



The Illinois Mathematics and Science Academy of Aurora, IL presents

IMSANITY 4

-ROUND 13-

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Tossups

- (1) In one work by this author, the characters take turns telling fables like *The Dog and the Cow*. In another work, a student complains about a toothache when she's asked to translate words. This author of *The Lesson* wrote a play which begins with an English clock striking 17 English times, and another where Dudard argues with Botard about the title creature's existence and is romantically interested in Daisy. The Fire Chief stops by at a dinner between the(*) Smiths and Martins in one play, and in another, Berenger is the only one to not transform into the title creature. For ten points, identify this author of *The Bald Soprano* and *The Rhinoceros*.

ANSWER: Eugene Ionesco (or Eugen Ionescu)

- (2) This shape is the circular inverse of a cardioid. This curve can be approximated by connecting crossing pairs of equally-spaced points from two intersecting lines. Archimedes used the method of exhaustion with inscribed triangles to compute the area of segments of this shape, and supposedly used the three-dimensional analogue of this shape to create a(*) heat ray. The path of an object experiencing constant non-zero acceleration is this shape. Every point on this shape is equidistant from the focus and the directrix. For ten points, name this conic section with eccentricity one, exemplified by the equation y equals x squared.

ANSWER: parabola

- (3) One man from this country lost the Battle of Santa Rosa and the Second Battle of Rivas before claiming the presidency of Nicaragua. This country wanted one of its borders to be along the Haro Strait, but the San Juan Strait became the actual border after the Pig War. The Cherry Valley Massacre made some in this country fear "the Monster Brant". This nation memorialized its destruction of one of its ships in Tripoli during the(*) Barbary Wars in a military hymn. A naval leader from this country is credited with "opening" Japan and was named Matthew Perry. For ten points, name this country whose imperialism was justified as "manifest destiny".

ANSWER: United States of America (accept USA, reluctantly accept America)

- (4) This figure used the dragon Campe as a guardian, and was defeated by a figure who was raised by the goat Amalthea. In one story, this man was made King of Elysium after his defeat. This man overthrew Ophion and Eurynome, and this man's rule was known as the Golden Age. This figure led the losing side at the Titanomachy. He mistakenly ate the Omphalos stone instead of the last of his(*) children. This leader of the Titans was the husband of Rhea. For ten points, name this god who took power after castrating his father Uranus and who was overthrown by Zeus.

ANSWER: Cronus (or Kronos or Cronos)

- (5) One film from this country sees Pascals wager discussed between the marxist Vidal and a Christian. In addition to Eric Rohmers *My Night at Mauds*, one early film from this country sees Selenites imprison six humans and is called *A Trip to the Moon*. The American Patricia rats out her boyfriend, who later claims that "That's really disgusting", in(*) *Breathless*, and the juvenile delinquent Antoine runs into the sea in its *The 400 Blows*. Those works from this country's New Wave Movement were directed by Jean-Luc Godard and Francois Truffaut. For ten points, identify this country which hosts the annual Cannes Film Festival.

ANSWER: France (or French Republic)

- (6) After a failed assassination attempt, this politician cracked down of the Wafd Party, and he created the Liberation Rally party. This author of the *Philosophy of the Mind* forced the ulema at the al-Azhar University to support his policies. This second Secretary General of the Non-Aligned Movement worked with(*) Muhammad Naguib to overthrow King Farouk as a member of the Free Officers movement. In order to raise funds for the Aswan High Dam, this man nationalized the Suez Canal. For ten points, name this president of Egypt succeeded by Anwar Sadat.

ANSWER: Gamal Abdel Nasser

- (7) This artist's partnership with Michelozzo produced the Tomb of Cardinal Rainaldo Brancacci. The only signed work by this artist shows a woman with a partially-gilded sword holding the severed head of the Babylonian general Holofernes. This artist sculpted a wooden statue of an emaciated *Penitent Magdalene*. Another sculpture found in Padua depicts the Venetian mercenary Erasmo di Narni, better known as^(*) Gattamelatta. A nude boy in boots with a laurel-topped hat holds the sword of his vanquished adversary in this man's most famous sculpture. For ten points, identify this sculptor of the first free-standing nude since antiquity, the bronze *David*.

ANSWER: Donatello (or Donato di Niccoló di Betto Bardi)

- (8) Maffucci syndrome is characterized by the formation of benign tumors in these tissues known as enchondromas. Ewing's Sarcoma affects these tissues, whose cells express high amounts of the enzyme cathepsin K. A modified form of hydroxyapatite is found in these tissues, which contain Howship's lacunae. Hematopoiesis occurs in these organs, which is targeted by parathyroid hormone. Vitamin D deficiency lowers mineral content in this tissue, causing^(*) rickets. Its resorption is controlled by osteoclasts. A common treatment for lymphoma is a transplant of its namesake marrow. For ten points, identify these rigid, hard organs, examples of which include the sternum and femur.

ANSWER: bone (accept bone marrow before "Ewing's Sarcoma" and prompt on it thereafter)

- (9) A character in this play quotes Nietzsche by saying "God is dead: of His pity for man hath God died" after being told that his father prayed for his mother every day. One character in this play tried to kill himself at Jimmie the Priest's, and later recounts how Shaughnessy accused Harker of giving his pigs pneumonia. One character repeatedly tries to fix her hair and describes her dream of becoming a nun as "the more beautiful one" than becoming a concert pianist. Another character fatally infected his younger brother with the measles. The^(*) tubercular Edmund and morphine-addicted Mary appear in, for ten points, this play about the Tyrone family, a work by Eugene O'Neill.

ANSWER: Long Day's Journey Into Night

- (10) **One generalization of this statement provides bounds in the Absolute Convergence Theorem. A positive-definite symmetric function satisfying this condition is called a metric. This statement for inner products is a direct result of the Cauchy-Schwarz inequality. One version of this theorem is that the absolute value of a sum is(*) at most the sum of the absolute values, and this theorem implies that the shortest path between two points is a straight line. For ten points, name this inequality which states that the sum of the lengths of the shorter two sides is larger than the longest side of its namesake polygon.**

ANSWER: triangle inequality

- (11) **A failed suicide attempt in this work occurred because a doctor misrepresented the location of the heart. One character in this novel starts taking baths in the evenings so she can rendezvous with her lover, who is always accompanied by masses of yellow butterflies. Marvelous inventions, such as ice, are shown to characters by the gypsy(*) Melquiades, and Remedios the Beautiful levitates up to heaven. The last child born in this book has a pig's tail, as Ursula had always feared, and most of the male characters are named either Aureliano or Jose Arcadio. Set in Macondo, for ten points, identify this Gabriel Garcia Marquez novel.**

ANSWER: One Hundred Years of Solitude (or Cien años de soledad)

- (12) **This band's album *Discovery* was the soundtrack to the anime film *Interstella 5555*. One music video from this band shows robots, mummies, and skeletons dancing in a circle while the title phrase repeats. This band who performed *Around The World* was sampled in 2007 by Kanye West on his song(*) *Stronger*. This group performed the soundtrack to *Tron: Legacy*. Its newest album includes the song *Lose Yourself to Dance* and another which features Pharrell Williams claiming "we're up all night to get some". For ten points, identify this helmet-wearing electronic duo whose 2013 album *Random Access Memories* includes the song *Get Lucky*.**

ANSWER: Daft Punk

- (13) During this battle, attacks by Charles Portal caused a shift in the attackers' strategy. Biggen Hill was devastated in this battle, and the Royal Observation Corps aided one side in locating enemies. Stukas were outmatched by Hurricanes in this battle, and the words(*) "Never in the field of human conflict was so much owed by so many to so few" were spoken at its conclusion. This battle halted Operation Sea Lion. Pitting forces led by Hugh Dowding against those of Hermann Goering, for ten points, name this battle in which RADAR helped the Royal Air Force defeat the Luftwaffe to prevent an invasion of the namesake island during World War II.

ANSWER: Battle of Britain

- (14) This man's piece *Ruines* was incorporated into a later one of his works for solo piano, *Fantasie*. He used a brief quote from *La Marseillaise* in the first Allegro movement for his work *Carnival Scenes from Vienna*. The legend of Genevieve of Brabant inspired this man to write his only opera, and a Jean Paul novel inspired his(*) *Papillons*. "A Curious Story" and "Blind Man's Bluff" are two movements in his thirteen piece work for piano, *Kinderszenen*. This composer dedicated his work *Kreisleriana* to Frederic Chopin. For ten points, name this German composer of *Spring* and *Rhenish* symphonies.

ANSWER: Robert Schumann

- (15) This phenomenon was studied by a series of high-altitude balloons fitted with bolometers in the BOOMERANG experiment. The effect of inverse Compton scattering on this phenomenon is termed the Sunyaev-Zel'dovich effect. The effect of gravitational potentials on it is given by the ordinary and integrated forms of the Sachs-Wolfe effect, and its temperature was measured by WMAP. Affected by late time and primary anisotropies, it emits a thermal black body spectrum, and the 1978 Nobel Prize was awarded to its co-discoverers,(*) Arno Penzias and Robert Wilson. For ten points, name this widespread radiation that is a remnant of the Big Bang.

ANSWER: cosmic microwave background radiation (or CMBR)

- (16) In this war, John Parker's forces were crushed at the Battle of Sabbath Day Point. One side in this war gained allies in the Treaty of Easton. Soon after this war, Henry Bouquet fought a rebellion at the Battle of Bushy Run. This war saw General Montcalm win the Battle of Carillon and Battle of the Monongahela. This war began with the death of Ensign de Jumonville, who was killed by a patrol led by the man who surrendered(*) Fort Necessity. The Battle of the Plains of Abraham helped the British capture Quebec. For ten points, name this war that was followed by Pontiac's Rebellion and which saw fighting between British and French colonies in America.

ANSWER: French and Indian War (prompt on Seven Years' War)

- (17) This author wrote a novel in the form of a movie script by William Tallis following a devil-worshipping post-World War III society. In addition to *Ape and Essence*, this man wrote a work in which Gombauld's advances on Anne cause Denis to leave the title estate, at which he had discussed history with Mr. Wimbush and society with Mr. Scogan. This author of(*) *Crome Yellow* wrote a novel whose protagonist was found on a New Mexico reservation by Lenina and Bernard Marx and brought back to London, where he meets World Controller Mustapha Mond. For ten points, name this author who wrote of John the Savage in future London in his novel *Brave New World*.

ANSWER: Aldous Huxley

- (18) The Rameshwaram temple is a holy site for this deity, represented in one form as an infinite column of light. He created Virabhadra and Bhadrakali in rage after Daksha provoked the self-immolation of this deity's first wife, Sati. One of this god's sons wields the Vel and rides a peacock. This deity dances on top of the demon Apasmara in his Nataraja form, and he also rides the white bull(*) Nandi. Drinking the poison halahala turned this god's throat blue, and this god's most common representation is the lingam. For ten points, name this resident of Mount Kailash and consort of Parvati, the member of the Hindu trimurti known as the Destroyer.

ANSWER: Shiva or Siva (accept Nataraja before mention)

- (19) One chapter in this work, titled *Debtor to the Ages and the World*, explores the significance of being offered a cigarette without reciprocity. In another chapter entitled *The Circle of Human Feelings*, this work discusses Percival Lowell's study of "hardening oneself". C. Douglas Lummis criticized this book for its heavy reliance on information from Robert Hashima. This work was funded by the U.S. Office of(*) War Information, and it was sourced largely from newspaper clippings. This work of "anthropology at a distance" described the "shame" culture of Japan. For ten points, name this work written by Ruth Benedict.

ANSWER: The Chrysanthemum and the Sword

- (20) A solution of viscose reacts with this compound to form filaments of rayon. Mills-Packard chambers and a nitrogen oxide catalyst were used in an early method of creating this chemical, which is the catalyst during the Beckmann rearrangement for caprolactam production as well as the synthesis of isooctane. This compound reacts with fluorapatite and water to produce phosphoric acid in the wet method. The(*) lead-chamber process for production of this compound has been largely replaced by the use of a vanadium oxide catalyst in the contact process, and it is a major component of Venus's atmosphere and acid rain. For ten points, identify this strong diprotic acid with formula H_2SO_4 .

ANSWER: sulfuric acid (accept oil of vitriol)

- (21) One character in this work starts to recite *The Fallen Woman* but is interrupted by a waltz, and another cries when describing how "for over a century" a bookshelf has "sought the pure ideals of truth and justice." Daily telegrams from a sick lover eventually convince one character in this play to move back to Paris. The "eternal student" Petya Trofimov says he is "above love" with Anya, which doesn't really address Varya's fears. When no one listens to(*) Lopakhin's suggestion, he buys the title estate from Madame Ranevsky. For ten points, identify this Anton Chekhov play which ends with the title object being cut down.

ANSWER: The Cherry Orchard (or Vishnyovy sad)

Bonuses

- (1) This game series recently featured an expansion titled *Brave New World*. For ten points each:
- [10] Name this game series, created by Sid Meier, that is now in its fifth installment. In it, a player must found and raise its titular groups from the Stone Age to the Space Age.
ANSWER: Sid Meier's Civilization
- [10] In Civilization V, one can lead this nation symbolized by a red flower. Unique units for this nation include the Samurai and the Zero fighter plane.
ANSWER: Japan (accept Nihon or Nippon)
- [10] Players representing Japan in Civilization V act as this character. His Civilopedia entry notes that he was supported by Shiba Yoshimune and that he ended the Ashikaga Shogunate.
ANSWER: Oda Nobunaga
- (2) Pangar would not destroy this structure despite Vespasian's commands. For ten points each:
- [10] Name this structure, which is the ideal place for Jews to pray to due to its proximity to the Holy of Holies and which is the last remaining part of the Holy Temple.
ANSWER: Western Wall (accept Wailing Wall or Kotel or Buraq Wall)
- [10] The Western Wall is located in this city, which is also home to the Dome of the Rock on Mount Moriah.
ANSWER: Jerusalem
- [10] Just outside Jerusalem sits this hill on which Jesus was crucified. The nearby Church of the Holy Sepulchre supposedly covers his burial ground.
ANSWER: Calvary or Golgotha
- (3) This man's half-brother signed the Locarno Treaties, and under Stanley Baldwin, he was Chancellor of the Exchequer. For ten points each:
- [10] Name this British Prime Minister who practiced appeasement by signing the Munich Pact in order to avoid war and claim "peace for our time."
ANSWER: Neville Chamberlain
- [10] In the Munich Agreement, Chamberlain allowed Hitler to take over this territory, the German-speaking parts of the Czechoslovakia.
ANSWER: Sudetenland
- [10] This person resigned from the position of Foreign Secretary to protest Chamberlain's appeasement policy. He later mediated British relations with de Gaulle, but failed to contain the Suez Crisis as Prime Minister.
ANSWER: Anthony Eden

- (4) One character in this novel dreams that he's riding a horse and following his father, who's carrying a horn lantern through a snow-covered pass. For ten points each:
 [10] Identify this novel in which Llewelyn Moss and his wife Carla Jean get caught up with a drug gang, hunted by Anton Chigurh and unsuccessfully protected by Ed Tom Bell.
ANSWER: No Country For Old Men
 [10] *No Country for Old Men* is a work by this author who wrote about "the kid," the Glanton gang, and Judge Holden in *Blood Meridian*.
ANSWER: Cormac McCarthy (or Charles McCarthy)
 [10] The title for *No Country for Old Men* came from this poem by William Butler Yeats, which states "an aged man is but a paltry thing... unless / Soul clap its hands and sing" as a reason for taking the title action.
ANSWER: Sailing to Byzantium
- (5) Hess's Law states that the change in this value for a reaction is a state function. For ten points each:
 [10] Name this term that describes the total energy of a system. A reaction with a negative change in this quantity is called exothermic.
ANSWER: enthalpy
 [10] Enthalpy is calculated as the sum of internal energy and the product of volume and this value. Unlike internal energy, enthalpy is measured when this value is constant.
ANSWER: pressure
 [10] This term describes the change in molar enthalpy for the vaporization of a solid. Values for this quantity are determined experimentally through a Born-Haber cycle.
ANSWER: lattice enthalpy
- (6) The author of *On the Bondage of [this entity]* argued that it does not exist because of the sinful nature of mankind. For ten points each:
 [10] Name this concept that appears in another philosopher's *The World as [this concept] and Representation*, in which it is described to be the source of suffering.
ANSWER: will
 [10] *The World as Will and Representation* is by the German thinker and writer of *On the Fourfold Root of the Principle of Sufficient Reason*. He wrote that a temporary escape from the suffering caused by willing is through aesthetics, especially music.
ANSWER: Arthur Schopenhauer
 [10] This Dutch thinker wrote *The Freedom of the Will* to argue the existence of free will, which was responded to as part of a long-running debate with Martin Luther in a later work.
ANSWER: Desiderius Erasmus Roterodamus or Desiderius Erasmus of Rotterdam

- (7) The International Astronomical Union does not recognize all constellations. Answer the following questions about a former constellation for ten points each:
- [10] This enormous southern constellation appeared as a ship. It was split up into the constellations Carina, Puppis, and Vela by Nicolas Louis de Lacaille.
ANSWER: Argo Navis (accept Argus Navis)
- [10] One man of this surname unsuccessfully suggested the constellation Malus, the mast of Argo Navis, as a replacement for Pyxis. He named four moons of Uranus, a planet which his father of this surname discovered.
ANSWER: Herschel
- [10] Argus is the only one of the forty-eight constellations that this man listed in his *Almagest* to not be recognized by the IAU. This Alexandrian also suggested a geocentric model of the solar system in which orbiting bodies followed epicycles.
ANSWER: Claudius Ptolemy
- (8) Goods tells the protagonist “My condition is man’s soul to kill; / If I save one, a thousand I do spill,” and Knowledge promises to be his guide, but eventually leaves him as he finishes his journey. For ten points each:
- [10] Identify this medieval morality play, which sees the title character abandoned by everyone except Good Deeds.
ANSWER: Everyman
- [10] *Everyman* inspired this work, which saw Christian meet Faithful and visit Vanity Fair, where Faithful is executed as a martyr. He then meets Hopeful, and finally reaches the Celestial City.
ANSWER: The Pilgrim’s Progress from This World to That Which Is to Come
- [10] In *Pilgrim’s Progress*, Christian enters the Valley of this word. In *Everyman*, this figure is a messenger of God, claims that no man fears him “For every man I arrest and no man spare,” and he sends Everyman to the grave.
ANSWER: Death
- (9) This agreement was passed in the wake of the Mexican-American War and dealt with slave and free states. For ten points each:
- [10] Name this “omnibus bill” supported by Henry Clay and Stephen Douglas and passed under Millard Fillmore. California gained statehood and slavery was outlawed in Washington, D.C., and William Henry Seward’s *Higher Law* speech countered it.
ANSWER: Compromise of 1850
- [10] The Compromise of 1850 saw the passage of this act, which mandated that all runaway slaves had to be returned to their masters. It was controversially supported by Daniel Webster in his *Seventh of March* speech.
ANSWER: Fugitive Slave Act of 1850
- [10] This law would have banned slavery from any territory acquired in the Mexican-American war, but it failed in the Senate. It was supported by the Barnburners and later the Free Soil Party.
ANSWER: Wilmot Proviso

- (10) The title of this painting was inspired by the central window above the porch. For ten points each:
- [10] Name this work depicting the artist's sister Nan and her dentist holding a pitchfork in Iowa, an iconic American work by Grant Wood.
- ANSWER:** American Gothic
- [10] Grant Wood was a member of this art movement, which primarily depicted rural life in the American Midwest. Another member of this movement, John Steuart Curry, painted a mural of John Brown holding a gun and a Bible in front of a tornado.
- ANSWER:** regionalism or regionalist
- [10] This other member of the "Regionalist Triumvirate" created the *History of Missouri* murals. This artist greatly influenced the style of Jackson Pollock's *Going West*.
- ANSWER:** Thomas Hart Benton
- (11) This group of organisms is a part of the subphylum Chelicerata and use pedipalps for feeding and sensing. For ten points each:
- [10] Name this group of eight-legged organisms that include Lyme disease-spreading ticks as well as poisonous ones such as scorpions and spiders.
- ANSWER:** arachnids
- [10] Spiders are unique for containing this respiratory organ that consists of stacks of platelike organs to facilitate exchange of gases between the air and internal hemolymph.
- ANSWER:** book lung
- [10] This organ on the underside of a spider's abdomen allows it to produce silk in the desired pattern. Consisting of many tiny spigots, this organ is usually found in groups of six or four.
- ANSWER:** spinneret
- (12) This composer used the bass to represent a sultan in *The Kalendar Prince* and *The Sea and Sinbad's Ship*, movements found in his *Scheherezade* suite. For ten points each:
- [10] Identify this Russian composer of *Sadko* whose opera *The Tale of Tsar Saltan* contains the orchestral interlude *The Flight of the Bumblebee*.
- ANSWER:** Nikolai Andreyevich Rimsky-Korsakov
- [10] Rimsky-Korsakov was a member of this nationalistic circle of composers which met in St. Petersburg and included Modest Mussorgsky and Alexander Borodin.
- ANSWER:** The Mighty Five or The Mighty Handful
- [10] This leader of The Mighty Five wrote the tone poem *Tamara* and composed an oriental fantasy for solo piano called *Islamey*.
- ANSWER:** Mily Alexeyevich Balakirev

- (13) As U.S. poet laureate, he distributed copies of *Six American Poets* to hospitals, homeless shelters, and hotels. For ten points each:
 [10] Identify this Nobel laureate and author of poetry collections like *Part of Speech* and *To Urania* and essay collections like *Less than One* and *On Grief and Reason*.
ANSWER: Joseph Brodsky (or Iosif Aleksandrovich Brodsky)
 [10] Brodsky wrote that this author “has sunk in sleep. His verses sleep” in an *Elegy for the death of [this poet]*. This poet is best remembered for a collection of Holy Sonnets, including one which begins “Death, be not proud.”
ANSWER: John Donne
 [10] Brodsky described this character in Sicily and how “All his life from those clever constructions, from those inventions, he had to flee,” and referred in particular to the labyrinth.
ANSWER: Daedalus
- (14) Early engagements in this war included the Battles of Chiari and Cremona. For ten points each:
 [10] Name this war which was sparked after Charles II of Spain died heirless and ended with the Treaty of Utrecht. It included the Battles of Ramillies and Blenheim, and it was fought over who would control the title throne.
ANSWER: War of the Spanish Succession
 [10] The Battles of Ramillies and Blenheim were won by British and allied forces under this general, who earlier saw action at the Nine Years’ War. He also put down the Monmouth Rebellion
ANSWER: John Churchill, 1st Duke of Marlborough (accept either)
 [10] With the signing of the Treaty of Utrecht, Spain agreed to give the British this contract, allowing them to supply African slaves to the Spanish Colonies.
ANSWER: Asiento
- (15) Mount Harvard and Mount Princeton can be found in the Collegiate Peaks mountain range in this state. For ten points each:
 [10] Name this U.S. state that contains the Mesa Verde National Park in its southwestern corner. Rivers that originate in this state include the Arikaree, which flow eastward to form the Republican river.
ANSWER: Colorado
 [10] This largest mountain range in North America covers the western half of Colorado. It stretches from the province of British Columbia to the state of New Mexico, and its highest peak is Mount Albert.
ANSWER: Rocky Mountains (accept Rockies)
 [10] Another subrange of the Colorado Rockies is this one, home to the ski resort city of Telluride. The Rio Grande river rises on its eastern slopes before flowing southeast towards New Mexico.
ANSWER: San Juan mountains

- (16) Answer the following about writers of essays, for ten points each.
- [10] This French author pioneered the genre with his collection *Essays*, including his *Apology for Raymond Sebond*.
ANSWER: Michel de Montaigne
- [10] This American wrote about a transparent eyeball in his essay *Nature* and wrote that “a foolish consistency is the hobgoblin of little minds” in *Self Reliance*.
ANSWER: Ralph Waldo Emerson
- [10] This author wrote an essay against William Wood’s patent to mint coins, *Drapier’s Letters*, and appealed to the authority of “a very knowing American” and Psalmanazar in his most famous satirical essay.
ANSWER: Jonathan Swift
- (17) Catalan mythology is very interesting, but sadly it is often ignored. For ten points each:
- [10] One figure in Catalan mythology is Dip, one of these animals, which serves the Devil and feeds on blood. One of these animals guards the Underworld in Norse mythology and is named Garm.
ANSWER: dog (accept equivalents)
- [10] Another dog in Catalan Mythology is the Pesanta, which lays on peoples’ chests and causes these phenomena. In Norse mythology, they were caused by the Nara. In Greek mythology, Phobeter, son of Nyx, was seen their personification of these things.
ANSWER: nightmares
- [10] According to Catalan legends, Home del Nassos has three-hundred sixty-five of these body parts, shedding one on each day of the year. In Russian mythology, Baba Yaga has a long, crooked one she uses to catch the scent of her visitors.
ANSWER: noses
- (18) This phenomenon occurred as light passed through a double-slit in an experiment conducted by Thomas Young. For ten points each:
- [10] Name this phenomenon in which light bends around small obstacles. Bragg’s Law describes its occurrence with X-rays in crystal and lattice structures.
ANSWER: diffraction
- [10] Diffraction in a small circular aperture results in the formation of this pattern, named after an English scientist. The smearing of these features is used in the Rayleigh criterion for determining resolving power.
ANSWER: Airy disk
- [10] This equation is used to compute the effects of near-field diffraction, which only occurs when its namesake number is greater than one. Poisson spots appear at the center of a shadow caused by this form of diffraction.
ANSWER: Fresnel equation (accept Fresnel diffraction)

- (19) It came into fruition after the Boshin War and saw the formation of the Republic of Ezo. For ten points each:
 [10] Name this movement whose goals were written in the Charter Oath. It sought to westernize and bring back imperial rule to the country in which it occurred.
ANSWER: Meiji Restoration or Period (accept Meiji Ishin)
 [10] The Meiji Restoration occurred in this country, which had been ruled from Edo Castle by the Tokugawa Shogunate.
ANSWER: Japan (accept Nippon or Nihon)
 [10] During the Meiji Restoration, this rebellion occurred when disgruntled samurai reacted to westernization. Led by Saigo Takamori, it saw the Siege of Kumamoto Castle and the Battle of Shiroyama.
ANSWER: Satsuma Rebellion
- (20) Identify the following about searching in computer science for ten points each.
 [10] This data structure can be searched depth-first or breadth-first. In the former case, one starts at a root, travels to child nodes until arriving at a leaf, and then backtracking.
ANSWER: tree
 [10] This name is given to a tree whose parent nodes have keys greater than their child nodes. An algorithm named for this data structure can be used to sort an array in $n \log n$ time to enable faster searching.
ANSWER: heap
 [10] In this type of data structure, each node contains only its data and a pointer to the next node. As a result, searching it takes linear time.
ANSWER: linked list
- (21) Answer the following about areas of triangles for ten points each.
 [10] This type of triangle, with three sixty degree angles and all equal side lengths, has the greatest area-to-perimeter ratio.
ANSWER: equilateral (or equiangular)
 [10] This type of triangle has a one-hundred-eighty degree angle and collinear vertices. Trivially, it has the lowest area-to-proportion ratio.
ANSWER: degenerate
 [10] The area of a triangle is cut exactly in half by one of these lines from a vertex to the midpoint of the opposite side.
ANSWER: median