Question #1: Miscellaneous

10 points

This person portrayed Gloria Gaines, who was the wife of the protagonist, in *The Butler*. This person produced and starred in the movie version of *Beloved*. More recently, this person hosts the television show *Super Soul Sunday*. This person started Harpo Productions, which produces the shows *Dr. Phil*, *Rachael Ray*, and *The Dr. Oz Show*. A well-known meme shows this person repeatedly saying "And you get a car!". Until Breonna Taylor was on the cover of the September 2020 issue, this person was always on the cover of the magazine named for her. Name this former talk-show host who formed the O.W.N. network and publishes *O* magazine.	**Oprah** (Gail) **Winfrey** [accept either underlined name; accept Orpah (Gail) **Winfrey**]

Question #2: Social Studies

10 points

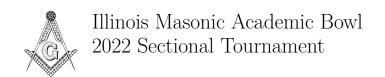|	
After this leader captured the princess Drypetis [DRYP-tiss], he arranged for her to marry his bodyguard Hephaestion [huh-FEESS-tee-un]. This person came to power when his father was killed by the bodyguard Pausanias [paw-SAY-nee-us]. Shortly after gaining power, this leader forced the surrender of the army of Thessaly [THESS-uh-lee]. Because Pindar praised one of this person's ancestors, he spared Pindar's house when he destroyed Thebes [theebz]. This leader ended the Achaemenid [uh-KEE-muh-nid] Empire after defeating Darius III at Gaugamela [gau-guh-MEH-luh] and Issus. Name this person who succeeded his father, Philip II of Macedon, after being tutored by Aristotle.	**Alexander** the Great [or **Alexander III** of Macedon]

Question #3: Science

10 points

These structures contain Volkmann's canals that allow blood flow from nutrient arteries. The ends of some of these structures are called epiphyses [eh-PIF-uh-seez]. Of the three classes of fish, the one that is not *Agnatha* or *Chondrichthyes* [kahn-DRIK-theez] has a name indicating that it has the tissue in these structures. These structures often include medullary [MED-ul-ar-ee] cavities that are lined by the endosteum [en-DAH-stee-um], while the outer surfaces of these structures are lined by the periosteum [peer-ee-AH-stee-um]. One tissue often found inside of these structures is where leukemia is active and where blood cells are created; that tissue is the marrow. Name these rigid structures that make up the skeleton.	**bone**s

Question #4: Literature

10 points

At the beginning of a short story by this author, a woman waits to call her mother and then tells her that her husband was not staring at trees as he drove. In that story, this author wrote about a conversation on the beach between Sybil Carpenter and Seymour Glass. A novel by this author is narrated by the brother of the author of "The Secret Goldfish". This author's best-known narrator becomes upset because of a date between Ward Stradlater and Jane Gallagher after he is expelled from Pencey Preparatory Academy. Name this author of "A Perfect Day for Bananafish" who wrote about Holden Caulfield in *The Catcher in the Rye*.	J(erome) D(avid) **Salinger**

Question #5: Social Studies

10 points

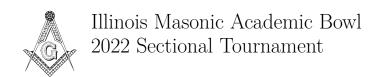|	
An angel told this person "Recite in the name of thy lord who created, created man from a clot." This person rode a winged horse-like creature called a Buraq [boo-RAHK] to Jerusalem, where he met Abraham and Jesus, and he got into a debate with Moses about daily prayers. Later, though he was badly outnumbered, this leader won the Battle of the Trench. That battle was fought at Yathrib [YAY-thrib], which now has a different name. This person's practices are described in the sunna [SOON-uh], and his words are given in hadith [hah-DEETH]. Name this 6th- and 7th-century leader who was visited by the angel Gabriel and wrote down the Koran.	**Muhammad** [prompt on **The Prophet** or **The Messenger**]

Question #6: Mathematics

10 points

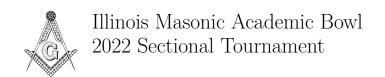|	
In a Wronskian [RAHN-skee-un] matrix, after the first row each entry is made by applying this operation to the entry above it. "Partial" versions of this operation are used to compute each entry in a Jacobian [yah-KOH-bee-un] matrix. Divergence, curl, and gradient are versions of this operation for vector-related functions. A rhyme ending "draw the line and square below" is used to remember how to perform the quotient rule for this operation. This operation can also be done using the product rule and the chain rule. Name this operation used in calculus to find the slope of a tangent line to a function's graph.	**derivative**s or **differentiation** or **differentiating**

Question #7: Literature

10 points per part

	The traveller in this poem states "Two vast and trunkless legs of stone stand in the desert."	
1	Name this poem by Percy Bysshe [bish] Shelley that says "Look on my Works, ye Mighty, and despair!".	"**Ozymandias**"
2	"Ozymandias" is this type of 14-line poem.	**sonnet** [do not accept more specific answers]
3	Percy Shelley also wrote this lyrical drama in which the protagonist gets to live in a cave with his wife Asia.	***Prometheus Unbound***

Question #8: Literature

10 points per part

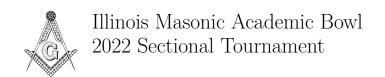|	During a debate, these creatures are described as "the most filthy, noisome, and deformed animals which nature ever produced."	
1	Name these fictional creatures that resemble humans and are ruled by a race of talking horses.	**Yahoo**s
2	The Yahoos appear in the fourth part of this novel. Its title character goes to Laputa [lah-POO-tuh] and Brobdingnag [BRAHB-ding-nag].	***Gulliver's Travels*** (or ***Travels into Several Remote Nations of the World***. *In Four Parts. By Lemuel Gulliver, First a Surgeon, and then a Captain of Several Ships*)
3	This author wrote *Gulliver's Travels* and *A Modest Proposal.*	Jonathan **Swift**

Question #9: Science

10 points per part

	This region takes up over 80% of the Earth's volume.	
1	Name this region between the core and the crust.	**mantle**
2	Many of the rocks in the mantle, including olivine [AH-luh-VEEN], garnet, and pyroxene ["pie-ROCK-seen"], contain this element and oxygen. This element is the second-most abundant in the crust after oxygen, and it is third after magnesium in the mantle.	**silicon** [accept **S**]
3	The inner mantle has these rocks with the same structure as calcium titanium oxide, though the ones in the inner mantle tend to be magnesium, iron, or calcium silicate [SIL-ih-kit].	(post-)**perovskite** [**puh-RAHVSS-"kite"**] [or **silicate perovskite**]

Question #10: Science

10 points per part

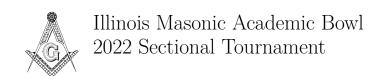|	This person wrote the book *The Origin of Continents and Oceans.*	
1	Name this person credited with the theories of tectonic plates and continental drift.	Alfred **Wegener** [**VAY-guh-nur**]
2	Wegener gave this name to the supercontinent that existed 300 million years ago and was surrounded by the ocean Panthalassa [pan-thuh-LASS-uh].	**Pangaea** [**pan-JEE-uh**]
3	Support for Wegener's theories grew decades after his death with the study of these zones with many earthquakes that are named after a Japanese and an American scientist.	**Wadati-Benioff** seismic zones [accept names in either order]

Question #11: Fine Arts

10 points per part

	The protagonist of this musical, Tevye [TEV-yuh], sings "All day long I'd biddy-biddy-bum, if I were a wealthy man."	
1	Name this musical about Jews living in a Russian shtetl [SHTEH-tul].	***Fiddler on the Roof*** [prompt on ***Fiddler***]
2	Yente [YEN-teh] plays this role in *Fiddler on the Roof.* Three of Tevye's daughters sing a song whose title is this word repeated.	**matchmaker**
3	This is the name of the shtetl where the musical is set. This name is also the title of the last song of the musical.	**Anatevka [an-uh-TEV-kuh]**

Question #12: Fine Arts

10 points per part

	When this musical was turned into a movie, Frankie Valli recorded a song saying that the song's title "is the time, is the place, is the motion" and "is the way we are feeling".	
1	Name this musical about the class of 1959 at Rydell High School, which includes the T-Birds and the Pink Ladies.	***Grease***
2	In *Grease*, this is the name of Kenickie's [kuh-NIK-ee'z] car and the title of the song he sings when he fixes it up.	"**Greased Lightnin'**" [accept **Greased Lightning**]
3	This character is the head of the Pink Ladies. At one point in the musical she thinks she is pregnant, though that scene is left out of some productions.	(**Betty**) **Rizzo** [accept either underlined part]

Question #13: Social Studies

10 points per part

	Answer the following about rulings the Supreme Court made in 2021:	
1	The court supported Shawne Alston over this organization, so student athletes can now receive non-cash compensation for academic-related purposes.	**NCAA** or **National Collegiate Athletic Association**
2	In a separate case, the court ruled that Google could use parts of Java application programming interfaces even though this company owns the copyright to Java.	**Oracle** (America, Inc.)
3	Give the common name for the Migrant Protection Protocols policy. The court forced the Biden Administration to try to follow the policy by rejecting a stay in *Biden v. Texas*.	**Remain-in-Mexico** policy

Question #14: Social Studies

10 points per part

	This cable channel was started by Roger Ailes [AY-ulz], who resigned in 2016 when several sexual harassment allegations were made against him.	
1	Name this network that has shows hosted by Sean Hannity and Laura Ingraham.	**Fox News** Channel [or **FNC**; prompt on **Fox**]
2	In 2021, Fox News mentioned this academic movement over 1,000 times. This legal movement holds that racism is common and cannot be overcome by color-blind policies.	**critical race theory** [accept **CRT**]
3	In 2021, Fox News host Tucker Carlson was criticized for statements such as "demographic change is the key to the Democratic Party's political ambitions". Such statements support this white nationalist conspiracy theory.	(great) **replacement** theory [accept **replacist** theory or global **replacism**]

Question #15: Science

10 points

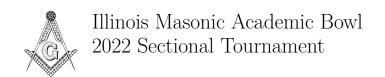|	
A device that changes this quantity in an electrical signal is a combination of a rectifier and an inverter. A non-linear electrical circuit called a mixer is sometimes named for the fact that it mixes two values of this quantity. Using the most common unit for this quantity, it has a value between about 20 and 20,000 for audible sound. Albert Einstein explained the photoelectric effect by describing a photon's energy as proportional to this quantity. The speed of a wave is the product of the wavelength and this quantity. Name this quantity of waves that is the reciprocal of period and which is measured in hertz ["hurts"].	**frequency** [prompt on **hertz**]

Question #16: Literature

10 points

Near the end of one story by this writer, the Captain sees his white floppy hat in the water, which helps him steer clear of the island of Koh-ring. This writer has the narrator of that story describe another man as his "double". In that story, this author wrote about sailing close to the ship *Sephora* [seh-FOR-uh], which allowed Leggatt [LEG-ut] to come aboard after escaping. In a novella by this author, the manager's boy famously announces that one of the characters is dead shortly after that character says "The horror! The horror!". That character, who is an ivory trader by the Congo River, is Mr. Kurtz. Name this author of "The Secret Sharer" and *Heart of Darkness*.	Joseph **Conrad** [or Józef Konrad **Korzeniowski**]

Question #17: Fine Arts

10 points

Some of the sculptures by this artist show his companion Fernande Olivier [fur-NAHND oh-LEE-vee-ay], including some of his *Head of a Woman* sculptures. After this artist broke up with Olivier, he repainted two of the faces on a painting of five women so that those two women now appear to wear African masks. In that painting, this artist portrayed five aggressively posed naked prostitutes. This painter of *Les Demoiselles d'Avignon* [lay dem-wah-zel dah-veen-yohn] also made a work showing the suffering of people and animals after a bombing during the Spanish Civil War. Name this painter of *Guernica* [gair-NEE-kah].	Pablo (Ruiz y) **Picasso**

Question #18: Social Studies

10 points

William F. Buckley ran for this position in 1965. The person who beat Buckley, who would win re-election to this job by running for the Liberal Party after losing the Republican primary, was John Lindsay. The person who held this job from 1934 to 1945 was a pro-New Deal Republican who hosted the radio show "Talk to the People" and worked closely with Robert Moses to build roads, bridges, and airports. From 1994 to 2001, this job was held by Rudy Giuliani, and Giuliani was succeeded by the wealthiest politician in U.S. history, Michael Bloomberg. Name this position, once held by Fiorello La Guardia [fee-oh-RELL-loh lah GWAR-dee-ah], that oversees the most populous U.S. city.	**mayor** of **New York** City [accept alternate phrasings that include both underlined parts; prompt on **mayor**; accept **NYC** in place of **New York**]

Question #19: Literature

10 points

One of this author's characters likes to fly kites and works on a memorial speech that refers to King Charles I. This author has that character, who is called Mr. Dick, help Dr. and Annie Strong with their marriage. Dr. Strong heads a school that this author's title character attends after leaving a school headed by Mr. Creakle. In another novel by this author, two characters who look nearly identical are named Sydney Carton and Charles Darnay. This author began that novel "It was the best of times, it was the worst of times." Name this author of *David Copperfield* and *A Tale of Two Cities*.	Charles (John Huffam) **<u>Dickens</u>**

Question #20: Science

10 points

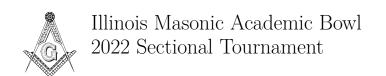|	
In the body, an equivalent of this molecule is condensed with carbon dioxide and ATP to form carbamoyl [kar-BAM-oh-ill] phosphate, ADP, and phosphate. Outside the body, sodium carbonate is created by the Solvay process, which begins with brine absorbing this compound. An alternative name for the Solvay process is based on the fact that it combines this compound with soda. The Ostwald process makes nitric acid from this compound. The Haber–Bosch [HAH-bur bahsh] process creates this compound from atmospheric nitrogen. Name this compound whose chemical formula is NH_3 ["N H 3"].	**<u>ammonia</u>**

Question #21: Mathematics

10 points per part

	The least common multiple is used to find this value when adding or subtracting fractions.	
1	Give this term for the number or expression on the bottom of a fraction.	**denominator**
2	Find the least common denominator if you are adding fractions whose denominators are 10 and 12.	**60**
3	Find the least common denominator if you are adding fractions whose denominators are the following expressions: "x squared times y cubed times z" [pause] and "x cubed times y times z squared".	**x cubed times y cubed times z squared** [accept the x, y, and z portions in any order, but the words following each variable must match]

Question #22: Mathematics

10 points per part

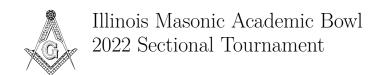|	This operation can be understood as repeated multiplication.	
1	Name this operation usually written by putting a number or expression as a superscript.	**exponent**iation (accept taking **power**s)
2	Find the value of 8 raised to the 4/3 power.	**16**
3	The inverse of an exponential function is a logarithmic function. Find the logarithm, base 16, of 4.	**1/2** or 0**.5**

Question #23: Social Studies

10 points per part

	This person's uniform number 42 is retired from baseball except on April 15, when everybody wears it.	
1	Name this first African-American person to play Major League Baseball in the 20th century.	(Jack Roosevelt) "Jackie" **Robinson**
2	This Brooklyn Dodgers general manager signed Robinson to a contract in 1945. Robinson made it to the majors in 1947 and was the National League Rookie of the Year.	(Wesley) Branch **Rickey**
3	In 1956, this woman became the first African-American person to win a tennis Grand Slam title. She later integrated professional women's golf.	Althea (Neale) **Gibson**

Question #24: Social Studies

10 points per part

	Doris Kearns Goodwin wrote *Team of Rivals* about this president and his cabinet.	
1	Name this president from 1861 to 1865 who was succeeded by his second vice president, Andrew Johnson.	Abraham **Lincoln**
2	This person was Lincoln's secretary of State. During Johnson's presidency, he negotiated the purchase of Alaska.	William (Henry) **Seward**
3	This person was Lincoln's secretary of the Treasury for most of Lincoln's presidency. Lincoln then appointed him as Chief Justice.	Salmon P(ortland) **Chase** [do not accept "Samuel Chase"]

Question #25: Science

10 points per part

	These molecules are used during translation.	
1	Name these molecules that are usually classified as messenger, transfer, or ribosomal.	**RNA** [or **ribonucleic acid**]
2	This nucleobase [NOOK-lee-oh-"base"] is used in RNA but not DNA, since DNA uses thymine ["THIGH"-meen] instead of this base.	**uracil** [**YUR-uh-sill**] [prompt on **U**]
3	The DNA types of these enzymes separate DNA strands, while the RNA types identify viruses and also bind or remodel RNA.	**helicase**s [**HEE-lih-"case**s"]

Question #26: Science

10 points per part

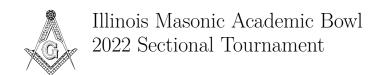|	These plants bear flowers and have stamens with pollen sacs.	
1	Name these plants that enclose their seeds within fruit, unlike gymnosperms [JIM-no-"sperms"].	**angiosperm**s or **Angiospermae**
2	Angiosperms are typically placed at this taxonomic [tak-soh-NAH-mik] rank that is equivalent to an animal phylum.	**division**(s)
3	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.	**sympodial** branching

Question #27: Literature

10 points per part

	This character "longed to travel or to go back to her convent. She wished at the same time to die and to live in Paris."	
1	Name this title character who marries a doctor and has several affairs.	Madame **Emma Bovary** [accept either underlined name]
2	This author wrote *Madame Bovary*.	Gustave **Flaubert** [goo-stahv **floh-bair**]
3	Instead of Paris, Madame Bovary ends up living in this market town with her husband and daughter Berthe [bair-tuh].	**Yonville**-l'Abbaye [**yohn-veel** lah-bay]

Question #28: Literature

10 points per part

	Much of this short story is about the relationship between Dr. Ragin [RAY-gin] and Ivan Dmitritch Gromov [GROH-mawff].	
1	Name this story in which Ragin eventually becomes a psychiatric patient like Gromov.	"**Ward Number 6**" [or "**Palata nomer shest**"]
2	This Russian author wrote "Ward Number Six" as well as plays such as *Three Sisters* and *The Cherry Orchard*.	Anton (Pavlovich) **Chekhov** [AN-tahn **"CHECK-off"**]
3	In this Chekhov play, Nina compares herself to the title bird that has been killed by Konstantin [KAHN-stun-teen].	*The **Seagull*** [or ***Chayka***]

Question #29: Social Studies

10 points

This European country settled the city of Dili [DEE-lee] in the 16th century, and they fought for many years with the Dutch and the natives over the island of Timor [TEE-mor]. This country also fought with the Dutch over other islands in a conflict nicknamed the "Spice War". This country claimed Mozambique [moh-zam-BEEK] after expeditions by Pedro da Covilhã [koo-VEEL-yaw] and Vasco da Gama. Another explorer from this country was Pedro Cabral, who is considered the European discoverer of Brazil. Name this country that signed the Treaty of Tordesillas [tor-day-SEE-yahss] with Spain and which now shares the Iberian Peninsula with Spain.	(Kingdom of) **Portugal** [or Reino de **Portugal**]

Question #30: Mathematics

10 points

Poincaré [pwan-kar-ay] models allow for "ultra-" and "limiting" versions of this concept. Those alternative types of this concept occur generally in hyperbolic geometry. Playfair's axiom is equivalent to the postulate named for this property, which is the last of Euclid's [YOO-klid'z] five postulates. Playfair's axiom, which is sometimes mistakenly described as the postulate named for this property, states that given a line and a point not on it, there is exactly one line through the point with this property relative to the original line. If two lines have the same slope, they also have this property. Name this property of lines that go in the same direction.	**parallel**(ism) or being **parallel** or **parallel** lines

Question #31: Literature

10 points

This novel praises the pictures in Thomas Beale's history book. One character in this novel says the word "Rarmai" while lying in his coffin and then decides to live. This novel's narrator asks himself about that character, "How then could I unite with this wild idolator in worshipping his piece of wood?". In the end, this novel's narrator stays afloat on top of an unused coffin after everyone else is killed. Daggoo, Tashtego, and Queequeg [KWEE-kweg] are the harpooners in this novel. This novel consists of Ishmael narrating Captain Ahab's pursuit of a whale. Name this novel by Herman Melville.	**_Moby-Dick_**_(; or, The Whale)_ [do not accept or prompt on "The Whale"]

Question #32: Science

10 points

This object is the location of Ahuna [ah-HOO-nuh] Mons, which is a large cryovolcano ["CRY"-oh-"volcano"] with vertical streaks. Research in the last few years indicates that this object has a similar amount of water and water ice to Earth, including in its mantle and on its surface, even though this object's radius is a little under one-tenth of Earth's radius. This object is the larger of the two objects orbited by the *Dawn* spacecraft, which has been going around it since 2015. This object is larger than, but in a similar orbit to, Pallas and Vesta. This object is by far the nearest dwarf planet. Name this largest asteroid.	**Ceres** ["series"]

Extra Question #1: Literature

10 points

This god had relationships with two nymphs, both of whom were eventually turned into plants, and who were named Leuke [LOO-kuh] and Minthe [minth]. Just after Helen of Sparta was kidnapped by Theseus [THEE-see-uss], an attempt to steal this god's wife was made by Pirithous ["pie"-RITH-oh-uss], who was punished by being unable to get up from a rock he was sitting on. This god made his wife eat a pomegranate [PAHM-eh-gran-it] seed, and as a result she spends one-third of the year with him rather than returning permanently to her mother. This god was married to Persephone [pur-SEFF-uh-nee] and was assisted by the multi-headed dog Cerberus [SUR-bur-uss]. Name this god of the dead and ruler of the underworld.	__Hades__ or __Pluto__(n)

Extra Question #2: Mathematics

10 points

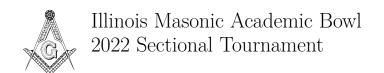|	
The partial type of this property exists for trace monoids. In logic, the material conditional is the only major binary relation that does *not* have this property. When this property does not hold, it is necessary to specify left or right multiplication. If this property holds, then changing the order of the operands does not change the result. NAND gates exhibit this property but are not associative. Many systems that have this property also have distributive and associative properties. Name this property stating that "x plus y" always equals "y plus x".	__commutative__ property or __commutativity__ [accept answers that also mention addition or multiplication]

Extra Question #3: Social Studies

10 points

This person "was happiest amongst mortals anywhere" according to one of the seven stanzas devoted to him in Lord Byron's *Don Juan* [dahn JOO-un]. One of the towns named for this person was established at the same time and in the same area as Harrod's Town and Logan's Fort. One of the expeditions this person led was turned back after his son James was tortured to death. A major project by this person was done for the Transylvania Company and started from Fort Chiswell in Virginia. Name this American frontiersman who started the Wilderness Road through the Cumberland Gap into Kentucky.	Daniel **Boone**

Extra Question #4: Fine Arts

10 points

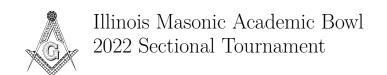|	
This composer worked with the violinist Paul Zukofsky [zoo-KAWFF-skee] to create a very detailed set of études [ay-toodz] inspired in part by the phrase "practicality of the impossible". That work is similar to a set of études this composer wrote for the pianist Grete [GREH-tuh] Sultan. Those works are the *Freeman Etudes* and *Études Australes* [ay-toodz aw-STRAH-layss]. This composer also wrote a series of five compositions with the same title, the fourth of which is played by 24 performers using 12 radios. This composer of *Imaginary Landscapes* also wrote a piece that allows listeners to focus on the sound of their environment. Name this experimental composer of *Four Minutes, Thirty-Three Seconds*.	John (Milton) **Cage** (Jr.)

Extra Question #5: Science

10 points

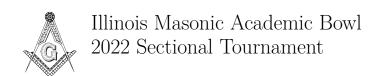|	
This disease was the first one fought using human diploid [DIP-loyd] cell and purified-chick-embryo cell-culture vaccines, though most people are not vaccinated for it. The virus that causes this disease is the most widely known Lyssavirus [LIS-uh-"virus"]. The name of this disease comes from the Latin word for "madness" because it causes confusion and hallucinations. Because one of the symptoms of this disease is a paralysis of throat muscles leading to a fear of water, it used to be called hydrophobia. This disease causes excessive salivation, which is commonly called "foaming at the mouth". Name this disease that is most commonly transmitted by an animal bite.	**rabies** [prompt on **hydrophobia** before it is mentioned]

Extra Question #6: Literature

10 points per part

	The speaker of this poem tells inanimate objects "Stay where you are until our backs are turned!".	
1	Name this poem that ends with the quote "Good fences make good neighbors."	"**Mending Wall**"
2	This American poet wrote "Mending Wall". He read his poem "The Gift Outright" at President Kennedy's inauguration.	Robert (Lee) **Frost**
3	What is the last word in Robert Frost's poem "The Road Not Taken"? The rest of the line is "And that has made all the…"	**difference**

Extra Question #7: Literature

10 points per part

	This book starts in Sanderling Island, Georgia, and the first part of it is from the point of view of Orleanna Price.	
1	Name this novel in which Orleanna's daughter, Ruth May, forgets to take her malaria pills and is bitten by a snake.	*The **Poisonwood Bible***
2	This author wrote *The Poisonwood Bible* and *Animal, Vegetable, Miracle.*	Barbara **Kingsolver**
3	Methuselah, who is an African grey parrot in *The Poisonwood Bible*, is compared to this poet's raven.	Edgar Allan **Poe**

Extra Question #8: Mathematics

10 points per part

	Answer the following about mathematical tools:	
1	Classical geometric construction problems are limited to an unmarked straightedge and this device, used to draw circles or arcs.	**compass**(es)
2	These ancient calculation instruments usually had sets of five beads on one side and two beads on the other side.	**abacus**(es) [or **abaci** or **soroban**s or **suanpan**s]
3	Find the result of a one-digit by two-digit multiplication using Napier's bones if the left square has an upper-left 3 and lower-right 5, and the right square has an upper-left 4 and lower-right 9.	**399**

Extra Question #9: Mathematics

10 points per part

	This many seconds is a little over 30,000 years.	
1	Name this number equal to 10 to the 12th power.	one **trillion**
2	Name the number that equals 1 trillion times 1,000.	one **quadrillion**
3	This mathematician introduced "up-arrow notation" to make it easier to express very large numbers.	Donald **Knuth** [**kuh-NOOTH**]