

**Collegiate** Written by Ewan MacAulay, Grant Boggess, Austin Brownlow, Michael Chuber, Alex Dzurick, Joey  
**Novice 4** Goldman, Nicholas Karas, Melanie Keating, Paul Kelson, Benjamin Johnson, Grace Liu, Brian  
**Fall 2013** Mongilio, Itamar Naveh-Benjamin, Robert Pond, Victor Prieto, Jacob Reed, Graham Reid, Jihye Shin,  
**Packet 10** Jonathan Tong Xu, Eric Xu, and Haohang Xu. Edited by Andrew Hart.

1. Fragments created due to this process can be detected using the TUNEL assay and DNA laddering. The CED9 gene codes for a protein in *C. elegans* that inhibits this process, which is regulated by the Bax and BAD proteins in the Bcl-2 family in humans. In the TNF path, a DISC forms when Fas ligand binds to Fas receptors, causing this process to occur. When DNA is damaged, the tumor suppressor p53 can initiate this process, which is contrasted with necrosis. For 10 points, name this process of programmed cell death.

ANSWER: apoptosis

2. This play inspired a dramatic monologue in which a figure sprawled in mire reflects on the god Setebos. In this play, a servant falls under the influence of a drunken steward and a humpbacked jester named Stephano and Trinculo. A witch named Sycorax used to live in the place where this play occurs. This play's characters include, Ferdinand, a shipwrecked prince; Miranda, the daughter of the overthrown Duke of Milan; and Caliban, Prospero's slave. For 10 points, name this Shakespeare play set on a magical island inhabited by the mysterious spirit Ariel.

ANSWER: *The Tempest*

3. This man's book *The Cardinal's Mistress* allegedly inspired Dorothy Parker to quip that bad books should not be cast aside lightly, but instead "thrown with great force." This man, who passed the Acerbo Law to reform the voting system in his favor, carried out the "gold for the fatherland" and "battle for land" policies. This leader was a member of the "Pact of Steel," conquered Ethiopia, commanded the Blackshirts, and came to power in the March on Rome. For 10 points, "Il Duce" was the nickname of what leader of Fascist Italy?

ANSWER: Benito [Amilcare Andrea] Mussolini

4. In a difficult D-minor piece by this composer, a 4-2 fingering in the left hand results in detached ascending thirds, which imitate a galloping horse. That piece by this composer of the *Years of Pilgrimage* piano cycle appears before the "Feux Follets" in a set of 12 studies. Besides writing "Mazeppa," a *Transcendental Etude*, this composer pioneered the symphonic tone poem and adapted gypsy melodies from his homeland in a set of 19 piano pieces. For 10 points, name this piano virtuoso composer of the *Hungarian Rhapsodies*.

ANSWER: Franz [Ritter von] Liszt [or Liszt Ferenc; or Ferenc Liszt]

5. One challenge to this case arose when Paul Cassell, not the solicitor general, argued before the Supreme Court, which ruled that this case's outcome has "become a part of our national culture." *Dickerson v. United States* held that the outcome of this case was a constitutional rule whose waiver must be knowing, intelligent, and voluntary. This case arose when a Latino man confessed to a kidnapping in Phoenix. For 10 points, name this case in which the Supreme Court held that the Fifth Amendment required telling arrestees that they had the right to remain silent.

ANSWER: Miranda v. *Arizona* [prompt on Arizona]

6. This character has a "dead man" in his tent named Lieutenant Mudd. While this man is in the hospital, he signs some of his letters as Washington Irving, which prompts an investigation. The first time this character sees the chaplain, "It was love at first sight." This character, who is stabbed by Nately's whore and goes AWOL in Rome, is flying a mission over Avignon when Snowden dies his arms. Claiming insanity does not excuse him from flying more missions. For 10 points, name this protagonist of Joseph Heller's *Catch 22*.

ANSWER: Captain John Yossarian [accept either underlined part]

7. In this ballet, a “Dance of the Goblets” ends a birthday party. The protagonist of this ballet, who accepts a crossbow from his mother on his 21st birthday, is tutored by Wolfgang. In this ballet, the main character accidentally vows to love the black-costume-wearing Odile instead of his true love in the third act. This ballet’s protagonist, Siegfried, almost shoots Odette, who has been forced by von Rothbart to transform into the title animal during the daytime. For 10 points, name this Tchaikovsky ballet titled for a body of water where a large bird swims.

ANSWER: Swan Lake [or Lebedinoya ozero]

8. A system named for this man can be analyzed using the Viterbi algorithm. Policy iteration and value iteration can be used to solve one of this man’s namesake decision processes. Another system named for this man is called ergodic if any state can reach any other state in a finite number of steps. The simplest dynamic Bayesian network is a “hidden” model named for this man, whose namesake property is possessed by a system whose future states only depend on the present state. For 10 points, name this Russian mathematician who names stochastic “chains.”

ANSWER: Andrey [Andreyevich] Markov

9. This was the position that “King” Kelly subbed himself into in the middle of a play to catch a foul ball. A hall of famer who played this position hit the “Homer in the Gloamin’” for the Cubs. Another player at this position, Johnny Roseboro, was hit over the head with a bat by Juan Marichal. During the 1970 All Star Game, Pete Rose ruined the career a player at this position, Ray Fosse, with a hard slide. Gabby Hartnett played this position, which was also manned by Mike Piazza. For 10 points, name this position that receives the ball from the pitcher.

ANSWER: catcher

10. This city was bombed in Operation Whitebait to divert attention from Operation Hydra, which targeted Peenemünde. A street in this city is named after the 17th of June, the date a construction-worker strike boiled over into widespread protests. Operation Vittles was an attempt to supply this city, which was home to a structure that could be crossed at Checkpoint Charlie. While visiting this city in 1963, President Kennedy gave his “ich bin ein” speech. For 10 points, name this German capital that was relieved by a 1948 airlift and was once divided by a wall.

ANSWER: Berlin

11. The main character of a novel set in this country, who loves his sickly cousin despite being destined to marry another cousin, is born with a piece of stone in his mouth. The Oath of the Peach Garden and the Battle of Red Cliffs are described in another novel from this country, also the setting of a book that chronicles Tripitaka’s travels to India with Sandy, Pigsy, and Sun Wukong, the Monkey King. For 10 points, name this country that is the setting of *Dream of the Red Chamber*, *Romance of the Three Kingdoms*, and *Journey to the West*.

ANSWER: China [or Zhongguo; accept People’s Republic of China or PRC]

12. In the first of these conflicts, Sir George Colley’s forces lost in quick succession at Laing’s Nek, Ingogo, and Majuba Hill. In the second of these conflicts, the founder of the Boy Scouts defended the besieged town of Mafeking. The Jameson Raid sparked off these conflicts, during which one side was led by President Paul Kruger. The first of these conflicts was fought for control of the Transvaal and was ended by the Pretoria Convention. For 10 points, name this pair of wars fought in South Africa between the British and the namesake Dutch farmers.

ANSWER: Boer Wars [or Vryheidsoorloë; prompt on Freedom Wars]

13. Deities in this religion, which include conjoined twins known as the Marassa, are divided into 21 nations, including Rada and Petwo. Among its clergy are magicians-for-hire called bokors, priests called houngans, and priestesses called mambos. Members of this religion pray to saint-like spirits such as Papa Legba who are known as loa, intermediaries between humans and the supreme god Bondye. For 10 points, name this syncretic Haitian religion whose actual religious practices typically don't involve raising zombies or sticking pins into dolls.

ANSWER: Voodoo [or Haitian Vodoun]

14. One work by this man was updated by Anthony Giddens, who added "new" to its title. In another work, this author advanced the distinction between "organic" and "mechanical solidarity." This author claimed that the sacred was the only commonality of all religions in *The Elementary Forms of Religious Life*. He wrote a case study on a behavior he divided into egoistic, altruistic, fatalistic, and anomic types. For 10 points, name this sociologist whose works include *The Rules of Sociological Method*, *The Division of Labor in Society*, and *Suicide*.

ANSWER: [David] Emile Durkheim

15. Chiriquí Island is located in this country's province of Puntarenas near where its Tempisque River empties into its Gulf of Nicoya. This country's Cordillera Central range includes the Poás and Irazú volcanoes. Tourism to national parks, which cover about 25% of this country's land, has overtaken coffee and bananas in driving this country's economy. The San Juan River lies on this country's border with Nicaragua to the north. For 10 points, name this northern neighbor of Panama, a Central American country with no standing army and its capital at San José.

ANSWER: [Republic of/Republica de] Costa Rica

16. Results of this technique for organic molecules can be used to calculate the Kovats index. The molar mass distribution of polymers can be found with the size-exclusion type of this technique. The retention factor of this technique can be calculated as the migration distance of the analyte divided by the migration distance of the solvent. Pigments can be analyzed in the "paper" type of this technique, which also comes in high-performance liquid and "thin layer" types. For 10 points, name this chemical technique that separates mixtures based on polarity.

ANSWER: chromatography [accept word forms and more specific answers]

17. This deity got his epithet "Bhasma Anga Raaga" from his penchant for smearing ashes on himself. His namesake sect arose from the worship of the Vedic god Rudra. This deity wields the trishula trident, which some myths say is the instrument with which he chopped off Ganesha's original head when Ganesha got too close to this god's wife, Parvati. This deity, who is typically worshipped in the phallic form of the Lingam, is also depicted as Nataraja, the Cosmic Dancer. For 10 points, name this Hindu destroyer god who forms the Trimurti with Vishnu and Brahma.

ANSWER: Shiva [or Mahadeva; or Mahesh; or Bholenath]

18. These particles give their name to an epoch shortly after the big bang during which the average energy of particle collision was too high to form hadrons. They are the only elementary particles in the Standard Model that experience all four fundamental interactions. Hadrons are classified in terms of how many "valence" types of these particles they have. One of these particles and its anti-variant form a meson, and baryons are formed from a combination of three of them. For 10 points, give the name for these particles that come in charm, strange, up, and down varieties.

ANSWER: quarks [accept more specific types]

19. This author, who called Constantin Guys the “painter of modern life,” described his drug use in *Artificial Paradises*. In one of his collections, he compared a poet to a bird whose “giant wings prevent him from walking” and called the “hypocrite reader” “my twin, my brother.” This author wrote “To the Reader” and “The Albatross,” poems that appeared in his work whose sections include “Parisian Scenes,” “Wine,” “Revolt,” and “Spleen and Ideal.” For 10 points, name this French author of *Les Fleurs du Mal*.

ANSWER: Charles **Baudelaire**

20. One painting by this man depicts a sofa on a wood floor that stands in for Mae West’s lips. In another painting by this man, a fish jumps out of water to eat a tiger. In addition to creating *Dream Caused by the Flight of a Bee Around a Pomegranate a Second Before Awakening*, this man depicted 28 copies of the Venus De Milo in *The Hallucinogenic Toreador*. Against a backdrop of the cliffs of Catalonia, this artist depicted ants swarming a pocket watch and several melting clocks. For 10 points, name this Spanish surrealist of *The Persistence of Memory*.

ANSWER: Salvador [Domingo Felipe Jacinto] **Dalí** [i Domènech]

TB1. In a book about supervenience and this philosophical entity, Jaegwon Kim set forth an argument for reductive physicalism to explain it. The “computational theory” of this entity was put forth by Hilary Putnam. Gilbert Ryle critiqued the Cartesian theory of this entity in a 1949 book titled for the “concept” of this entity, which compares Descartes’ theory of it to a “ghost in a machine.” George Berkeley was an immaterialist and thought that everything existed in this entity. For 10 points, name this thing that dualists believe is separate from the body.

ANSWER: **mind** [accept no other answer]

TB2. The speaker of this work is described as “stout as a horse, affectionate, haughty” and “of the foolish as much as the wise.” This work describes taking “the exact the dimensions of Jehovah” and “buying drafts of Osiris.” The speaker answers, “The beautiful uncut hair of graves” to a child asking “What is the grass?” in this poem, whose speaker claims that “every atom belonging to” him belongs to the reader as well, because he is large and contains multitudes. For 10 points, name this 52-section poem found in *Leaves of Grass*, in which Walt Whitman celebrates and sings himself.

ANSWER: **Song of Myself**

**Collegiate** Written by Ewan MacAulay, Grant Boggess, Austin Brownlow, Michael Chuber, Alex Dzurick, Joey  
**Novice 4** Goldman, Nicholas Karas, Melanie Keating, Paul Kelson, Benjamin Johnson, Grace Liu, Brian  
*Fall 2013* Mongilio, Itamar Naveh-Benjamin, Robert Pond, Victor Prieto, Jacob Reed, Graham Reid, Jihye Shin,  
*Packet 10* Jonathan Tong Xu, Eric Xu, and Haohang Xu. Edited by Andrew Hart.

1. This author used Matthew 7:14 to title a novel about Jerome and Alissa. For 10 points each:

[10] Name this author of *Straight is the Gate* who wrote about a man who discovers he loves young Algerian boys in *The Immoralist*.

ANSWER: Andre [Paul Guillaume] **Gide**

[10] Andre Gide was a writer from this country, which is also the surname of the author of *Penguin Island*.

ANSWER: **France** [accept **Anatole France**; or French **Republic**; or République **française**]

[10] This Algerian-French author described Mersault killing an Arab in his novel *The Stranger*.

ANSWER: Albert **Camus**

2. This man claimed that *A Treatise of Human Nature* “fell stillborn from the press.” For 10 points each:

[10] Name this Scottish Enlightenment thinker who reformulated that work into his *An Enquiry Concerning Human Understanding*.

ANSWER: David **Hume**

[10] Hume also wrote a work styled as a dialogue between Pamphilus, Cleanthes, Philo, and Demea, who all discuss the “natural” type of this institution.

ANSWER: natural **religion** [accept *Dialogues Concerning Natural Religion*]

[10] Hume was, along with John Locke, a member of this philosophical school that believed that knowledge only comes from experience and emphasized the importance of experiments.

ANSWER: **empiricism** [accept word forms]

3. This conflict began with a rebellion led by counts Egmont and Horn that the Duke of Alba quickly quashed. For 10 points each:

[10] Name this war of independence that ended at the same time as the Thirty Years’ War.

ANSWER: **Eighty Years’** War [or **Dutch** War of Independence]

[10] After the Eighty Years’ War, Dutch provinces formed a union named after this city, where a 1713 treaty later ended the War of the Spanish Succession.

ANSWER: **Utrecht** [accept **Treaty of Utrecht** or **Peace of Utrecht** or **Union of Utrecht**]

[10] The Dutch Republic founded New Amsterdam in 1625 as the capital of New Netherland on this island that is now home to Central Park.

ANSWER: **Manhattan** Island

4. These bonds explain why water has a high boiling point. For 10 points each:

[10] Name these bonds that occur between polar molecules containing a certain element.

ANSWER: **hydrogen** bonds [or **H** bonds]

[10] These intermolecular forces occur between non-polar molecules that have temporarily induced dipoles. They are a subset of van der Waals forces.

ANSWER: **London dispersion** forces [accept either or both underlined parts; accept **LDF**]

[10] These noncovalent interactions in proteins are formed from a combination of hydrogen bonding and electrostatic interactions. They share their name with a device that connects the oxidation and reduction half-cells of a galvanic cell.

ANSWER: **salt bridges**

5. A dog at the bottom of this painting blends into the wooden floor. For 10 points each:

[10] Name this 1434 work that shows a man with a black hat on the left and a woman in a green dress on the right holding hands.

ANSWER: *The Arnolfini Wedding* [anything including Arnolfini]

[10] Besides creating *Portrait of a Man*, this painter of *The Arnolfini Wedding* also created the *Ghent Altarpiece* with his brother Hubert.

ANSWER: Jan van Eyck

[10] This other Netherlandish painter created *The Astronomer*, *The Milkmaid*, and *Girl with a Pearl Earring*.

ANSWER: Jan Vermeer [or Johan Vermeer]

6. In this work, Manolin visits Santiago to discuss baseball and Joe DiMaggio. For 10 points each:

[10] Name this short novel that tells the story of Santiago and his struggle to catch a huge marlin after not catching anything for 84 days.

ANSWER: *The Old Man and the Sea*

[10] In this novel, American ambulance driver Frederic Henry becomes involved with an English nurse named Catherine Barkley.

ANSWER: *A Farewell to Arms*

[10] This American author wrote both *The Old Man and the Sea* and *A Farewell to Arms*.

ANSWER: Ernest [Miller] Hemingway

7. This empire's final ruler, Brihadratha, was killed during a military parade by his chief general. For 10 points each:

[10] Name this Indian empire that lasted from 322 to 185 BCE, whose emperors included Bindusara.

ANSWER: Maurya Empire [or Mauryan Dynasty]

[10] This fan of war elephants founded the Maurya Empire and was the addressee of Kautilya's *Arthashastra*. He shares his name with a later "great" emperor from the Gupta dynasty.

ANSWER: Chandragupta Maurya [accept Chandragupta II The Great]

[10] The grandson of Chandragupta, Ashoka, was remorseful after the bloody Kalinga War, leading him to convert to this nonviolent religion whose edicts were printed on stone inscriptions.

ANSWER: Buddhism [accept word forms; accept Theravada Buddhism]

8. This man was destined to murder his father and marry his mother. For 10 points each:

[10] Name this man who solved the riddle of the Sphinx and became king of Thebes before stabbing his eyes out with Jocasta's pins.

ANSWER: Oedipus [or Oidipous]

[10] This ancient Greek playwright wrote the tragedies *Oedipus Rex*, *Oedipus at Colonus*, and *Antigone*.

ANSWER: Sophocles

[10] Sophocles' lost work *Trackers*, a play in this bawdy genre that was typically performed after three tragedies, was discovered in fragmentary form in 1912.

ANSWER: satyr play

9. This man wrote *Imperialism, the Highest Stage of Capitalism*. For 10 points each:

[10] Name this Russian who returned from exile in 1917 to lead the Bolsheviks during the Russian Civil War, after which he became the first Premier of the Soviet Union.

ANSWER: Vladimir [Ilyich] Lenin [or Vladimir Ilyich Ulyanov]

[10] This Russian, who founded the Red Army, served as Lenin's right-hand man until he was exiled to Mexico.

ANSWER: Leon Trotsky [or Lev Davidovich Bronstein]

[10] This Russian leader, who led the USSR during World War II, ordered the exile and later assassination of Trotsky.

ANSWER: Joseph Stalin [or Iosif Vissarionovich Stalin; or Ioseb Besarionis dze Jughashvili]

10. Mushroom Mix-Up was one of the stages in the first entry in this video game series. For 10 points each:

[10] Name this video game series in which players move around a board by rolling a dice and purchasing stars with coins earned primarily through success in mini-games.

ANSWER: Mario Party

[10] The first game to feature the Rumble Pak was in this series, whose characters include Slippy Toad and Peppy Hare.

ANSWER: Star Fox

[10] A *Star Fox* game appeared for this console, which also featured the original *Mario Party* game and *The Legend of Zelda: Ocarina of Time*.

ANSWER: Nintendo 64 [accept N64]

11. Substance P and epinephrine are both this type of chemical. For 10 points each:

[10] Name these chemicals, such as serotonin, that carry signals between neurons.

ANSWER: neurotransmitters

[10] Excessive amounts of this neurotransmitter have been shown to be involved with schizophrenia, while decreased amounts are related to Parkinson's disease.

ANSWER: dopamine

[10] Neurotransmitters are released into the 20-nanometer gap called the cleft in these specialized junctions between neurons.

ANSWER: chemical synapses

12. This politician won his first Democratic nomination after John Nance Garner dropped out of the race to be his running mate. For 10 points each:

[10] Name this governor of New York who was elected to four terms as president.

ANSWER: Franklin Delano Roosevelt [or FDR]

[10] In his speech accepting the nomination, FDR used this two-word phrase for the first time to describe his plan for combating the Great Depression.

ANSWER: New Deal

[10] This organization, the largest New Deal agency, hired many unemployed adult men who worked on public construction projects. It was run by Harry Hopkins between 1935 and 1943.

ANSWER: WPA [or Works Progress Administration; or Work Projects Administration]

13. This religion's name came from a derogatory nickname for members of Oxford's Holy Club. For 10 points each:  
[10] Name this Protestant denomination, whose American branch suffered a north-south schism that lasted for almost one hundred years following an 1844 conference in Louisville.

ANSWER: **Methodism** [accept word forms]

[10] This English theologian, who names a Connecticut liberal arts university, is generally regarded as the founder of Methodism.

ANSWER: John **Wesley** [accept **Wesleyan** University]

[10] Methodists use the *Book of Offices*, which is based on the *Book of Common Prayer* developed for this protestant denomination.

ANSWER: **Anglicanism** [accept word forms; or Church of **England**; or **Episcopalian** Church]

14. This man wrote a "mad scene" into his opera *Lucia di Lammermoor*. For 10 points each:

[10] Name this *bel canto* operatic composer who wrote the aria "Una furtiva lagrima" for the tenor role Nemorino in his comic opera *The Elixir of Love*.

ANSWER: [Domenico] Gaetano [Maria] **Donizetti**

[10] This Donizetti rival was a *bel canto* composer whose *The Puritans* and *Norma* were revived in the 1950s by soprano Maria Callas.

ANSWER: Vincenzo [Salvatore Carmelo Francesco] **Bellini**

[10] Both Donizetti and Bellini hail from this country, where Claudio Monteverdi began modern opera with his *L'Orfeo*.

ANSWER: **Italy** [or **Italian** Republic; or Repubblica **Italiana**]

15. This man was struck blind by Hera. For 10 points each:

[10] Name this Theban prophet whose shade advises Odysseus to leave the cattle of Helios alone in Book 11 of the *Odyssey*.

ANSWER: **Tiresias**

[10] Tiresias once struck two of these animals, which are depicted encircled around Hermes's staff Caduceus, when he saw them copulating on the road.

ANSWER: **snakes** [or **serpents**; accept equivalents]

[10] By striking the snakes, Tiresias displeased Hera, causing him to undergo this transformation, which allowed him to later report certain information about sex to Hera.

ANSWER: **changing gender** [accept **turning into a woman** or any equivalent]

16. One building in this network of museums is built like a ship's prow. For 10 points each:

[10] Name this network of museums that includes a New York building designed by Frank Lloyd Wright and another building in Bilbao, Spain.

ANSWER: **Guggenheim** Museums

[10] This architect of the MIT Stata Center and the Guggenheim Museum in Bilbao often uses curving metal exteriors to simulate randomness.

ANSWER: Frank [Owen] **Gehry** [or Frank/Ephraim Owen **Goldberg**]

[10] The metal-sheeted, Gehry-designed Walt Disney Concert Hall is located in this California city, which is also home to the Hollywood Bowl.

ANSWER: **Los Angeles** [or **LA**]



17. John Shade is the fictional author of this poem-within-a-novel. For 10 points,

[10] Name this poem supposedly edited by Charles Kinbote, who claims that it alludes to the deposed King of Zembla.

ANSWER: **Pale Fire**

[10] *Pale Fire* was written by this author of *Pnin*, a Soviet expatriate who described growing up in Russia in his autobiography, *Invitation of a Beheading*.

ANSWER: Vladimir [Vladimirovich] **Nabokov**

[10] In this Nabokov novel, the death of Annabel Leigh drives the middle-aged Humbert Humbert to pursue a relationship with the twelve-year-old “nymphet” Dolores Haze.

ANSWER: **Lolita**

18. Examples of these phenomena include the fundamental attribution error. For 10 points each:

[10] Name these patterns of deviation in judgment that lead people to draw illogical conclusions, exemplified by the “confirmation” type in which people only seek out the information they want.

ANSWER: cognitive **biases** [accept **confirmation bias**]

[10] Confirmation bias is a concept from this field of psychology, which examines how the presence of other individuals affects people’s thoughts, feelings, and actions.

ANSWER: **social** psychology [accept word forms]

[10] People use these cognitive shortcuts to make decisions; they result in biases when they deviate systematically from logic, probability, or rationality.

ANSWER: **heuristics**

19. Name these authors who wrote about English butlers, for 10 points each.

[10] Bertie Wooster’s valet, Jeeves, is a recurring character in this British author’s short stories.

ANSWER: [Sir Pelham Grenville] P.G. **Wodehouse**

[10] In this Japanese-born British author’s *Remains of the Day*, the butler Stevens narrates his relationship with his former employer, Miss Kenton.

ANSWER: Kazuo **Ishiguro**

[10] This is the surname of the author of *Loving*, about World War II servants. This color also appears in the title of a novel about the execution of John Coffey, a death-row inmate with healing powers.

ANSWER: **Green** [accept **Henry Green** or *The **Green Mile***]

20. This quantity is negative for left-handed metamaterials. For 10 points each:

[10] Name this quantity, the ratio of the speed of light in a vacuum to the speed of light in that material.

ANSWER: **index of refraction** [or **refractive index**; prompt on **IR**]

[10] This law relates the index of refraction to the ratio of the sine of the angles of incidence.

ANSWER: **Snell**’s law [or **Snellius**’s law; or **Snell-Descartes** law; prompt on law of **refraction**]

[10] If the index of refraction depends on the polarization or propagation direction of light, this optical property results. It is the cause of double refraction in calcite.

ANSWER: **birefringence**

21. Fossils of these marine organisms have been found on all continents. For 10 points each:

[10] Name these small arthropods, a signature marker of the Paleozoic Era named for the number of axial and pleural body segments they possess.

ANSWER: **trilobites**

[10] The appearance of trilobites marks the start of Series 2 of this geologic period, whose namesake “explosion” was the appearance of major animal phyla around 542 million years ago.

ANSWER: **Cambrian** period

[10] These extremely old fossils are formations created by the precipitation of minerals from microbial communities such as cyanobacteria and algae.

ANSWER: **stromatolites** [or **stromatoliths**]