio López de Santa Anna.  
ANSWER: Mexico  
<Suh, World History>

8. After visiting a convent school, this author wrote a poem ending with the question “how can we know the dancer from the dance?” In another poem by this author, “The broken wall, the burning roof and tower / And Agamemnon dead” is “engender[ed]” by the aftermath of “a sudden blow.” One of this author’s poems asks “sages standing in God’s holy fire” to “gather me / Into the (\*) artifice of eternity.” This author of “Leda and the Swan” wrote a poem that asserts that “an aged man is but a paltry thing” and begins, “That is no country for old men.” For 10 points, name this poet of “Sailing to Byzantium” and “The Second Coming.”  
ANSWER: William Butler Yeats [“yates”]  
<Yue, British Literature>

9. According to Zoroastrian eschatology [“ess–kuh–TAW–loh–gee”], a river of molten metal will feel like this substance for the righteous. Rada is the Islamic prohibition on marriage between certain people who have a type of “kinship” named for this substance. 1 [“first”] Corinthians 3 and Hebrews 5 contrast this substance with “solid food.” It is not kosher to eat (\*) meat with this stuff. Ghee is made from this substance. Hindus celebrate the churning of a primordial ocean of this stuff. The Promised Land is often referred to as a land flowing with honey and this substance. For 10 points, name this liquid produced by the most revered animal in Hinduism, the cow.  
ANSWER: milk (prompt on other dairy goods like butter or cheese)  
<Suh, Religion>

10. An activist from this country cofounded “Women Journalists Without Chains.” An ongoing cholera epidemic in this country is the most severe in recorded history. Representative Ro Khanna sponsored legislation to remove American forces from this country, which President Trump vetoed. Rebels in this country claimed responsibility for drone bombings at (\*) oil facilities in this country’s northern neighbor. In November 2019, this country’s government and UAE-backed separatists signed a peace deal. A Saudi-led coalition has intervened against Houthi insurgents in this country’s ongoing civil war. For 10 points, name this Arab country with capital Sana’a [“san-AH”].

ANSWER: Yemen

<R. Li, Current Events>

11. The mentality of these people are critiqued in a Ludwig Feuerbach [“FOY-er-bock”] work titled for *The Essence of their namesake discipline*. An autobiography recounts the author stealing pears before becoming one of these people. These people do not fall into “despair” according to *The Sickness Unto Death*. In contrast to the “master morality” of Greeks and Romans, this generic group of people adhere to a “slave morality” in (\*) Nietzsche’s *On the Genealogy of Morals*. Pascal argued that a person must be one of them given the possibility of eternal damnation in his “wager.” For 10 points, name this generic religious group that St. Augustine belonged to.

ANSWER: Christians (accept specific denominations like Catholics and Protestants; accept people who believe in Jesus or Christ; accept Christian priests or Catholic saints; prompt on just religious people, believers, or people who believe in God with “Of what general faith?”)

<Yue, Philosophy>

12. The British-owned Argentine newspaper *The Standard* encouraged production of a good in response to a shortage caused by this war. Lancashire experienced a “famine” of that good during this war. The Battle of Cherbourg in this war ended in the sinking of a ship made in Liverpool. Lord Palmerston considered entering this war after the removal of two diplomats from the RMS (\*) *Trent*. The damages caused in this war by two ships built in the UK was settled in the *Alabama* claims. Some hoped the UK would enter this war because of the influence of “King Cotton.” For 10 points, name this war during which the UK did not recognize the Confederacy.

ANSWER: American Civil War

<Suh, British History>

13. This sense’s namesake brainstem implant can be used if the eighth cranial nerve is damaged. Both a BAHA [“BAH-ha”] and a stapedectomy [“STAY-ped-ect-oh-me”] can treat conductive loss of this sense. Meningitis can cause ossification leading to loss of this sense. That loss can be halted by rapid insertion of a neuro-prosthetic implant into the (\*) temporal bone. Meniere’s [“men-ee-AIR’s”] disease causes fluctuations in this sense, which can also be impaired if the organ of Corti’s hair cells are damaged by ototoxic drugs. For 10 points, name this sense perceived when the cochlea turns mechanical sound waves into signals to the auditory nerve.

ANSWER: hearing (accept word forms; accept audition or auditory sense before mention)

<Murton, Biology>

14. This deity’s father rides past a bloody hound on his way to find out why this deity suffers from nightmares. This deity was said to possess the greatest ship ever built and live in the most beautiful hall. By his wife Nanna, this god was the father of Forseti, the god of justice. This god gave the messenger Hermodr [“her-MAH-dur”] a ring to deliver to (\*) Odin. Thokk, presumed to be Loki in disguise, refused to weep after this god’s death. This god’s mother Frigg made every object on earth swear to not harm him, but she forgot to ask the mistletoe plant. Loki tricked the blind god Hodr [“HODD-er”] into killing, for 10 points, what most beloved of the Norse gods?

ANSWER: Baldr (or Balder; or Baldur)

<Duffy, Mythology>

15. **Companies in this industry became widely associated with Aeron chairs and the phrase “burn rate.” Pioneers in this industry engaged in the “Mosaic Wars,” named for a popular early product from this industry. The COPA tried to regulate this industry. Companies centered on this technology primarily drove the high growth of the NASDAQ [“NAZ-dack”] in the (\*) 1990s. Senator Ted Stevens oddly described this technology as a “series of tubes.” Al Gore claimed that he “took the initiative in creating” this technology, a predecessor of which was the Department of Defense’s ARPANET. For 10 points, name this technology that was at the center of the dot-com bubble.**

ANSWER: the **Internet** (accept the **World Wide Web** or the **Web**; accept **online** shopping; accept **dot-com** bubble until mention; prompt on things like the **Net**, **tech**, **IT**, or **software**; prompt on just **browsers** by asking “browsing what?”; prompt on **startups**) [*Writer’s note*: Mosaic was a popular early web browser.]

<Suh, American History>

16. **A character in this novel frequently laments the smell of honeysuckle and dislikes his brother-in-law Herbert Head. That character thinks about convincing his father that he committed incest with his sister. This novel features a flashback to Damuddy’s funeral and a depiction of Reverend Shegog’s Easter sermon. This novel opens with a character looking for lost golf balls with (\*) Luster, and a character in it slaps his sister for getting her drawers muddy. That sister loses her virginity to Dalton Ames in this novel, and Quentin drowns himself at the end of its second section. For 10 points, name this William Faulkner novel about the Compson family.**

ANSWER: *The **Sound and the Fury***

<Kao, American Literature>

17. **The composer of an E-flat-major work in this genre set its theme to the words, “this you cannot understand,” directed at his critics. A lyrical C-major clarinet solo begins Prokofiev’s third of five works in this genre. Ravel was influenced by jazz to write a G-major piece in this genre, and wrote another in D major for Paul (\*) Wittgenstein. Nikolai Rubinstein initially disliked Tchaikovsky’s first work in this genre. Grieg took inspiration from Schumann for his work in this genre, which is in A minor and begins with a timpani roll. For 10 points, name these works exemplified by Beethoven’s “Emperor” for orchestra and a keyboard soloist.**

ANSWER: **piano concerto** (prompt on partial answer)

<Yue, Music>

18. **The Four Ordinances sparked a revolution in this city, and the Legitimist faction was formed in the wake of that revolution. Another revolution in this city began after the suppression of the Campaign of Banquets by a king who was almost assassinated by Giuseppe Fieschi’s [“FYE-ess-keez”] “Infernal Machine.” A February (\*) 1848 revolution occurred in this city, which was also the site of the “Three Glorious Days” in 1830. This city was home to a “citizen king” during the July Monarchy, and Charles X was the last member of the Bourbon dynasty to rule from this city. For 10 points, name this capital city from which rulers like Louis-Philippe and Louis XVI reigned.**

ANSWER: **Paris**

<L. Li, European History>

19. To explain outer-sphere electron transfer, Rudolf Marcus modified an equation by this man that was also modified to include the transmission coefficient kappa. That equation by this man has a constant proportional to steric factor and collision frequency. This man's namesake plot has an inverse-temperature x-axis, a line with negative slope, and a y-intercept equal to the (\*) pre-exponential factor. Two scientists generalized a theory by this man by writing compounds as "HA" and "B." This man's equation gives rate constant as proportional to " $e$  to the negative activation energy over  $RT$ ." For 10 points, name this Swedish chemist who wrote an early acid-base definition.

ANSWER: Svante August Arrhenius

<Yue, Chemistry>

20. A tenor aria from this opera begins with four high D's followed by another four D's sung an octave lower. A slave in this opera sings the aria "Signore, ascolta!" in a failed attempt to dissuade her unrequited love from taking on a challenge. A character in this opera who sings the aria "In questa reggia" is served by the ministers (\*) Ping, Pang, and Pong. A character in this opera who correctly answers three riddles predicts that a woman will not be able to know his name in the aria "Nessun Dorma," which was popularized by Luciano Pavarotti. For 10 points, name this unfinished opera by Giacomo Puccini ["pooh-CHEE-nee"] about the title Chinese princess.

ANSWER: Turandot

<Suh, Opera>

21. One of these objects "shudder[s]...like a frightened steed" and moves "tow'rds...Norman's Woe" in a Longfellow poem. A character observes the "elfish light" and "rich attire" of snakes "within the shadow" of one of these objects. Thomas Hardy cites "the Immanent Will that stirs...everything" as the reason behind a (\*) real-life incident involving one of these vehicles in "The Convergence of the Twain." A "Wedding-Guest" is told of how one of these vehicles becomes stranded after a character shoots an albatross in "The Rime of the Ancient Mariner." For 10 points, name these vehicles, examples of which include the *Hesperus* and the *Titanic*.

ANSWER: ships (accept reasonable equivalents such as boats)

<R. Li, World Literature>

## Bonuses

1. One character in this novel agrees to marry a doctor only if she is never made to eat eggplants, and that doctor later cheats on her with Barbara Lynch. For 10 points each:

[m] Name this novel in which Florentino pines after the wife of Dr. Juvenal Urbino, Fermina.

ANSWER: **Love in the Time of Cholera**

[e] *Love in the Time of Cholera* was written by this Colombian novelist. He is better known for chronicling the history of the Buendia family in his novel *One Hundred Years of Solitude*.

ANSWER: Gabriel **García Márquez** (prompt on Márquez)

[h] García Márquez's novel *The Autumn of the Patriarch* depicts a man with this profession. Another novel that belongs to the literary genre named for this profession is Mario Vargas Llosa's *The Feast of the Goat*.

ANSWER: **dictator** (accept **tyrants** and other equivalents; prompt on just a leader of a country or a general or politician)

<Yue, World Literature>

2. A Bronisław Malinowski ["mah-li-NAWF-ski"] book partly titled for this concept examines it through the lens of maintaining coral gardens. For 10 points each:

[e] Name this concept which preceded religion and science according to *The Golden Bough*. It is often associated with shamans and witches, and its "black" form is performed by practitioners with selfish intent.

ANSWER: **magic** (accept *Coral Gardens and Their Magic*; accept black **magic**; do NOT accept or prompt on "sorcery" or other perceived equivalents)

[m] This anthropologist described the "King of the Wood" ceremony in his aforementioned study of magic and religion, *The Golden Bough*.

ANSWER: James **Frazer**

[h] This Oxford anthropologist discussed the title central African tribe's tendency to blame witchcraft and magic for misfortune in his study *Witchcraft, Oracles and Magic Among the Azande*.

ANSWER: E. E. **Evans-Pritchard**

<Yue, Anthropology>

3. This man defeated the Bear Lake Monster in a wrestling match and later shot down all of the stars except the Lone Star to impress a girl. For 10 points each:

[m] Name this mythical cowboy, a common figure in tall tales from the American West.

ANSWER: **Pecos Bill** (prompt on Bill)

[h] One of Pecos Bill's most famous exploits was when he captured one of these things with his rattlesnake lasso and used it to carve out the Grand Canyon.

ANSWER: **tornado** (accept equivalents like **twister** or **cyclone**)

[e] Pecos Bill's horse, Widowmaker, once bucked Bill's wife, Slue-Foot Sue, so high that she became stranded on this object. In honor of Pecos Bill's sorrow over losing his wife, coyotes now howl at this celestial object.

ANSWER: the **Moon**

<Duffy, Mythology>

4. This national team's unexpected 1–2 loss to Uruguay in the 1950 World Cup is known as “The Agony of Maracanã.” For 10 points each:

[e] Name this country that also infamously lost a 2014 World Cup semifinal match against Germany 1–7. This country hosted the 2016 Rio Olympics and also won gold at the men's soccer event.

ANSWER: **Brazil** national football team (accept the **Seleção** [“seh-leh-SAU”])

[m] Unlike in the 2014 match, Brazil beat Germany 2–0 in the 2002 World Cup final thanks to two goals from this forward nicknamed “El Fenómeno.” Do not confuse him for a similarly named Portuguese soccer player.

ANSWER: **Ronaldo** Luís Nazário de Lima (accept **R9**; do NOT accept or prompt on “Cristiano Ronaldo” or “CR7”)

[h] The 2002 World Cup was jointly hosted by these two nations, one of which is the only team from its continent to have defeated Brazil in a full international men's soccer match. Name either of the two host nations.

ANSWER: **South Korea** and **Japan** (accept **Republic of Korea** for South Korea and **Nippon** for Japan; prompt on **Korea**) [*Writer's note*: South Korea beat Brazil 1–0 in 1999.]

<Suh, Trash>

5. The wavelengths of these waves are unit fraction multiples of the fundamental wavelength. For 10 points each:

[m] Name this series of waves whose members contain an increasing number of nodes. The first member in this series is called the fundamental tone, and each following member is an overtone.

ANSWER: **harmonic** series

[e] The density wave theory was posited to explain the winding problem within the arms of these large astronomical objects. The Milky Way is a barred spiral type of these astronomical objects.

ANSWER: spiral **galaxy**

[h] The wave equation states that this differential operator of a function is linearly related to the function's second time derivative. This operator is represented by a nabla squared and is equal to the divergence of the gradient.

ANSWER: **Laplacian** (or **Laplace** operator)

<K. Li, Other Science>

6. Congratulations! You are the newborn child of a sitting Byzantine emperor. For 10 points each, answer the following questions about yourself.

[h] Because you were born *after* your father had become emperor, you are described by this phrase, referring to the fact that your mother probably gave birth in a room decorated with a very expensive color.

ANSWER: **born in the purple** (or **porphyrogenitus**; prompt on **purple**)

[e] You became the eighth emperor with this name who ruled from 962 to 1025. The first emperor of this name, nicknamed “the Great,” is the namesake of the capital city you ruled from.

ANSWER: **Constantine** (accept **Constantine** VIII or **Constantine** the Great)

[m] Unfortunately, you didn't do much during your reign, as you spent most of it co-reigning with your brother Basil II. Basil won the Battle of Kleidion against these people, and was thus known as the “Slayer” of these people.

ANSWER: **Bulgars** (or **Bulgarians**)

<Suh, European History>

7. Not everything that's named after an American president is actually in the United States. For 10 points each:  
[e] Boggy Peak, the highest point on the island of Antigua, was renamed in 2009 after this first African-American president of the United States. The name was changed back to Boggy Peak in 2016.

ANSWER: Barack **Obama**

[m] This South American country named its Presidente Hayes department after President Rutherford B. Hayes. It is the only South American country that has never had a coastline.

ANSWER: Republic of **Paraguay**

[h] This other country has the only non-US national capital named after a US president. This country's nearby city of Buchanan, however, is *not* named after president James Buchanan; it's named after his cousin Thomas.

ANSWER: Republic of **Liberia** [*Writer's note: The capital is Monrovia.*]

<CGH, Geography>

8. One character explains the existence of this profession by saying that "our civilization is so vast that we can't have our minorities upset and stirred." For 10 points each:

[h] Name this profession of Stoneman, Black, and the protagonist of a novel. That protagonist is annoyed by a Denham's Dentifrice commercial after his Seashell-radio-wearing wife asks him to watch the White Clown with her.

ANSWER: **firemen** (accept word forms; do NOT accept or prompt on anything else as "firemen" is the specific term)

[e] This science-fiction author wrote about the fireman Guy Montag burning books in his dystopian novel *Fahrenheit 451*.

ANSWER: Ray **Bradbury**

[m] Several short stories by Bradbury concern moving to this general place, including "The Exiles" and "The Rocket." His collection containing the story "There Will Come Soft Rains" is titled for this place's *Chronicles*.

ANSWER: **Mars** (accept *The Martian Chronicles*)

<Yue, American Literature>

9. Photographs by this man were named for his last name appended with the suffix "ograph," and his photographs include ones of a woman crying glass tears and a woman next to an African mask. For 10 points each:

[h] Name this photographer who depicted the back of his frequent model Kiki de Montparnasse in *Le violon d'Ingres* ["*leh vio-LON DAN-grr*"].

ANSWER: **Man Ray** (or Emmanuel **Radnitzky**; accept **ray**ograph)

[m] Man Ray photographed this friend and fellow Dadaist in costume as his alter ego Rose Selavy. Man Ray and this artist met at the 1913 Armory Show, where this artist showed a work dubbed an "explosion at a shingle factory."

ANSWER: Marcel **Duchamp**

[e] Man Ray pioneered this genre of photography by publishing photos of models in fancy clothing for *Vogue*. Man Ray collaborators like Coco Chanel were designers for the art form that names this genre.

ANSWER: **fashion** photography

<Yue, Photography>



10. One of the 25 sureties of this document, Robert FitzWalter, had earlier joined a conspiracy against a monarch after accusing that monarch of attempting to seduce his daughter Matilda. For 10 points each:

[e] Name this 1215 document signed at Runnymede, which guaranteed rights and limited the power of the English crown. A monarch's refusal to abide by this document led to the First Barons' War.

ANSWER: **Magna Carta Libertatum** (or the **Great Charter of Liberties**)

[m] The *Magna Carta* was agreed to by this English king who was excommunicated after he refused to appoint Stephen Langton the Archbishop of Canterbury.

ANSWER: **John** Lackland (or **John I**)

[h] The *Magna Carta* was accompanied by a 1217 "charter" named for these places, which established the right of free men to access these places. Pannage rights apply to these places.

ANSWER: **forests** (accept Charter of the **Forest**; accept royal **forests**) [*Writer's note*: Pannage is the right to feed livestock pigs on a forest's fallen nuts.]

<L. Li, British History>

11. John Keats's epitaph makes a reference to a work by this artist. For 10 points each:

[h] Identify this creator of works like *Fontana della Barcaccia* ["bar-KAH-chee-ah"] and *Truth Unveiled by Time*.

ANSWER: Gian Lorenzo **Bernini** [*Writer's note*: Keats died while listening to water flowing from *Fontana della Barcaccia*.]

[m] Bernini created *Truth Unveiled by Time* probably in reaction to the criticism he faced while building two towers to this church in Rome. Bernini also designed a namesake bronze Baldachin within this church.

ANSWER: **St. Peter's** Basilica (accept **St. Peter's Baldachin**)

[e] Another Bernini creation is a fountain named for four of these things. One of the heads in the fountain is draped over to signify that, at the time of its creation, no one knew the source of one of these things that flowed in Egypt.

ANSWER: **river** (accept *Fountain of the Four Rivers*) [*Writer's note*: The Nile's head is draped over in the fountain.]

<Suh, Sculpture>

12. In one play by this author, the slave Sceledrus spots two lovers kissing while he chases a monkey. For 10 points each:

[h] Name this author who depicted the title "Vainglorious Soldier" in his play *Miles* ["mee-lays"] *Gloriosus*. That play, like many by this author, features a "clever slave."

ANSWER: Titus Maccius **Plautus**

[e] Although *Miles Gloriosus* is set in a Greek city, its characters speak this language. Plautus was a member of this ancient Roman language's namesake "Old Period."

ANSWER: **Latin**

[m] *Miles Gloriosus's* title character extols "the lustre" of one of these objects as "more bright than the rays of the sun." In the *Aeneid*, one of these objects is said to depict an infant Romulus and Remus and the Battle of Actium.

ANSWER: a **shield**

<R. Li, Ancient Literature>

13. Peaks in this technique are reported in terms of their wave number. For 10 points each:

[m] Name this technique used to detect vibrational modes which have a change in dipole moment. This technique is named for a region of the electromagnetic spectrum found above the microwave region.

ANSWER: **infrared spectroscopy** (accept **IR spectroscopy**; prompt on **IR** or **infrared**)

[e] Identical diatomic molecules whose atoms have this relationship to each other will have different vibrational frequencies. This term refers to atoms with the same number of protons but different number of neutrons.

ANSWER: **isotopes**

[h] The Tolman electronic parameter is determined by measuring the change in the vibrational frequency of this molecule. The dipole moment of this diatomic molecule points towards the less electronegative element.

ANSWER: **carbon monoxide** (accept **CO**; accept **carbonyl** ligand)

<K. Li, Chemistry>

14. The last person to be officially referred to by this title was Maximinus II. For 10 points each:

[e] Name this title commonly held by the rulers of Ancient Egypt. Cleopatra and her son Caesarion were the last holders of this title before Egypt's annexation into the Roman Empire.

ANSWER: **pharaoh**

[m] This was the Mandinka word for the sultan of the Mali Empire. The tenth ruler to hold this position was known for his generous expenditures while on a pilgrimage.

ANSWER: **mansa** (accept **Mansa** Musa; generously prompt on **Musa**)

[h] The title *Mai* was held by Idris Alooma and other rulers of the Kanem–Bornu Empire, which was centered around this African geographical feature.

ANSWER: Lake **Chad**

<Suh, World History>

15. At the end of a novel by John Gardner, this character declares in the third person that he's "had an accident," and menacingly wishes, "So may you all." For 10 points each:

[m] Name this character, described as a "dark death-shadow" and part of "Cain's clan" in another work, who terrorizes King Hrothgar's hall Heorot ["**HAIR-it**"] before his arm is torn off by that work's title character.

ANSWER: **Grendel**

[e] Grendel is the first of three major foes to face the title warrior-hero of this Old English epic.

ANSWER: **Beowulf**

[h] In this other Old English epic, Jesus' crucifixion is recounted by the cross on which he is nailed. This poem has been variously attributed to Caedmon and Cynewulf ["**KIN-i-wolf**"], and is preserved in the Vercelli Codex.

ANSWER: *The **Dream of the Rood***

<Yue, British Literature>

16. This constant was one of four to have its numerical value defined exactly in the SI base unit revision that went into effect in 2019. For 10 points each:

[h] Name this constant that became the new basis for the kelvin in the 2019 revision. This constant has the same dimensions as entropy and is multiplied by temperature in the formula for thermodynamic beta.

ANSWER: **Boltzmann** constant (or **Boltzmann**'s constant; prompt on  $k_B$ )

[e] The kelvin used to be based on the temperature of this substance's triple point. The solid state of this substance floats, which is why aquatic life is not crushed when this substance solidifies.

ANSWER: **water** (or **H2O**)

[m] The Boltzmann constant is multiplied by this function of the number of microstates to find a gas's entropy. When applied to Euler's ["**OY-lur's**"] number, this function returns one.

ANSWER: natural **logarithm** (or **ln**)

<K. Li, Physics>

17. This man named his retirement home Sherwood Forest to express his sentiment that he had been “outlawed” by his own political party. For 10 points each:

[m] Name this President whose administration saw the signing of the Webster–Ashburton Treaty. Shortly before his death, he was elected to the Confederate House of Representatives.

ANSWER: John **Tyler**

[e] Three days before leaving office, Tyler signed a bill to annex this territory. This territory fought a war against Mexico at the Alamo.

ANSWER: **Texas** (accept Republic of **Texas**)

[h] Tyler’s administration suffered badly when a gun on the USS *Princeton* exploded and killed six people including Secretary of State Abel P. Upshur, who was then replaced by this man.

ANSWER: John C. **Calhoun**

<Suh, American History>

18. At the end of his last work, this composer quoted the main theme from his early tone poem *Death and Transfiguration* as a soprano sings, “Is this perhaps death?” For 10 points each:

[m] Name this composer of tone poems such as *Don Juan*, *Till Eulenspiegel’s* [“**OY-len-shpee-gull**”] *Merry Pranks*, and one that begins with a “Sunrise” and ends with a “Song of the Night Wanderer.”

ANSWER: **Richard** [“**RHEE-kard**”] **Strauss** (prompt on partial answer)

[e] Strauss’s final tone poem depicts an eleven-hour adventure navigating one of these geographic features. A “Night on [a] Bald” one titles a tone poem by Modest Mussorgsky.

ANSWER: a **mountain** (accept the **Alps**)

[h] This composer wrote the harmonically complex tone poems *Poem of Ecstasy* and *Prometheus: The Poem of Fire*, the last of which requires a color organ to simulate this composer’s synesthesia.

ANSWER: Alexander **Scriabin**

<Yue, Music>

19. This process is used when preparing biological samples for transmission electron microscopy. For 10 points each:

[h] Name this process which can be accomplished with formalin or glutaraldehyde. During Gram staining, heat accomplishes this process which aims to preserve and stabilize the internal structure of biological samples.

ANSWER: **fixing**

[e] Aldehydes “fix” a biological specimen by cross-linking these macromolecules. These macromolecules are synthesized during translation and form the major internal structural components of all cells.

ANSWER: **proteins**

[m] Following fixing, samples must be stained with electron-dense substances such as the acetate or formate salt of this radioactive metal.

ANSWER: **uranium** (prompt on **uranyl**)

<K. Li, Biology>

20. In this book, Jesus assesses the state of the churches in Asia Minor, including Ephesus, Smyrna, and Philadelphia. For 10 points each:

[e] Name this last book of the New Testament that describes the appearance of the Antichrist and the coming of the New Jerusalem.

ANSWER: Book of **Revelation** (or the **Revelation** to John or the **Apocalypse** of John; do NOT accept or prompt on “Book of Revelations”)

[m] In Revelation, Jesus addresses seven of these groups in Asia Minor, including ones at Sardis, Philadelphia, and Ephesus.

ANSWER: **churches**

[h] In Revelation 20, the Dragon is imprisoned for a thousand years in a place that has this specific characteristic.

ANSWER: a **bottomless** pit (accept reasonably equivalent descriptive answers; prompt on pit or abyss)

<Suh, Religion>

21. For 10 points each, answer some questions about the bacteria *K. xylinus*.

[h] The culture used to make this fermented health beverage often includes *K. xylinus*, which digests the alcohols produced by the yeast. This beverage is made by adding its namesake culture to sugared tea broth.

ANSWER: **kombucha** (prompt on tea mushroom, tea fungus, or Manchurian mushroom, which are names for the culture)

[e] *K. xylinus* belong to a group of bacteria which oxidize ethanol to produce this two-carbon carboxylic acid. This weak acid has chemical formula  $\text{CH}_3\text{COOH}$  and is found in vinegar.

ANSWER: **acetic** acid (or **ethanoic** acid)

[m] *K. xylinus* is known for its ability to create this most abundant organic polymer. Rayon can be made by dissolving this compound in Schweizer’s reagent and then adding sulfuric acid.

ANSWER: **cellulose**

<K. Li, Biology>