Science

Question Sampler

Human Reader Companion Book

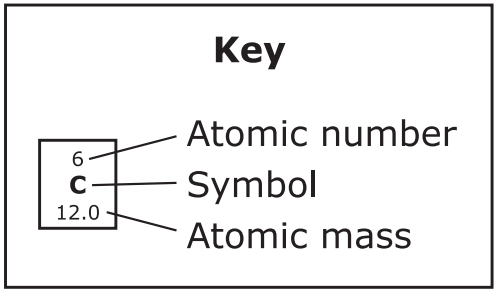
utah Aspire ACT PLUS

Spring 2021

HIGH SCHOOL
SCIENCE
SYMBOL LIST

+	Plus Sign
−	Minus Sign
×	Times Sign
÷	Division Sign
$\frac{\square}{\square}$	Fraction
$\square\frac{\square}{\square}$	Mixed Number
y^x	Exponent
$\sqrt{\ }$	Square Root
$\sqrt[3]{\ }$	Cube Root
=	Equal
(•)	Parenthesis
%	Percent
±	Plus Minus Sign
−	Negative Sign
•	Times Dot
/	Division Slash
[•]	Bracket
|•|	Absolute Value
<	Less Than
>	Greater Than
≤	Less Than or Equal
≥	Greater Than or Equal
$\sqrt[n]{\ }$	General Root
log	Common Logarithm
°	Degree Sign
π	Constant Pi
∞	Infinity
i	Imaginary i
e	Exponential e
θ	Theta
sin	Sine
cos	Cosine
tan	Tangent
$\sin^{-1}$	Inverse Sine
$\cos^{-1}$	Inverse Cosine
$\tan^{-1}$	Inverse Tangent

Periodic Table of Elements



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1 **H** 1.0																	2 **He** 4.0
2	3 **Li** 6.9	4 **Be** 9.0											5 **B** 10.8	6 **C** 12.0	7 **N** 14.0	8 **O** 16.0	9 **F** 19.0	10 **Ne** 20.2
3	11 **Na** 23.0	12 **Mg** 24.3											13 **Al** 27.0	14 **Si** 28.1	15 **P** 31.0	16 **S** 32.1	17 **Cl** 35.5	18 **Ar** 39.9
4	19 **K** 39.1	20 **Ca** 40.1	21 **Sc** 45.0	22 **Ti** 47.9	23 **V** 50.9	24 **Cr** 52.0	25 **Mn** 54.9	26 **Fe** 55.8	27 **Co** 58.9	28 **Ni** 58.7	29 **Cu** 63.5	30 **Zn** 65.4	31 **Ga** 69.7	32 **Ge** 72.6	33 **As** 74.9	34 **Se** 79.0	35 **Br** 79.9	36 **Kr** 83.8
5	37 **Rb** 85.5	38 **Sr** 87.6	39 **Y** 88.9	40 **Zr** 91.2	41 **Nb** 92.9	42 **Mo** 95.9	43 **Tc** (98.0)	44 **Ru** 101.1	45 **Rh** 102.9	46 **Pd** 106.4	47 **Ag** 107.9	48 **Cd** 112.4	49 **In** 114.8	50 **Sn** 118.7	51 **Sb** 121.8	52 **Te** 127.6	53 **I** 126.9	54 **Xe** 131.3
6	55 **Cs** 132.9	56 **Ba** 137.3	57–71	72 **Hf** 178.5	73 **Ta** 181.0	74 **W** 183.8	75 **Re** 186.2	76 **Os** 190.2	77 **Ir** 192.2	78 **Pt** 195.1	79 **Au** 197.0	80 **Hg** 200.6	81 **Tl** 204.4	82 **Pb** 207.2	83 **Bi** 209.0	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
7	87 **Fr** (223)	88 **Ra** (226)	89–103	104 **Rf** (261)	105 **Db** (262)	106 **Sg** (266)	107 **Bh** (264)	108 **Hs** (277)	109 **Mt** (268)	110 **Ds** (281)	111 **Rg** (280)	112 **Cn** (285)	113 **Nh** (286)	114 **Fl** (289)	115 **Mc** (289)	116 **Lv** (293)	117 **Ts** (294)	118 **Og** (294)

* Mass numbers in parentheses are those of the most stable or most common isotope.

Lanthanide Series	57 **La** 138.9	58 **Ce** 140.1	59 **Pr** 140.9	60 **Nd** 144.2	61 **Pm** (145)	62 **Sm** 150.4	63 **Eu** 152.0	64 **Gd** 157.3	65 **Tb** 158.9	66 **Dy** 162.5	67 **Ho** 164.9	68 **Er** 167.3	69 **Tm** 168.9	70 **Yb** 173.0	71 **Lu** 175.0
Actinide Series	89 **Ac** (227)	90 **Th** 232.0	91 **Pa** 231.0	92 **U** 238.0	93 **Np** (237)	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (262)

Human Reader Instructions

When to Use the Human Reader Companion Book

This Human Reader Companion Book should be used with students who have been approved for a human reader accommodation. Students approved for this accommodation are those who would benefit from content being read aloud that are not able to access the built-in text-to-speech feature in the online test.

This Human Reader Companion Book provides instructions for the human reader and includes only the assessment content that is appropriate to be read aloud.

This Human Reader Companion Book may **only** be used with students taking the tests in the following formats:

- braille test book (please refer to the comments memo included with the braille test books to identify modifications made for the braille tests)
- large print test book
- standard print test book
- online test form enabled for use with assistive technology other than screen readers

Instructions and some assessment content are presented differently to students depending on whether they are taking a paper or an online assessment. Due to these differences, students taking paper tests and online tests should not be administered the assessment in the same setting when being provided a human reader.

Differences Between the Human Reader Companion Book and the Student's Online or Paper Test

- Assessment content that is not appropriate to be read aloud does **not** appear in the Human Reader Companion Book.
- Page numbers in the Human Reader Companion Book and the standard print or large print test book will not match.
- Mathematical expressions and scientific notation in the items have been replaced with alternative text descriptions.
- Punctuation marks are not to be read aloud to the student unless specifically noted.
- Images have been removed and replaced with alternative text descriptions.

A Guide to Human Reader Companion Book Formatting

The Human Reader Companion Book includes special formatting to guide the human reader through the script.

Understanding What to Read Aloud to Students

 **and** 

Instructions that should be read to **all** students will appear next to the **paper** and **online** icons.

 Instructions that should be read **only** to students taking **paper** tests will appear next to the paper icon.

 Instructions that should be read **only** to students taking **online** tests will appear next to the online icon.

Alternative Text Descriptions for Images

If the item includes an image, the human reader will see a box in place of the image that includes the alternative text description for the image.

If the answer choices for an item are images, the human reader will see a box in place of the answer options that includes the alternative text description for each image next to the appropriate letter for each answer option.

These alternative text descriptions **should** be read to students.

Notes for the Human Reader

[Notes to the human reader appear in italics and brackets.]

These notes should **not** be read aloud to students.

[Some notes to the human reader appear in bold and brackets.] These notes **should** be read aloud to students.

Human Reader Script for Science

Test Directions

This question sampler allows students to experience the types of items presented on the Utah Aspire Plus assessment. Items on the question sampler may not be representative of the level of content knowledge presented in the assessment. The question sampler should not be used to measure students' content knowledge.

The science question sampler presents multiple-choice/multiple-select questions and text entry questions based on several passages about scientific topics. After reading a passage, use the information in the passage to answer each question.

Multiple-choice Questions:

- Read the question and then choose the best answer/answers from the answer choices given.
- If you decide to change your answer, erase your first mark completely.
- It is best to mark an answer for every question even if you are not sure which answer is correct.

Text Entry Questions:

- Write your entire answer inside the box that goes with the question.
- Use your best handwriting as your answers will be entered online by a test administrator.

Please Note:

- Any writing in your test booklet will NOT be scored. Your answers in the booklet will be entered online by a test administrator.
- Begin working on the test when you are told to do so.

Test Directions

You are now ready to take the Science test. This test is designed to measure your understanding of the Utah Core Standards for Science. At the top of your screen, you will find buttons for the following tools, from left to right: the forward and back navigation arrows, the Review button, and the Bookmark button.

[Read the following passage/stimulus which will be used to answer questions 1 through 4.]

Tektites are a category of rock found at only a few locations on Earth's surface. Tektites are typically a few inches in diameter or less, glassy in appearance, and shaped like rounded buttons. Two students offered differing viewpoints about the origin of tektites.

Student 1

Tektites are the remains of *space debris* (meteoroids and other extraterrestrial material) that have fallen to Earth. Long ago, large meteorites struck the Moon's surface, ejecting Moon rocks into space. Attracted by Earth's gravity, these rocks fell through the atmosphere at very high speeds. Atmospheric drag caused the surfaces of these rocks to melt and flow, giving the rocks the characteristic tektite shape. Chemical analysis of tektites indicates that the time they spent in space was less than 100,000 years, so they must have come from someplace near Earth. This is consistent with a lunar origin. Further, tektites have virtually zero water content, which is consistent with Moon rocks but different from Earth rocks. In addition, the iron content of tektites is very different from that of Earth rocks.

Student 2

Tektites are a result of meteorite impacts on Earth, not on the Moon, and are made of Earth rocks, not of space debris. Long ago, when meteorite impacts on Earth were more common, some of the larger impacts ejected Earth rocks into the atmosphere at very high speeds. Atmospheric drag heated these rocks as they flew up and then fell back to the surface, giving them the characteristic tektite shape and glassy sheen. Chemically, tektites are the same as common Earth rocks, except for their water content and iron content. Both of these differences are the result of the rocks being heated to over 1,000 degrees Celsius during flight. Further, there are many chemical differences between tektites and Moon rocks. In addition, many tektites are associated with known impact craters on Earth's surface.

Question 1

 **and**

Which of the following findings would be LEAST consistent with Student 2's viewpoint?

A. The iron content of nonlunar space debris differs from that of tektites.

B. The iron content of rocks heated inside Earth differs from that of unheated surface rocks.

C. Wherever many tektites are located, large impact craters are also found.

D. Tektites found in Antarctica were formed within the last 10 years.

[Pause for students to answer the question.]

Question 2

 **and**

Which of the following statements about tektites is consistent with both students' viewpoints?

A. Tektites melted due to friction in the atmosphere.

B. Tektites come from the Moon.

C. Tektites and Earth rocks have the same iron content.

D. Tektites typically contain more water than do Earth rocks.

[Pause for students to answer the question.]

Question 3

 **and**

The students' viewpoints are similar in that they both indicate that tektites:

A. have the same iron content as that of other meteorites.

B. are the result of meteorite impacts.

C. are among the largest examples of space debris to fall to Earth.

D. should also be found on the Moon.

[Pause for students to answer the question.]

Question 4

 **and**

Which of the following procedures would best test aspects of both students' viewpoints? A sample of Earth rocks and a sample of Moon rocks are analyzed after the samples had been:

A. shaken vigorously in separate containers.

B. spun at high speed in separate containers.

C. launched from space toward Earth's surface.

D. dropped into the ocean from Earth's surface.

[Pause for students to answer the question.]

[Read the following passage/stimulus which will be used to answer questions 5 through 8.]

Mars 2020 is the name of a new NASA mission to and on Mars. During the mission, a rover called *Perseverance* is performing a variety of tests on Martian soil and air. The rover carries a helicopter drone, the *Ingenuity*, which is being used to test powered flight on another planet for the first time. The *Ingenuity* is shown in Figure 1.

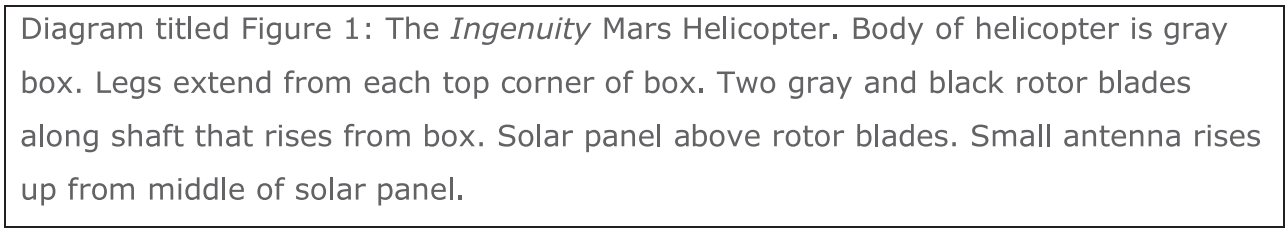


Diagram titled Figure 1: The *Ingenuity* Mars Helicopter. Body of helicopter is gray box. Legs extend from each top corner of box. Two gray and black rotor blades along shaft that rises from box. Solar panel above rotor blades. Small antenna rises up from middle of solar panel.

Ingenuity's low-density foam and carbon fiber rotors provide the lift necessary for flight. The rotors are driven by two electric motors, which are powered by lithium-ion batteries. The batteries are located in the body of the helicopter and are recharged through a solar panel above the rotors while the helicopter is not in flight. *Ingenuity*'s batteries must charge for an entire Martian day to achieve a 90-second flight. *Ingenuity* will make one flight per day, and a total of five flights are planned.

Ingenuity also carries two cameras and a flight-control system in its body. These systems are kept warm by the heat output by the batteries in the body. The antenna allows *Ingenuity* to communicate flight data with the *Perseverance* rover after a flight is complete.

Because of the distance between Earth and Mars, scientists on Earth cannot control *Ingenuity*'s flight in real time. The flight instructions will be programmed into its flight-control system in advance.

Ingenuity was designed and is being tested with Martian conditions in mind. Table 1 shows some differences between conditions on Earth and Mars.

The title of the table is "Table 1. Conditions on Earth and Mars." The table has three columns and six rows.

From left to right the column headings read,

Condition	Earth	Mars
Gravity at surface (meters per second squared)	9.80	3.71
Average solar energy reaching atmosphere (Watts per meters squared)	1,361	586
Average temperature of atmosphere (degrees Celsius)	15	negative 63
Density of atmosphere at surface (kilograms per meters cubed)	1.22	0.02
Speed of sound at surface (meters per second)	340	244
Composition of atmosphere	78% nitrogen 21% oxygen 1% other gases	95% carbon dioxide 3% nitrogen 2% other

From left to right the first row reads,

The second row reads,

The third row reads,

The fourth row reads,

The fifth row reads,

The sixth row reads,

Figure 2 shows some of the forces acting on a hovering helicopter.

Diagram titled Figure 2: Some Forces on a Hovering Helicopter. Arrow pointing upward from helicopter labeled Lift. Arrow pointing downward from helicopter labeled Weight.

A spinning rotor pushes air in order to achieve lift. The lift that a rotor can achieve is directly proportional to the density of the air, the surface area of the rotor, and the square of the speed of the rotor. Drag forces that are not shown in Figure 2

occur at the tips of the rapidly moving rotor blades. The speed of the rotors is limited because, as the speed of the rotor-blade tips approaches the speed of sound, drag forces at the rotor-blade tips prevent an increase in speed.

In addition to the conditions in Table 1, NASA scientists have to account for seasonal dust storms on Mars with winds that can blow up to 30 meters per second. Typical Martian winds are between 2 and 10 meters per second. Dust storms can sometimes completely block the surface of Mars from view by orbiting satellites or telescopes on Earth. A multiyear survey of the Mars 2020 landing site concluded that dust storm activity at the site will be at its maximum during the Martian fall season. The landing site, Jezero Crater, is located in Mars's northern hemisphere. Figure 3 shows the orbit of Mars. Mars's rotational axis is tilted 24.9° relative to its orbital plane, which is very similar to Earth's axial tilt of 23.5°.

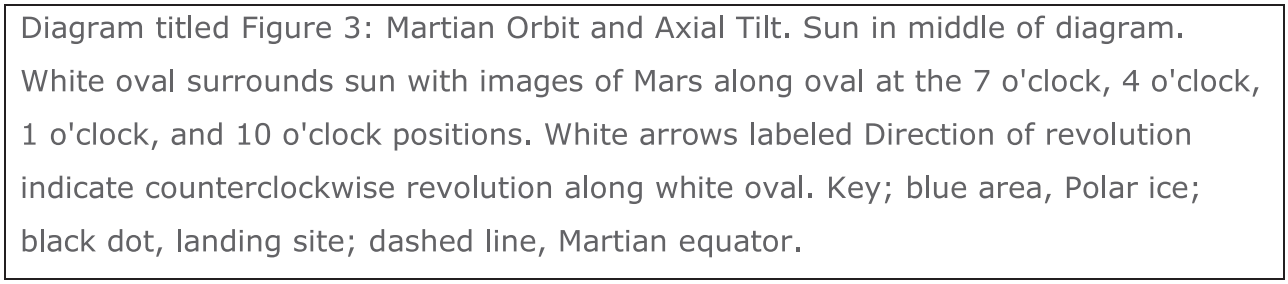


Diagram titled Figure 3: Martian Orbit and Axial Tilt. Sun in middle of diagram. White oval surrounds sun with images of Mars along oval at the 7 o'clock, 4 o'clock, 1 o'clock, and 10 o'clock positions. White arrows labeled Direction of revolution indicate counterclockwise revolution along white oval. Key; blue area, Polar ice; black dot, landing site; dashed line, Martian equator.

Task Statement: In the questions that follow, you will investigate the solutions developed by NASA as they designed and tested the *Ingenuity* Mars helicopter for the Mars 2020 mission.

Question 5

 **and**

This question has two parts.

Part A

Powered flight on Mars is more challenging than flight on Earth. Which factor makes it more difficult for the *Ingenuity* to achieve sufficient lift on Mars?

A. the force of Martian gravity

B. the distance of Mars from Earth

C. the density of the Martian atmosphere

D. the composition of the Martian atmosphere

[Pause for students to answer the question.]

Part B

Which solution would **most likely** enable *Ingenuity* to achieve sufficient lift on Mars?

A. building *Ingenuity* with the lowest-density materials possible

B. equipping *Ingenuity* with an antenna that allows for flight control

C. increasing the speed of *Ingenuity*'s rotors to 2.6 times the speed required on Earth

D. decreasing *Ingenuity*'s flight times to about half of the maximum flight times that are possible on Earth

[Pause for students to answer the question.]

Question 6

and

To test the lift that *Ingenuity* can produce, NASA scientists tested *Ingenuity* in a special chamber on Earth. Which variable should the scientists manipulate in order to test the lift that *Ingenuity* can produce on Mars?

A. the gravity in the chamber

B. the sunlight in the chamber

C. the density of the air in the chamber

D. the composition of the air in the chamber

[Pause for students to answer the question.]

Question 7

and

For some tests of *Ingenuity* that were conducted on Earth, scientists decreased the mass of the helicopter by removing its battery and flight-control system. The scientists connected the helicopter to a system that supplied power and flight control through wires so that the helicopter would continue to operate. What is the **most likely** reason the scientists did this for some tests?

A. to approximate the effect of Martian gravity on *Ingenuity*

B. to approximate the effect of Martian sunlight on *Ingenuity*

C. to approximate the effect of Martian dust storms on *Ingenuity*

D. to approximate the effect of the Martian atmosphere on *Ingenuity*

[Pause for students to answer the question.]

Question 8

 **and** 

How could a Martian dust storm create challenges for *Ingenuity*?

Select the blank boxes next to the **two** correct answers.

 To remove an answer, select the answer again.

 **and** 

A. by increasing the Martian gravity

B. by increasing the Martian wind speed

C. by changing the composition of the Martian atmosphere

D. by decreasing the temperature of the Martian atmosphere

E. by decreasing the solar energy that reaches the Martian surface

[Pause for students to answer the question.]

[Read the following passage/stimulus which will be used to answer questions 9 through 10.]

Students used a *viscometer* (a device that measures the viscosity of a substance) to study several liquids. The viscometer consisted of a tube to hold a liquid, a metal ball, and a magnetic pad that can hold or release the ball (see Figure 1).

Clockwise from the right the figure reads: magnetic pad that holds the ball, Point A, Point B, liquid. There is a timer to the left of the figure that counts from zero to 12 seconds.

Figure 1

The liquid is added to the tube and allowed to become still. The cap, to which the magnetic pad and ball are attached, is fitted on the tube. The ball is then released from the pad by remote control, and the time it takes for the ball to roll from Point A to Point B (the *roll time*) is measured. Six liquids (Liquids A through F) of known viscosity (in centipoise, c p) at 25°C were supplied with the viscometer for use as standards (see Table 1).

The title of the table is Table 1. The table has two columns and six rows.

From left to right the column headings read,	**Liquid**	**Viscosity (centipoise)**
From left to right the first row reads,	A	1
The second row reads,	B	50
The third row reads,	C	100
The fourth row reads,	D	200
The fifth row reads,	E	500
The sixth row reads,	F	1,000

Experiment 1

The roll time for each of Liquids A through F was measured at 25 degrees Celsius in the viscometer. The students prepared Figure 2 based on their results.

The horizontal axis is titled viscosity (centipoise). The axis has a range from zero to one thousand two hundred, increasing in increments of two hundred. The vertical axis is titled roll time (seconds). The axis has a range from zero to one hundred sixty, increasing in increments of twenty. There are six points marked on the graph: (0, 0), (50, 9), (100, 15), (200, 30), (500, 75), (1000, 150).

Experiment 2

The roll time of several common liquids was measured at 25 degrees Celsius in the viscometer (see Table 2).

(Note: S A E numbers refer to viscosity ratings set by the Society of Automotive Engineers.)

The title of the table is Table 2. The table has two columns and seven rows.

From left to right the column headings read,

From left to right the first row reads,

The second row reads,

The third row reads,

The fourth row reads,

The fifth row reads,

The sixth row reads,

The seventh row reads,

Liquid	Roll time (seconds)
Corn syrup	12
Kerosene	2
H 2 0	1
S A E 10 motor oil	8
S A E 20 motor oil	30
S A E 30 motor oil	60
S A E 50 motor oil	180

Question 9

 **and**

Based on Experiments 1 and 2, the viscosity of S A E 30 motor oil at 25 degrees Celsius is closest to which of the following?

A. 30 centipoise

B. 60 centipoise

C. 200 centipoise

D. 400 centipoise

[Pause for students to answer the question.]

Question 10

 **and**

Based on Experiments 1 and 2, the viscosity of S A E 40 motor oil at 25 degrees Celsius would most likely be:

A. lower than 200 centipoise.

B. between 200 centipoise and 300 centipoise.

C. between 300 centipoise and 400 centipoise.

D. higher than 400 centipoise.

[Pause for students to answer the question.]

[Read the following passage/stimulus which will be used to answer questions 11 through 13.]

A student's black Labrador retriever dog has a litter of five puppies. Even though the father of the puppies is also black, some of the puppies display other colors, as shown in Figure 1.

Diagram titled Figure 1: A Labrador Retriever Dog Family. At top; faces of two adult black dogs connected by line. Line extends downward from line that connects adult dog faces. The downward line splits to extend to five puppy faces; from left to right; two black; one brown; one yellow; one white.

Each Labrador puppy develops from a fertilized egg containing 78 chromosomes that come from the mother's egg cell and the father's sperm cell. Egg and sperm cells, also known as gametes, are different from other cells in the body, known as somatic cells. Only gametes are produced by meiosis, a process that separates and distributes chromosomes into newly formed cells. Two simplified models of meiosis are shown in Figure 2. *Uppercase A* and *lowercase a* represent two versions of one gene, and *Uppercase B* and *lowercase b* represent two versions of a second gene.

Diagram titled Figure 2: Two Models of Meiosis. Each of the two models contains 7 yellow circles at three levels. Each yellow circle has internal structures. Each internal structure is either blue or orange. Top level of model has 1 large circle with 4 X shaped structures. Arrows labeled Cell Division 1 point down to middle level. Middle level of each model has 2 large circles, each with 2 X shaped structures. Arrows labeled Cell Division 2 point down to bottom level. Bottom level of each model has 4 small circles, each with 2 linear structures. Each side of every X shaped structure, as well as the whole of each linear structure, is labeled with either an *Uppercase A*, *lowercase a*, *Uppercase B*, or *lowercase b*.

Some animals can reproduce with only one parent. The hydra, a freshwater invertebrate, can reproduce by budding offspring, as shown in Figure 3. But hydra can also produce gametes and reproduce through fertilization. A normal somatic cell of a hydra has 30 chromosomes.

Diagram titled Figure 3: A Hydra Reproducing by Budding.

Task Statement: In the questions that follow, you will engage in argument from evidence about the variations between parents and offspring.

Question 11

and

Why do some of the puppies in Figure 1 have a different color of fur than their parents have?

A. The chromosomes of three puppies mutated after fertilization.

B. The chromosomes of three puppies sorted incorrectly during meiosis.

C. Each puppy received different numbers of chromosomes from each parent.

D. Each puppy received a different combination of chromosomes from its parents.

[Pause for students to answer the question.]

Question 12

 **and**

This question has two parts.

Part A

How many chromosomes are in a normal gamete produced by meiosis in a Labrador retriever dog?

A. 156

B. 78

C. 39

D. 26

[Pause for students to answer the question.]

Part B

Which statement supports the correct answer to Part A?

A. DNA is duplicated before both Cell Division 1 and Cell Division 2, so each of the four daughter cells produced contains double the number of chromosomes found in the parent cell.

B. DNA is not duplicated between Cell Division 1 and Cell Division 2, so each of the four daughter cells produced contains half the number of chromosomes found in the parent cell.

C. DNA is duplicated before Cell Division 1 but not before Cell Division 2, so each of the four daughter cells produced contains the same number of chromosomes found in the parent cell.

D. DNA is duplicated neither before Cell Division 1 nor before Cell Division 2, so each of the four daughter cells produced contains one-fourth the number of chromosomes found in the parent cell.

[Pause for students to answer the question.]

Question 13

 **and** 

Which statement correctly describes how a puppy can have two copies of *uppercase A* and two copies of *lowercase b*?

A. Each of the parents contributed one copy of the *uppercase A* gene and one copy of the *lowercase b* gene.

B. One parent contributed both copies of the *uppercase A* gene, while the other parent contributed both copies of the *lowercase b* gene.

C. One parent contributed a copy of the *uppercase A* gene, while the other parent contributed a copy of the *lowercase b* gene, and then the genes were duplicated after fertilization.

D. One parent contributed a copy of the *uppercase A* gene, while the other parent contributed a copy of the *lowercase b* gene, and then the genes were duplicated during fertilization.

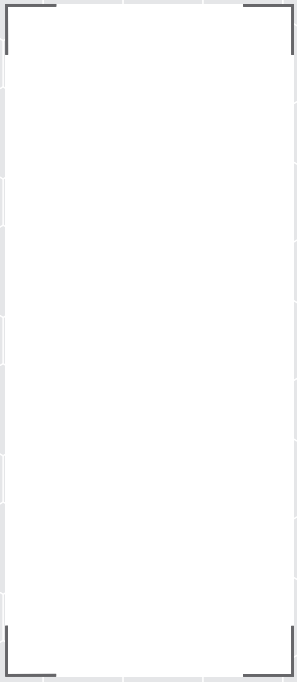
[Pause for students to answer the question.]

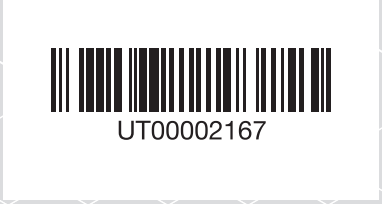
 End of test. If you finish before time is called, you may go back and check your work.

 End of Section 1

Use the **Review** button above to go back and review your answers. When you are done, use the **Submit Final Answers** button below to submit your answers.

Pearson





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