



## 2019 Science Championship Sample Packet

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**Uses** This sample packet of tossup questions is provided to familiarize players, parents, and sponsors with the style of questions they will encounter during the buzzer rounds of the Science Championship. All information and registration for the Science Championship can be found at [www.sciencechampionship.com](http://www.sciencechampionship.com).

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**Errata** If you find mistakes in these questions, please let us know!

1. This planet's tallest mountains, the Maxwell Montes [MON-tayz], lie on its large highland region of Ishtar Terra [ISH-tar TAIR-uh]. This planet has a 224-day orbit and is covered in perpetual clouds. Atmospheric carbon dioxide creates very high temperatures on—for 1 point—what planet between Earth and the Sun?

answer: Venus

<278838>

2. These particles form so-called "cathode rays," and they are also called "beta particles." The transfer of these particles between atoms underlies nearly all chemical reactions. For 1 point—name these negatively charged particles that orbit outside the atomic nucleus.

answer: electrons

<278481>

3. This organ's functional units contain capillaries that filter fluid called glomeruli [gloh-MAIR-yoo-lye]. If these organs fail, their function can be replaced by dialysis [dye-AL-uh-sis]. They drain via the ureters [YUR-uh-turz] into the bladder. For 1 point—name these organs that filter waste out of the blood via nephrons [NEF-rahnz].

answer: kidneys

<278134>

4. This constellation's left shoulder is the star Bellatrix [BEL-uh-"tricks"]. This constellation's left foot and right shoulder are the supergiant stars Rigel [RYE-jel] and Betelgeuse ["beetle-juice"], respectively. A three-star "belt" is in—for 1 point—what constellation that depicts a mythical Greek hunter?

answer: Orion (accept Orion's belt)

<344838>

5. This element can form various fullerenes [FULL-uh-reenz]. Other forms of this element, found in molecules such as alkenes [AL-keen-z] and alkanes [AL-"canes"], include graphite ["graph"-ite] and diamond. For 1 point—name this element found in all organic compounds, which has atomic number six and atomic symbol C.

answer: carbon (accept C before "C")

<276944>

6. This insect has Formosan [for-MOH-sun], Giant Northern, and "mound builder" types, and it produces methane as it digests its food. Like bees, this insect's colonies have queens. It has protozoa [proh-tuh-ZOH-uh] in its guts that break down cellulose ["SELL-you"-lohss]. For 1 point—name this pest that causes damage when it eats wood.

answer: termite(s) (or Isoptera)

<269226>

7. These strings are often paired with a six-digit number that changes every 30 seconds and is called a "second factor." These strings of text are often masked by asterisks or bullets on computer screens. For 1 point—name these secret bits of text that authenticate the owner of a username.

answer: passwords

<343170>

8. These events produce P waves and S waves, and they can cause soil liquefaction [lih-kwiw-FAK-shun] and tsunamis [soo-nah-meez]. The surface location above one of these events is called the focus; their intensity can be specified using the Richter scale. For 1 point—name these sudden movements of the Earth's crust.

answer: earthquakes (accept temblors; prompt on "tremors" or "seismic events")

<277052>

9. This quantity can be calculated using peripheral resistance, and controlled by drugs called ACE ["ace"] inhibitors. This quantity is elevated in hypertension. It comes in systolic [sis-"TALL"-ik] and diastolic ["DIE-uh-STALL"-ik] forms. For 1 point—name this measure of force exerted by the heart, also called BP.

answer: **blood pressure** (accept high **blood pressure**; accept systolic **blood pressure** before "diastolic"; accept diastolic **blood pressure** before "systolic"; accept **BP** before "BP"; prompt on "pressure")

&lt;120663&gt;

10. This operation's "synthetic" form is used to factor polynomials. This operation can be performed by subtracting the logarithms of the operands. This operation is equivalent to multiplying by a reciprocal. For 1 point—name this arithmetic operation that gives a quotient and remainder.

answer: **division** (accept **divides** or **dividing** or synthetic **division**)

&lt;289510&gt;

11. These items only produce virtual images if they are "diverging," while "converging" ones produce real or virtual images depending on how the object distance compares to the focal length. For 1 point—name these transparent objects used in cameras and to correct one's eyesight.

answer: **lens(es)** (accept diverging **lenses** before "converging")

&lt;268428&gt;

12. This animal is the only living member of order Cingulata ["SING"-yuh-lah-tah]. The "nine-banded" type gives birth only to identical quadruplets. This animal has a long snout and a leathery shell protected by bony shells. For 1 point—name this mammal whose name is Spanish for "little armored one."

answer: **armadillo**

&lt;278160&gt;

13. These numbers have a parity of zero, and they include all known perfect numbers. The positive subset of these numbers contains only one prime number, its lowest member. For 1 point—name this subset of integers that are evenly divisible by two, the opposite of the odd numbers.

answer: **even** numbers or **even** integers

&lt;278164&gt;

14. This type of event in 2017 inspired an episode of PBS's *Nova* produced in a single day. During one of these events, Donald Trump took a brief look without using special glasses. August 21, 2017 was the date of—for 1 point—what kind of event, in which the Sun is totally blocked?

answer: (total) **solar eclipse(s)** (prompt on "eclipse(s)")

&lt;437769&gt;

15. This diagram displays actinides [AK-tih-nydez] and lanthanides [LAN-thuh-nydez] separately, and places entries near the top that have lower atomic numbers. The existence of gallium [GAL-ee-um] was predicted using it by its inventor, Dmitri Mendeleev [men-duh-LAY-eff]. For 1 point—name this table displaying the chemical elements.

answer: **periodic table** (of the elements)

&lt;290346&gt;

16. This substance is synthesized in cells during "S phase," and its subunits include the base thymine ["THIGH"-meen]. Its structure, discovered by James Watson and Francis Crick, is organized into chromosomes. Genetic information is carried in—for 1 point—what double helix of nucleic acid?

answer: **DNA** or **deoxyribonucleic acid**

&lt;276943&gt;

17. This term labels three lines that meet at a triangle's centroid. One outlier in data has little effect on this statistic. Also called the second quartile, for a sorted sample of eleven values it is the sixth lowest. For 1 point—name this middle value contrasted with the mode and mean.

answer: **medians**

&lt;276838&gt;

18. This man spoke about supergravity in 1979, in his first lecture as Lucasian [loo-KAY-zhun] Professor. A form of "radiation" named for this physicist is emitted from the event horizons of black holes. *A Brief History of Time* was written by—for 1 point—what wheelchair-using scientist?

answer: Stephen (William) **Hawking** (accept **Hawking** radiation)

&lt;329002&gt;

19. This organelle [OR-guh-NEL] is where oxidative phosphorylation [AHK-sih-DAY-tiv FOS-foh-rih-LAY-shun] takes place.  $\text{NAD}^+$  ["N-A-D plus"] is reduced to NADH ["N-A-D-H"] in the Krebs cycle in this organelle. The inner part of this organelle contains cristae [KRIS-tee] that increase its surface area for generating ATP ["A-T-P"]. For 1 point—name this “powerhouse” of the cell.

answer: **mitochondrion** ["MY"-toh-KAHN-dree-un] or **mitochondria** ["MY"-toh-KAHN-dree-uh]

&lt;277961&gt;

20. This quantity, which is proportional to the average kinetic energy, joins with pressure to define the triple point of a substance. Charles' law says that for ideal gases it increases as volume increases. For 1 point—name this property measured on the Kelvin and Fahrenheit scales.

answer: **temperature**

&lt;295678&gt;

21. This substance has a chunky texture in its *aa* [ah-AH] variant, and a ropy texture in its *pahoehoe* [PAH-hoy-hoy] form. This substance builds up cinder cones and namesake “domes.” Before this fluid extrudes onto the surface, it is called magma. For 1 point—name this molten rock that erupts from volcanoes.

answer: **lava** (accept **lava** domes or basalt(ic) **lava**; do not accept or prompt on “magma”)

&lt;278176&gt;

22. These shapes make up the faces of a regular dodecahedron [doh-dek-uh-HEE-dron]. In regular examples of these polygons, the ratio of the diagonal length to side length is the golden ratio, and interior angles are each 108 degrees. The diagonals form a regular star in—for 1 point—what shapes with five sides?

answer: **pentagons** (prompt on “5-gon(s)”)

&lt;328636&gt;

23. This constant squared equals the ratio of an object's relativistic energy to its mass. Changes in gravitational fields propagate at this speed; it is also the speed of all massless particles, like photons. 186,282 miles per second is—for 1 point—what maximum possible speed?

answer: **speed of light** (in a vacuum) (prompt on “c”) [The first clue is the meaning of Einstein's  $E = mc^2$  formula.]

&lt;278482&gt;

24. These organisms are called tracheophytes [TRAY-kee-uh-“fights”] if they have specialized vascular tissue, such as xylem [ZYE-lum] and phloem [“FLOW”-um]. Their cells have chloroplasts [KLOR-oh-plasts], which let them convert carbon dioxide into oxygen and sugar via photosynthesis [“photo”-SIN-thuh-siss]. For 1 point—name these organisms that usually grow from seeds.

answer: **plants** or **Plantae**

&lt;289855&gt;

25. This substance, which when pure has a pH of 7.0, is known as the universal solvent. Ninety-seven percent of Earth's supply of this substance cannot be consumed by humans. Aquifers [AH-kwih-furz] are underground sources of—for 1 point—what substance with chemical formula  $\text{H}_2\text{O}$  [“H-two-O”]?

answer: **water** (accept **H<sub>2</sub>O** before “H<sub>2</sub>O”)

&lt;268704&gt;

26. These particles make up the majority of cosmic rays, and two of them begin the fusion chain in the Sun's core that ultimately makes helium nuclei. Named by Ernest Rutherford, they are counted in atomic numbers. For 1 point—name these particles within an atom's nucleus with +1 [“plus one”] charge.

answer: **proton(s)**

&lt;295677&gt;

27. This organ produces intrinsic factor and pepsin [PEP-sin]. Bariatric [“bare”-ee-AT-rik] surgery may restrict its volume or bypass it. It produces chyme [KYME] by breaking down food with hydrochloric [“high”-druh-KLOR-ik] acid, a component of its gastric [“GAS”-trik] juice. For 1 point—name this digestive organ into which the esophagus [ee-SOF-uh-guss] empties.

answer: **stomach**

&lt;344094&gt;