



**Question #1: Fine Arts**

10 points

<p>This musician is the namesake of the practice within jazz of changing chords by intervals of major thirds. This musician made those changes often on an album with several songs named for his relatives, including “Cousin Mary”, “<b>Syeeda’s [suh-YEE-duh’z]</b> Song Flute”, and “<b>Naima [nah-EE-muh]</b>”. That album is <i>Giant Steps</i>. This musician included the Cole Porter standard “Every Time We Say Goodbye” on his album <i>My Favorite Things</i>. Both this saxophonist and “Cannonball” Adderley performed on Miles Davis’s <i>Kind of Blue</i> album. Name this musician who included the sections “Acknowledgement”, “Resolution”, “Pursuance”, and “Psalm” on <i>A Love Supreme</i>.</p>	<p>John (William) <u>Coltrane</u></p>
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**Question #2: Science**

10 points

<p>The impedance of these circuit elements varies inversely with frequency. If one of these elements is placed in a direct-current circuit, then the current of the circuit will decay exponentially. Putting these elements in parallel can be described by a similar equation to the one for resistors in series, and vice versa. The strength of these elements can be increased by using a <b>dielectric [“die-electric”]</b> and is measured in <b>farads [FAIR-adz]</b>. In a circuit diagram, this element is represented by two congruent parallel segments. Name this element that stores electrical energy, often using two parallel plates.</p>	<p><u>capacitors</u></p>
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### Question #3: Social Studies

10 points

Dan Herbeck and Lou Michel [muh-SHEL] wrote a biography of this person. Lori Fortier [FOR-tee-ay] helped this person get a fake driver's license, and Fortier's husband Michael testified against this person and his accomplice. This person's best known action took place on the second anniversary of the Branch Davidian [duh-VID-ee-un] fire that killed 76 people in Waco [WAY-koh], Texas. When he was killed, this person was the first federal prisoner executed in 38 years. This person destroyed the Murrah Federal Building, killing 168 people, in 1995. Name this person who set off that bomb in 1995.

Timothy (James)  
**McVeigh**

### Question #4: Literature

10 points

A short poem by this writer ends with the wish "May God provide another who will love you." That poem by this author begins "I loved you; and perhaps I love you still." A patriotic poem by this writer begins with the question "Why rave ye, babblers, ye lords of popular wonder?". In another poem by this writer, a man loses his mind when Parasha's [PAH-ruh-shah'z] home is destroyed by a flood. This writer wrote that poem about Yevgeny. Most of that poem by this author praises the city of Saint Petersburg, and it includes a statue coming to life. Name this poet who wrote "To the Slanderers of Russia" and *The Bronze Horseman*.

Alexander **Pushkin** (The first poem mentioned is "I Loved You", or "Ya vas lyubil".)



### Question #5: Miscellaneous

10 points

The most destructive pest to this crop is *Heterodera glycines* [heh-tuh-RAH-duh-ruh gly-SEE-niss], and the scientific name of this crop is *Glycine max*. In Indonesia, **tempeh** [TEM-peh] is made by fermenting this crop, and in Japan this crop is the main ingredient in **miso** [MEE-soh]. In many countries this crop is used to make **edamame** [eh-duh-MAH-may]. Though this crop originated in Asia, the two biggest producers now are the United States and Brazil, and the overwhelming majority of U.S. oilseed production comes from this crop. Name this crop that is commonly used to make meat substitutes like tofu.

soybeans [or soya beans]

### Question #6: Science

10 points

After oxygen, hydrogen, chlorine, and sodium, this is the fifth-most abundant element in seawater. This element combines with hydroxide to form **brucite** [BROO-“site”], it combines with iron and **silicate** [SIH-lih-kut] to form **olivine** [AH-luh-veen], and it combines with calcium and carbonate to form **dolomite** [DOH-luh-“might”]. **Periclase** [PAIR-uh-klayss], which is very abundant in the Earth’s crust, is a mineral consisting of this element’s oxide. The sulfate of this element is hydrated to make Epsom salts. Brucite is used to make a common antacid called the “milk of” this element’s oxide. Name this alkaline-earth metal located below **beryllium** [buh-RILL-ee-um] and above calcium on the periodic table.

magnesium [accept Mg]



**Question #7: Mathematics**

*10 points per part*

Some simple examples of these solids can be classified as <b>Platonic</b> [pluh-TAH-nik] or <b>Archimedean</b> [ar-kih-MEE-dee-un] solids.	
<b>1</b>	Give this general term for a solid that has polygons as faces, line segments as edges, and points as vertices.
<b>2</b>	A topological “characteristic”, equal to the number of vertices minus the number of edges plus the number of faces, is always equal to 2 for convex polyhedra and is named for this mathematician.
<b>3</b>	The <b>dodecahedron</b> [doh-DEK-uh-HEE-drun] and <b>icosahedron</b> [“eye”-KAH-suh-HEE-drun] have the same number of edges. How many edges?

**polyhedron**  
[pah-lee-HEE-drun] or  
**polyhedra**

Leonhard (Paul) **Euler**  
[OY-lur]

**30** edges

**Question #8: Mathematics**

*10 points per part*

Wilson’s theorem is usually expressed using this type of arithmetic.	
<b>1</b>	Name this type of arithmetic in which two numbers are considered equivalent if they have the same remainder when divided by the same fixed number.
<b>2</b>	Which theorem states that “ $a$ to the $p$ power” is congruent to $a$ , mod $p$ , for every prime number $p$ ?
<b>3</b>	What one-digit positive number is congruent to $-12$ , mod $10$ ?

**modular** arithmetic  
[prompt on **modulus** or  
**modulo**]

**Fermat’s** [fair-mah’z]  
**little** theorem [prompt on  
partial answer]

**8**



**Question #9: Literature**

*10 points per part*

This poem ends “A mind at peace with all below, a heart whose love is innocent!”		
<b>1</b>	Name this poem about a woman who is “like the night of cloudless climes and starry skies.”	“ <u>She Walks in Beauty</u> ”
<b>2</b>	This poet wrote “She Walks in Beauty” as well as the longer works <i>Don Juan [joo-un]</i> and <i>Childe Harold’s Pilgrimage</i> .	(George <u>Gordon Noel</u> ,) Lord <u>Byron</u> [accept any underlined name]
<b>3</b>	In 1816, which became known as the Year Without a Summer, Byron wrote this poem that begins “I had a dream, which was not all a dream.”	“ <u>Darkness</u> ”

**Question #10: Literature**

*10 points per part*

The narrator of this novel says “You will hear these same persons talking as though Lord Darlington did something unusual in receiving hospitality from the Nazis on the several trips he made to Germany during those years.”		
<b>1</b>	Name this novel about a visit to Mrs. Benn, whose name used to be Miss Kenton.	<i>The <u>Remains of the Day</u></i>
<b>2</b>	This author wrote <i>The Remains of the Day</i> and <i>An Artist of the Floating World</i> .	Kazuo <u>Ishiguro</u>
<b>3</b>	In the novel, what country is Stevens’s new employer, Mr. Farraday, from?	<u>United States</u> of <u>America</u> or <u>U.S.A.</u> [accept any underlined portion]



### Question #11: Social Studies

*10 points per part*

Konrad Lorenz studied this phenomenon.		
<b>1</b>	Name this type of learning exemplified by very young birds that closely associate with an object, usually a parent.	<b><u>imprinting</u></b>
<b>2</b>	The study of imprinting led to this human psychological theory, developed by John <b>Bowlby</b> [" <b>BOWL-bee</b> "] and expanded by Mary Ainsworth, who observed children with their primary caregiver.	<b><u>attachment</u></b> theory
<b>3</b>	Though Bowlby believed in this method of treating disorders developed by Sigmund Freud, he was criticized by some of its practitioners.	<b><u>psychoanalysis</u></b> [or <b><u>psychoanalytic</u></b> method]

### Question #12: Social Studies

*10 points per part*

Elizabeth Loftus has been a leading researcher into the reliability of witness testimony.		
<b>1</b>	Loftus discredited the belief in this type of unconscious memory of traumatic events that is sometimes supposedly recovered and used against suspected child predators.	<b><u>repressed</u></b> memory
<b>2</b>	Loftus and her student Jim Coan used this technique named for a false memory that is easy to implant in people by suggestion.	<b><u>lost in the mall</u></b> technique
<b>3</b>	Loftus was an expert witness for this close friend of Jeffrey Epstein who was found guilty of child sex trafficking.	<b>Ghislaine</b> [gih-layn] (Noelle Marion) <b><u>Maxwell</u></b>



**Question #13: Science**

*10 points per part*

Like vitamin C, these vitamins are water soluble.		
<b>1</b>	Name this class that contains at least eight vitamins, including <b>thiamine [THY-uh-min]</b> and <b>riboflavin [RY-boh-FLAY-vin]</b> , though they are numbered up to at least 12. Give a one-letter answer.	<b>B</b> vitamins
<b>2</b>	Give the name of vitamin B9. This essential vitamin is especially recommended for women who will soon be pregnant or are pregnant.	<b>folate</b> [accept <b>folacin</b> or <b>folic acid</b> ]
<b>3</b>	A lack of folate can cause this type of birth defect affecting the brain, spine, or spinal cord. One type of this birth defect is <b>spina bifida [“SPY”-nuh BIH-fih-duh]</b> .	<b>neural tube</b> defects [accept <b>NTDs</b> ]

**Question #14: Science**

*10 points per part*

Despite its name, the primary purpose of this emergency procedure is to cause partial circulation while help is on the way.		
<b>1</b>	Name this manual procedure consisting primarily of chest compressions.	<b>CPR</b> or <b>cardiopulmonary resuscitation</b>
<b>2</b>	The ‘C’ in the “ABC” for first aid steps stands for “chest compressions”. What do the A and B stand for? For most patients, the order is now “C, A, B”.	<b>airway</b> and <b>breathing</b> [either order]
<b>3</b>	If CPR is being done with mouth-to-mouth resuscitation, how many compressions should be done for every two breaths?	<b>30</b> chest compressions



**Question #15: Literature**

10 points

In one novel by this author, Jimmy Herf asks the driver of a furniture truck for a ride and when asked how far he is going, he says “I dunno... Pretty far.” This author has Jimmy leave New York after divorcing Ellen Thatcher. In another novel by this author, Janey moves to New York and becomes the secretary of J. Ward Morehouse. This author introduced Charley Anderson at the end of that novel and developed him further in the novels *1919* and *The Big Money*. Name this author of *Manhattan Transfer* whose novel *The 42nd Parallel* was part of his *U.S.A.* trilogy.

John Dos Passos

**Question #16: Social Studies**

10 points

This country is the location of Chisanga Falls, which is in the eastern part of **Nyika [NEE-kuh]** National Park. Some ancient history of this country’s Chewa people is recorded in the **Chongoni [chon-GOH-nee]** Rock Art Area. This country contains the **Viphya [VIFF-yuh]** Mountains, which surround the city of **Mzuzu [em-ZOO-zoo]**. The south part of this country includes most of Lake Chilwa and the city of **Blantyre [BLAN-“tīre”]**. The north half of this country is between Zambia and **Tanzania [TAN-zuh-nee-uh]**, and the south half of this country is surrounded by Mozambique. The lake that shares its name with this country is also called Lake **Nyasa [NY-ah-suh]**. Name this country whose capital is **Lilongwe [lih-LAWN-gway]**.

(Republic of) Malawi [or  
(Dziko la) Malawi]





**Question #17: Mathematics**

10 points

A class of these functions used for data interpolation is named for **Joseph-Louis Lagrange** [zhoh-seff loo-ee luh-grahnj]. It is sometimes impossible to use a formula with ordinary operations to solve certain types of these functions according to the **Abel-Ruffini** [AH-bul roo-FEE-nee] theorem. The zeroes of this type of function are characterized by the fundamental theorem of algebra. By definition, a rational function is formed by dividing two of these functions. Derivatives of these functions can be found using the power rule and sum rule. The division of these functions can sometimes be done using synthetic division. Name this type of function that is called cubic when its degree is 3.

polynomials

**Question #18: Science**

10 points

The person who developed this process described offering his son to the Swedish royal family in the book *Dancing Naked in the Mind Field*. This process takes about five minutes, during which the temperature changes from about 200 to 130 to 160 degrees Fahrenheit. The third step of this process uses annealed primers. The first step of this process causes nucleic acid denaturation by using the substance *Taq*, spelled “T-A-Q”. This method has made it easier to test for HIV and COVID. Name this method developed by Kary Mullis that makes it much easier to make many copies of DNA samples.

PCR [accept polymerase chain reaction]



**Question #19: Literature**

10 points

This text has a preamble that states “Here we shall gather the manifestation, the declaration, the account of the sowing and the dawning by the Framers and the Shaper, She Who Has Borne Children and He Who Has Begotten Sons.” This text chronicles the defeat of an arrogant god who claims to have been shot by two demons, causing his teeth to hurt. That god’s name means “Seven Macaw”, and his enemies were two people who had been badly mistreated by their older siblings. This book chronicles the **K’iche’** [kee-CHEH] people, with a focus on the Hero Twins. Name this collection of mythology from the Mayan people.

Popol Vuh [accept Popol Wuj]

**Question #20: Social Studies**

10 points

The reverse program to this program included the use of luxury superliner ships. This program received Congressional approval despite testimony against it by Charles Lindbergh. This program was a strengthening of the Cash and Carry program, and it ended several Neutrality Acts. Under the leadership of Harry Hopkins, this program was expanded to help several countries, including the Soviet Union. Opponents of this program warned that it would get the United States involved in a major war, which did in fact happen. Name this program by which the United States sent supplies and equipment to the Allies, often on a temporary basis, during World War II.

Lend-Lease Program [or Lend-Lease Act]



**Question #21: Science**

*10 points per part*

This force should be taken into account when an object slides down a ramp, and its direction is opposite the sliding direction.		
<b>1</b>	Name this force that opposes motion.	<b>frictional</b> force
<b>2</b>	To find the frictional force, the coefficient of friction is multiplied by this force that is perpendicular to the direction of motion.	<b>normal</b> force [prompt on <b>support</b> force]
<b>3</b>	This deaf French scientist devised laws about friction that were later supported and expanded by <b>Charles-Augustin de Coulomb</b> [sharl oh-goo-stan duh koo-lohm].	<b>Guillaume Amontons</b> [ghee-yawm aw-mawn-tawn]

**Question #22: Science**

*10 points per part*

If this phenomenon occurs without damping, the result is an infinitely large amplitude.		
<b>1</b>	Name this phenomenon that occurs when a driving frequency equals a system's natural frequency.	<b>resonance</b> [or <b>resonating</b> ]
<b>2</b>	This 19th-century scientist developed a set of resonators that allowed him to identify sound frequencies. The quantity “internal energy minus temperature times entropy” is this scientist's namesake free energy, which is used at constant temperature.	Hermann von <b>Helmholtz</b>
<b>3</b>	Resonance was used to detect gamma rays in this 1959 experiment carried out at Harvard University. It used the Doppler effect to verify a key prediction of general relativity.	<b>Pound–Rebka</b> experiment



**Question #23: Literature**

*10 points per part*

Dorine tells this character that Elmire wants to talk to him, and he later tries to seduce Elmire.		
<b>1</b>	Name this character who tries to get Orgon arrested and gain Orgon's possessions.	<b>Tartuffe</b> [tar-toof]
<b>2</b>	Tartuffe is the title character in a play by this French writer who also wrote <i>The Misanthrope</i> .	<b>Molière</b> [mawl-yair] [or Jean-Baptiste <b>Poquelin</b> ]
<b>3</b>	A lost play by Molière is titled for a person with this job being <i>in Love</i> . In another play by Molière, two servants force a woodcutter to claim he has this job; that play is titled for somebody having this job <i>in Spite of Himself</i> .	<b>doctor</b> [accept <b>physician</b> or <b>médecin</b> ]

**Question #24: Literature**

*10 points per part*

One of the title characters in this novel is Pedro Camacho, who is from Bolivia.		
<b>1</b>	Name this novel published in 1977 that is set at a radio station.	<b><i>Aunt Julia and the Scriptwriter</i></b> [accept <b><i>La tía Julia y el escribidor</i></b> ]
<b>2</b>	This Peruvian author wrote <i>Aunt Julia and the Scriptwriter</i> .	(Jorge) Mario <b>Vargas Llosa</b> [YOH-sah] [prompt on <b>Llosa</b> ]
<b>3</b>	Pedro Camacho is hired after the radio station has troubles with scripts ordered from this country.	(Republic of) <b>Cuba</b> [or (República de) <b>Cuba</b> ]



**Question #25: Social Studies**

*10 points per part*

In 1945 and '46, an International Military Tribunal tried cases against Nazi leaders.		
<b>1</b>	Name the city where the trials took place.	<u>Nuremberg</u> , Germany [or <u>Nürnberg</u> ]
<b>2</b>	This president of the Reichstag and commander-in-chief of the <b>Luftwaffe</b> [LOOFT-vah-fuh] was sentenced to hang but committed suicide.	Hermann (Wilhelm) <u>Göring</u>
<b>3</b>	This person took a leave of absence from his job as a U.S. Supreme Court justice to be the U.S. chief prosecutor at Nuremberg.	Robert H(oughwout) <u>Jackson</u>

**Question #26: Social Studies**

*10 points per part*

This overall name is given to the conflict that included the Third Silesian War, the Pomeranian War, and the Spanish invasion of Portugal.		
<b>1</b>	Name this European war that also includes the French and Indian War fought in North America.	<u>Seven Years'</u> War
<b>2</b>	This Holy Roman Empress tried to get control of Silesia during the war but was unsuccessful.	<u>Maria Theresa</u> (Walburga Amalia Christina) [or <u>Maria Theresa</u> ; prompt on partial answers]
<b>3</b>	The Seven Years' War took place at the same time as the third of these wars between French and British forces in India.	Third <u>Carnatic</u> Wars



**Question #27: Fine Arts**

*10 points per part*

Name these London museums:		
<b>1</b>	This museum was the first public national museum in the world. It contains the Elgin Marbles and Rosetta Stone.	<b><u>British</u></b> Museum
<b>2</b>	This group used to be the National Gallery of British Art and now has four sites: two in London and one each in Liverpool and Cornwall. Three of these museums have displayed <b>Auguste Rodin's [oh-goost roh-dan'z] <i>The Kiss</i></b> .	<b><u>Tate</u></b>
<b>3</b>	This museum claims to be "the world's leading museum of art, design and performance". It contains Rodin's <i>Age of Bronze</i> and John Constable's <i>View of Salisbury Cathedral</i> .	<b><u>Victoria and Albert</u></b> Museum [accept <b><u>V&amp;A</u></b> ]

**Question #28: Fine Arts**

*10 points per part*

The male side of this painting has black and gray blocks, while the female side has wavy lines and circles of flowers.		
<b>1</b>	Name this painting completed in 1908 in Vienna.	<i>The <b><u>Kiss</u></b> [or <i>Der <b><u>Kuss</u></b>]</i></i>
<b>2</b>	This artist used gold leaf in <i>The Kiss</i> .	Gustav <b><u>Klimt</u></b>
<b>3</b>	Klimt painted <i>The Kiss</i> between painting portraits of this woman, both of which were taken by the Nazis.	Adele Bloch- <b><u>Bauer</u></b>



**Question #29: Literature**

10 points

One poem by this writer states “Ill fares the land, to hastening ills a prey, where wealth accumulates, and men decay.” This writer began that poem with the words “Sweet Auburn” addressed to the title location. In a novel by this author, Mr. Jenkinson adds to the misery of the protagonist by making him think that Olivia is dead, and several of the characters are surprised to learn that Olivia’s marriage to Squire Thornhill is valid. This author wrote that novel about the bankruptcy of Charles Primrose. Name this 18th-century Anglo-Irish writer of *The Deserted Village* and *The Vicar of Wakefield*.

Oliver Goldsmith

**Question #30: Mathematics**

10 points

These surfaces used to be called “spira,” which is why some slices of them are called **spiric** [“SPEAR”-ik] sections. **Villarceau** [vee-lar-soh] circles are on this type of surface. In topology, this surface is a common example of an orientable surface with **genus** [JEE-nus] one. These surfaces can be classified as horn, spindle, or the most common type, ring. Using Pappus’s centroid theorem, the volume of this solid can be shown to equal  $2\pi$  squared times big  $R$  times little  $r$  squared. The ring type of this shape can be generated by rotating a circle around an axis outside but co-planar to the circle. Name this shape that looks like a doughnut.

torus(es) [accept toroid or tori]



### Question #31: Social Studies

10 points

Before this person was well known, he ordered an aggressive attack against Italian forces at the Battle of **Tobruk** [TOH-bruk]. This person stopped Greek forces at the Battle of the **Sakarya** [suh-KAR-yuh]. As a politician, this person started the Republican People's Party, which included Republicanism, Populism, Nationalism, and **Laicism** [LAY-uh-sizm] as four of its "Six Arrows", which played a role in westernizing this person's country. This person changed his country's alphabet from being based on Ottoman to being based on Latin. Name this person who from 1923 to 1938 served as the first president of Turkey.

Mustafa **Kemal Atatürk**  
[moo-STAH-fuh  
**kay-MAHL**  
**AT-uh-turk**] [accept  
either underlined name]

### Question #32: Science

10 points

Staverman's reflection coefficient is multiplied by a difference of two of these values in the Starling equation. This quantity was traditionally measured using an inverted funnel in a device invented by **Wilhelm Pfeffer** [VIL-helm FEFF-ur]. This quantity is demonstrated using the difference in fluid heights in a **dialysis** ["die"-AL-uh-siss] tube. This quantity is based on preventing fluid movement across a semi-permeable membrane. This quantity is calculated by multiplying molar concentration of solute times the ideal gas constant times absolute temperature times the **van 't Hoff** [vahnt hof] index, and this quantity is often represented by the Greek letter pi. Name this **colligative** [kuh-LIG-uh-tiv] property.

osmotic pressure [accept  
oncotic pressure;  
prompt on pressure]





### Extra Question #1: Literature

10 points

One play by this writer begins with the high priest Joad talking to Abner and then agreeing with Josabet to try to dethrone the title character. This writer wrote that play about the king of Judah's widow, who abandoned Judaism. Another play by this neoclassical playwright begins with **Theramenes** [thuh-RAH-muh-neeZ] and **Hippolytus** [hih-PAH-lih-tuss] and uses the same characters as in a play by Seneca. In that play by this writer, the title character is the stepmother of Hippolytus and in love with him. This playwright used 12-syllable lines written in French **alexandrine** [al-ek-zan-DREEN]. Name this French contemporary of Pierre **Corneille** [kor-nay-uh] who wrote *Athalie* [ath-uh-lee] and *Phèdre* [feh-druh].

**Jean(-Baptiste) Racine**  
[zhahn rass-eeen]

### Extra Question #2: Mathematics

10 points

Schinkel's theorem for circles and **Kulikowski's** [koo-lih-KAWFF-skee'z] theorem for spheres states that there can be any natural number of these points on the circumference or surface of the shape. The Gauss circle problem asks how many of these points are inside a circle. Pick's theorem gives the area of a polygon using both the number of these points on the edge and the number of these points in the interior. Taxicab geometry is sometimes referred to as a geometry of these points. Models of random walks in two dimensions are generally confined to these points. Give this term for points whose coordinates are both integers.

**lattice** points



**Extra Question #3: Fine Arts**

10 points

One painting by this artist depicts a Christian being tortured by having his intestines wound around a windlass. That piece, which was originally used as an altarpiece in St. Peter's Basilica shortly after it was finished in the 17th century, is *The Martyrdom of Saint Erasmus*. That piece was commissioned after a cardinal who was the pope's nephew bought this artist's *The Death of Germanicus*. Another painting by this artist is named for a Latin inscription on a tomb that is pointed to by two shepherds in a painting that also has another man and a woman. Name this French Baroque painter of *Et in Arcadia ego*.

Nicolas **Poussin**  
[nee-koh-lah **poo-san**]

**Extra Question #4: Social Studies**

10 points

This person was the mayor of Panama City from 1519 to 1523. From there, this person got support from Hernando de **Luque** [LOO-kay] and Diego de Almagro, though after running into hardship this person continued on as the leader of the Famous Thirteen. This person ordered his best-known attack after Vincente de Valverde told him about somebody throwing a Bible on the ground and refusing to accept Charles V as his sovereign. Along with his half-brother **Hernando** [air-NAHN-doh], this person was successful at the Battle of **Cajamarca** [kah-hah-MAR-kah], which is where **Atahualpa** [ah-tah-WAHL-pah] was captured. Name this leader of the Spanish conquest of Peru who defeated the Incan Empire.

Francisco **Pizarro**  
(González)



**Extra Question #5: Science**

*10 points*

This physicist convinced Werner Heisenberg to add a note to the uncertainty principle paper based on this physicist's belief that physics should account for wave and particle properties using the complementarity principle. This person's push for quantum theories to not contradict classical theories, known as the correspondence principle, may have encouraged Arnold Sommerfeld to improve one of this physicist's models to use ellipses rather than circles. In that model, this physicist assumed quantized angular momentum to explain electron orbitals in a hydrogen atom. Name this Danish physicist who had famous debates with Albert Einstein.

Niels (Henrik David) Bohr



**Extra Question #6: Social Studies**

*10 points per part*

The Civil War did not end well for the Confederacy in Georgia.		
<b>1</b>	The Confederates won this battle in northern Georgia in September 1863. Braxton Bragg defeated William <b>Rosecrans</b> [“ROSE”-kranz], and there were a total of 35,000 casualties.	Battle of <b>Chickamauga</b> [“chick”-uh-MAW-guh]
<b>2</b>	In late 1864, this Union general captured Atlanta and then led the March to the Sea.	William Tecumseh <b>Sherman</b>
<b>3</b>	This battle at the end of Wilson’s Raid is often called the last battle of the Civil War, even though the Battle of Palmito Ranch happened later.	Battle of <b>Columbus</b>

**Extra Question #7: Social Studies**

*10 points per part*

Samuel Gompers led this union from 1886 to 1894 and again from 1895 until his death in 1924.		
<b>1</b>	Name this union that merged with the Congress of Industrial Organizations in 1955.	<b>American Federation of Labor</b> or <b>AFL</b>
<b>2</b>	This other union was viewed by the AFL as too radical. In 1917, the offices of this union were raided, and 101 of its leaders were found guilty of violating the Espionage Act.	<b>Industrial Workers of the World</b> or <b>IWW</b> [accept the <b>Wobblies</b> ]
<b>3</b>	The first union led by African–Americans to be chartered by the AFL was this union started by A. Philip Randolph.	<b>Brotherhood of Sleeping Car Porters</b> [accept <b>BSCP</b> ]



### Extra Question #8: Science

*10 points per part*

These elements have atomic numbers 89 through 103.		
<b>1</b>	Name these elements located below the <b>lanthanides [LAN-thun-“ides”]</b> on the periodic table.	<b>actinides</b> [AK-tin-“ides”] [accept <b>actinoids</b> ]
<b>2</b>	The International Union of Pure and Applied Chemistry recommends treating this element as an actinide even though its location on the periodic table appears to make it a transition metal.	<b>lawrencium</b> [accept <b>Lr</b> ]
<b>3</b>	Lawrencium was named for Ernest Lawrence, who invented this type of particle accelerator. These devices are now used primarily for proton beam therapy to treat cancer.	<b>cyclotrons</b>

### Extra Question #9: Science

*10 points per part*

This adjective is used to describe some reactions because they generally release heat.		
<b>1</b>	Give this adjective that describes reactions that decrease internal enthalpy.	<b>exothermic</b> [“ex”-oh-THUR-mik] reactions
<b>2</b>	This similar adjective describes reactions that have a decrease in Gibbs free energy.	<b>exergonic</b> [“ex”-ur-GAH-nik] reactions
<b>3</b>	Exergonic reactions are often described by this adjective because they proceed on their own without any external input.	<b>spontaneous</b> reactions