STUDENT NAME _____
(please print)

Grade
11

New Jersey Student Learning Assessment–Science (NJSLA–S) Practice Test

FORM
A

Spring 2024

SCHOOL USE ONLY:

Sample Items

This test booklet contains several different types of test questions. See the samples below, which will help you understand how to respond to each question type.

Record/mark your answers by circling the answer in the test booklet. If you need to change an answer, be sure to erase your first answer completely. **Only the answers you write in your test booklet will be scored.**

One of the questions will ask you to write a response. Write your response in the box provided in the test booklet. Be sure to keep your response within the provided space. Only responses written within the provided space will be scored.

Sample Item 1. Multiple-Choice (Select one answer.)

Which claim about the Sun is accurate?

A. The Sun appears smaller and brighter than other stars because it is the closest star to Earth.

B. The Sun appears larger and brighter than any other star because it is the closest star to Earth.

C. The Sun appears larger and less bright than other stars because it is the farthest star from Earth.

D. The Sun appears smaller and less bright than any other star because it is the farthest star from Earth.

Sample Item 2. Multi-Select (Select multiple answers.)

Select **two (2)** answers for this item. The risk of an earthquake happening is **higher**

A. in the South than in Alaska.

B. on the West Coast than in the Northeast.

C. on the East Coast than on the West Coast.

D. in Alaska than in the center of the country.

E. in the center of the country than on the West Coast.

Sample Item 3. Multi-Select Box Item (Select one answer for each box.)

A student claims that a soccer ball has less energy after it hits a wall. Select the correct word from each box to complete the statement that explains why this claim is true.

When a soccer ball hits the wall, [Y] of the soccer ball's energy is transferred to the air in the form of [Z].

[Y]

A. all

B. some

C. none

[Z]

A. light

B. sound

Sample Item 4. Constructed Response (Write out your answer.)

Many New Jersey towns have started programs to reduce the amount of traffic on roads as a means to help improve air quality. Give **two** examples of programs that would help reduce traffic and improve air quality.

Answers to Sample Questions

1. **A (B) C D**

2. **A (B) C (D) E**

3. **[Y]**
A (B) C

[Z]
A (B)

4. *Carpooling is one means to reduce the number of cars on the roads. Using public transit when available would also decrease the number of individual cars. Both of these measures would help improve air quality.*

Unit 3 Practice Test

Directions:

Today you will take Unit 3 of the Grade 11 New Jersey Student Learning Assessment–Science (NJSLA–S) Practice Test. You will be able to use a calculator and a periodic table.

Read each question. Then, follow the directions to answer each question. Circle the answer or answers you have chosen in your test booklet. If you need to change an answer, be sure to erase your first answer completely.

If a question asks you to show or explain your work, you must do so to receive full credit. Only responses written within the provided space will be scored.

If you do not know the answer to a question, you may go on to the next question. If you finish early, you may review your answers and any questions you did not answer in this unit **ONLY**. Do not go past the stop sign.

Use the information below to answer questions 1–4.

The populations of guppies and parasitic worms vary when humans are in their environment.

Scientists studied the Trinidadian guppy, *Poecilia reticulata*, and one of its parasites, the fish skin worm, *Gyrodactylus turnbulli,* when exposed to human-induced noise. In identical laboratory aquariums, populations of female guppies were exposed to long-term (several weeks) noise, short-term (1 day) noise, or no noise (control).

Next, each guppy was initially exposed to two worms, and then the guppies and their worms were observed for several weeks.

Figure 1 shows the number of worms parasitizing the noise-exposed and control guppies. Higher parasite counts usually indicate that the host's immune systems and responses have been compromised.

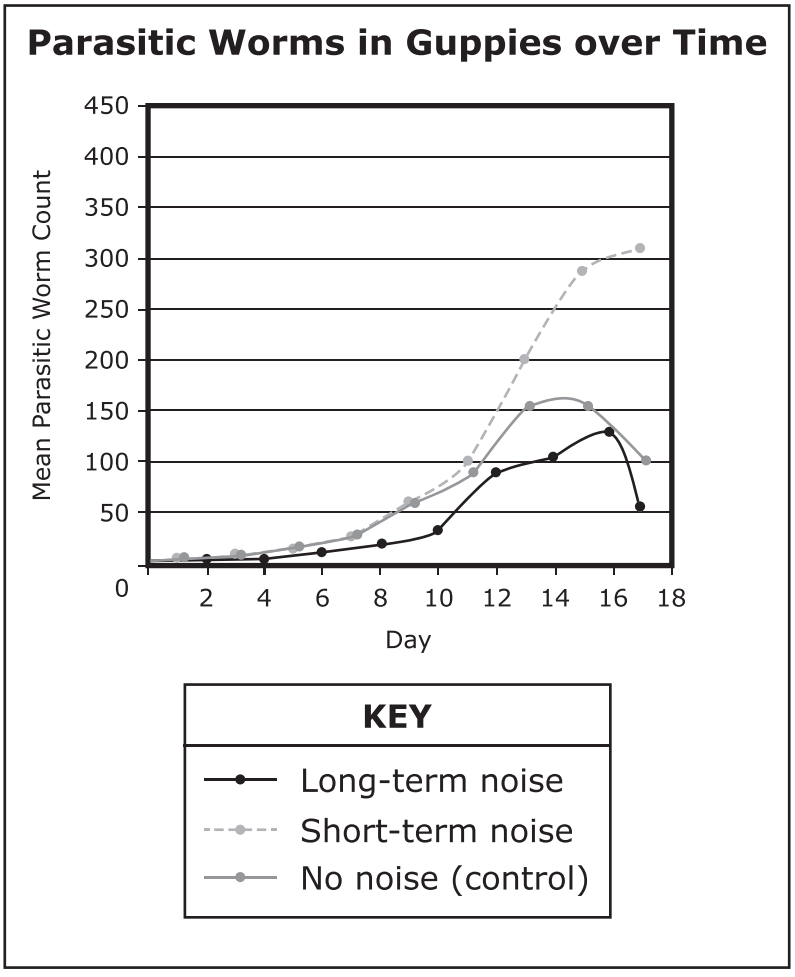


Figure 1.

GO ON →

1. Based on Figure 1, which claims about peak worm counts and guppy survival are **best** supported?

Select **three (3)** of the six claims.

On average, guppies exposed to

A. no noise had a lower worm count than all other guppies.

B. short-term noise had a higher worm count than all other guppies.

C. short-term noise had a lower survival rate than guppies not exposed to noise.

D. no noise had a higher survival rate than guppies exposed to long-term noise.

E. long-term noise had a higher worm count than guppies not exposed to noise.

F. long-term noise had a higher survival rate than guppies exposed to short-term noise.

2. Previous research found that increasing worm counts in males caused a decrease in mating. A student claims that short-term noise has the greatest negative impact on reproduction in guppy populations over time.

Based on Figure 1, and assuming the worm counts shown follow similar trends in male guppies, identify whether the claim is supported or is not supported.

Complete the sentences by choosing the correct answer from each box.

Over time, guppies exposed to [X] noise should have the lowest reproduction rates. After the treatment period, average worm counts in this group [Y] to increase. Therefore the student's claim [Z] supported.

[X]

A. no

B. short-term

C. long-term

[Y]

A. continued

B. did not continue

[Z]

A. is

B. is not

3. The guppies studied are native to the Caribbean and South America but have been introduced widely for the control of mosquito larvae. These guppies and their parasites are now found almost worldwide, competing with and threatening native minnows.

Based on Figure 1, predict the impacts if short-term noise is introduced to an ecosystem that previously had no noise.

Select all the correct answers.

Short-Term Noise Impact	Increase or Decrease
Minnow population	W
Competition pressure on the minnows from guppies	X
Mosquitoes eaten by guppies	Y
Parasite count in guppies	Z

W

A. Increase

B. Decrease

X

A. Increase

B. Decrease

Y

A. Increase

B. Decrease

Z

A. Increase

B. Decrease

4. Table 1 shows the results of an experiment scientists performed using guppies.

Table 1. Guppy Investigation Results

Male Type	Male Color	Female Time Spent Near Male	Female Response to Male Mating Display
Infected with worms	Dull orange	Less	Lower
Uninfected	Bright orange	More	Higher

Based on Table 1, which question were the scientists **most likely** investigating?

A. How do worms respond to color changes in male guppies?

B. How much time do female guppies spend looking for mates?

C. How does the level of infection impact mate choice in guppies?

D. How many parasites are transferred between males and females?

GO ON TO NEXT PAGE

GO ON →

Use the information below to answer questions 5–8.

Despite being in a cold room, coffee stays hot in a container for a long time.

The transfer of heat energy from an object can be calculated using the heat transfer equation:

$$Q = mc\Delta T$$

Where:

- Q = thermal energy, in joules[1] (J),
- m = mass of the substance, in kilograms,
- c = specific heat of the substance, the energy required to increase 1 kg of the substance by 1°C, in J/kg•°C, and
- ΔT = change in temperature, in °C.

The amount of heat lost through conduction is calculated using the conduction equation:

$$q = kA\Delta T$$

Where:

- q = heat transfer, in watts (W),
- k = heat conductivity[2] of the substance into which heat is transferred, in W/m•°C, and
- A = area of the radiating surface, in m^2.

[1]joules—unit of work, $kg \cdot m^2/s^2$
[2]conductivity—the degree to which electricity or heat is transmitted by a substance

GO ON →

Figure 1 shows a cross section of a portable container for liquids, often called a thermos.

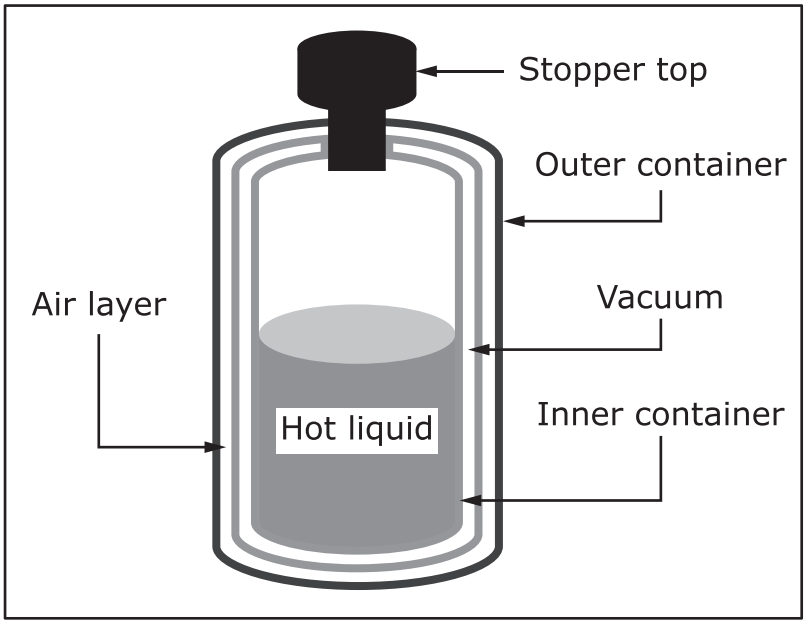


Figure 1. Diagram of Thermos

5. A cup containing 0.2 kg of coffee sat for several hours at room temperature, 20°C.

Based on the heat transfer equation, and assuming that the specific heat of coffee is approximately 4,200 J/kg•°C, how much thermal energy, in joules (J), would be required to warm the coffee up to 70°C?

A. 25,200

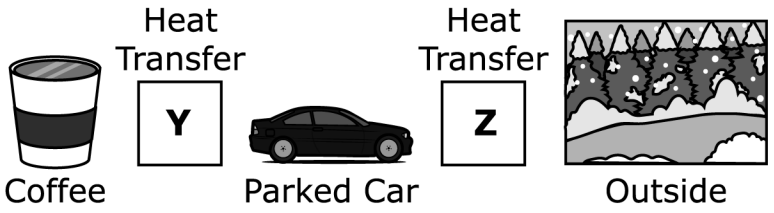
B. 42,000

C. 58,800

D. 75,600

6. A cup of coffee at 70°C is placed in a closed car with an air temperature of 20°C. The air temperature outside the car is 0°C. Based on the data, and assuming no other heat energy is introduced into the system, complete the model that shows how energy would transfer within the system.

Choose the correct arrow for each box. Answers may be used more than once. Not all answers will be used.



Y

A. →

B. ←

C. ↔

Z

A. →

B. ←

C. ↔

7. A student claims that putting the same amount of coffee in a larger cup will cause the coffee to cool more slowly. Indicate whether the claim is supported or is not supported by the data.

Complete the sentences by choosing the correct answer from each box.

Using the [X] equation, the larger cup [Y] the rate of heat loss. Therefore, the claim is [Z] by the data.

[X]

A. heat transfer

B. conduction

[Y]

A. reduces

B. increases

C. does not affect

[Z]

A. supported

B. not supported

8. The law of conservation of energy is represented by the equation:

$$Q_{(gain)} = {}^{-}Q_{(loss)}$$

A student wants to cool a cup of coffee by adding ice at a temperature of 0°C to 0.2 kg of coffee at a temperature of 70°C. The specific heat of coffee is 4,200 J/kg•°C and ice is 2,100 J/kg•°C.

Using the conservation of energy equation and the heat transfer equation, and assuming the system is closed and heat transfer to or from the surroundings and the cup are minimal, how much ice is needed to reduce the temperature of the coffee to 50°C?

A. 0.06 kg

B. 0.10 kg

C. 0.16 kg

D. 0.20 kg

GO ON TO NEXT PAGE

GO ON →

Use the information below to answer questions 9–11.

There is faint microwave light coming from every direction in the sky.

The cosmic microwave background (CMB) is the oldest light that currently exists in the universe. Scientists use the existence of the CMB to provide evidence for the big bang theory, a theory that states the universe expanded from a single point and then existed in a state of plasma that was so hot, atoms could not form. The CMB was produced 370,000 years after the big bang, following an event called recombination, during which protons and electrons could come together to form neutral hydrogen. The evolution of the universe, starting with the big bang, is shown in Figure 1.

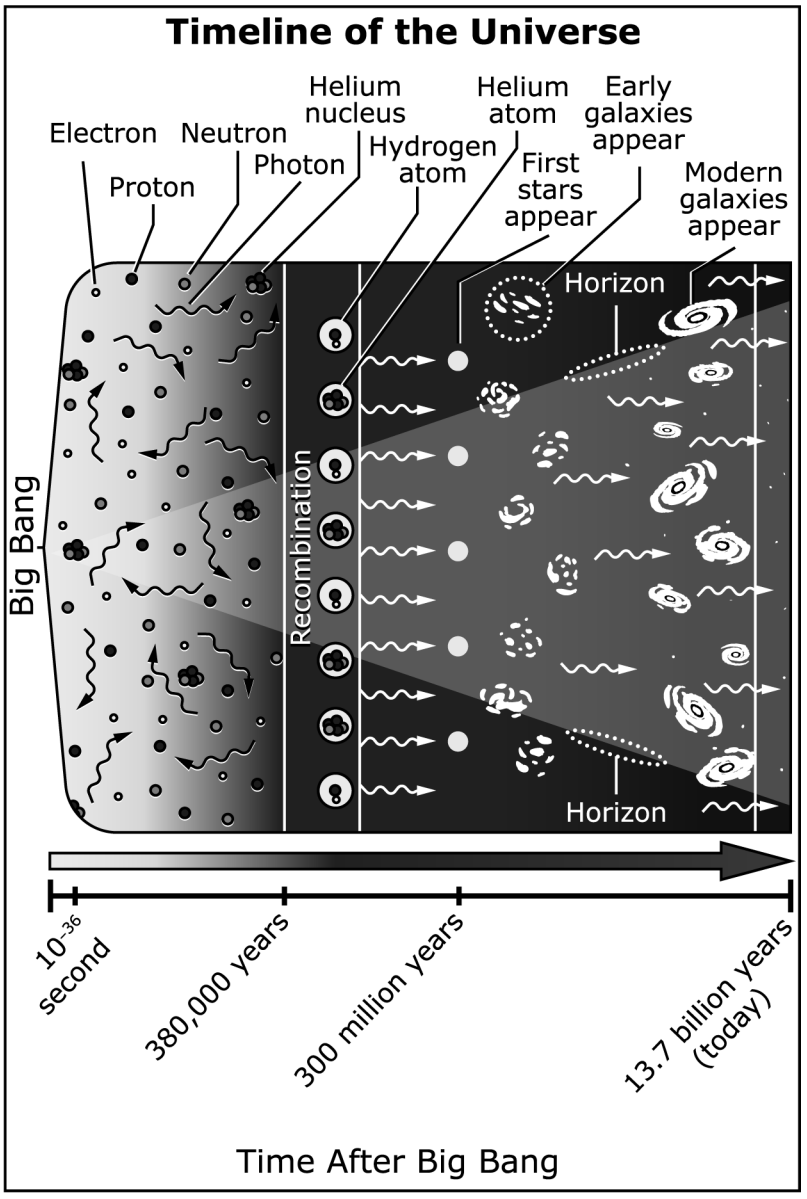


Figure 1.

GO ON →

The reaction between protons and electrons during recombination produced neutral hydrogen and photons, causing the plasma to turn into gas. This change in the abundance of free electrons (electrons unbounded to protons), affected the path that light was able to travel through the universe. This process is shown in Figure 2.

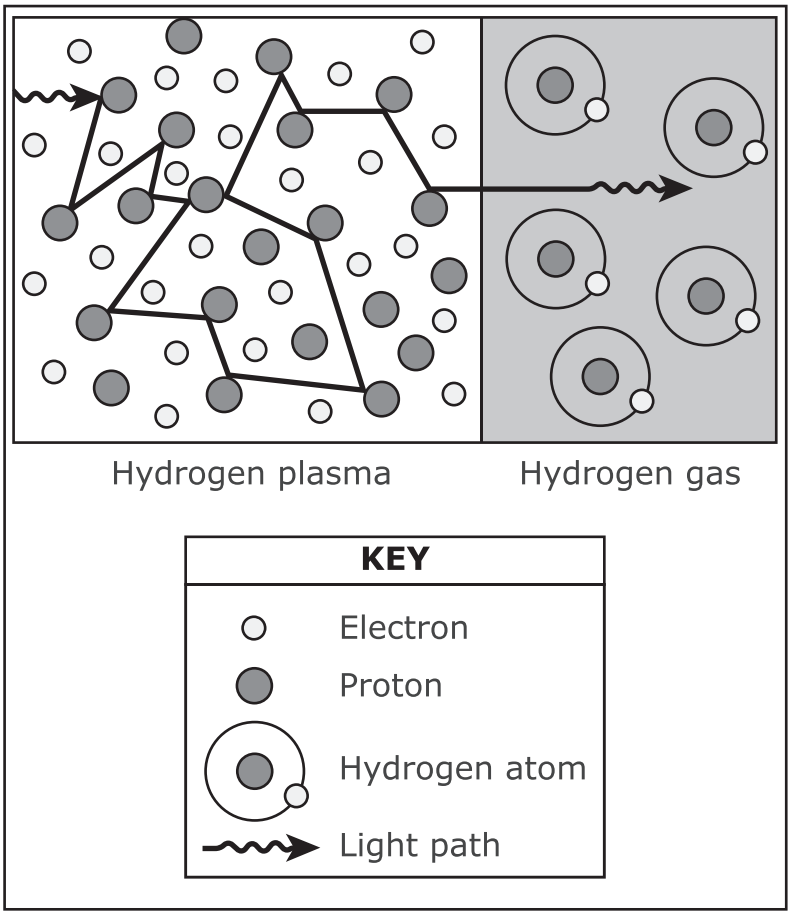


Figure 2. Light Path in Hydrogen Plasma vs. Hydrogen Gas

9. Based on the data, what was an immediate effect of recombination?

A. The first stars formed.

B. The universe cooled down.

C. The number of protons increased.

D. The abundance of free electrons decreased.

10. Based on Figure 1, put the following events in chronological order.

Choose the table that correctly orders the events from **earliest** (top) to **most recent** (bottom).

A.

Order	Event
Earliest ↓ **Most recent**	Big Bang
	Recombination
	First stars formed
	Universe made up of plasma

B.

Order	Event
Earliest ↓ **Most recent**	Universe made up of plasma
	Big Bang
	Recombination
	First stars formed

(Item 10 continued)

C.

Order	Event
Earliest ↓ **Most recent**	Big Bang
	Universe made up of plasma
	Recombination
	First stars formed

D.

Order	Event
Earliest ↓ **Most recent**	Recombination
	Universe made up of plasma
	First stars formed
	Big Bang

11. Based on the data, what is the **best** hypothesis for how recombination led to the CMB?

A. Recombination created the first stars, whose light became the CMB.

B. Recombination caused light to be scattered in every direction, producing the CMB.

C. Recombination produced the first hydrogen atoms, which released the light that became the CMB.

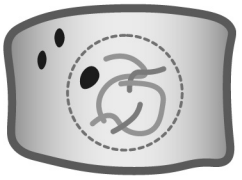
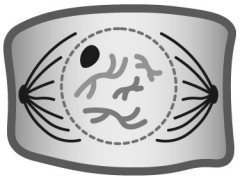
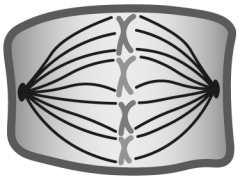
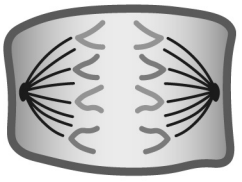
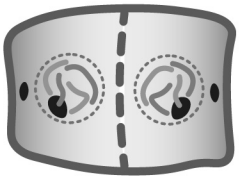
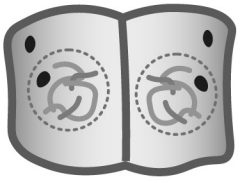
D. Recombination allowed light to travel unimpeded through space, eventually reaching Earth as the CMB.

Use the information below to answer questions 12–15.

A chemical treatment increases mitosis in a plant, yet the plant is less healthy than an untreated plant.

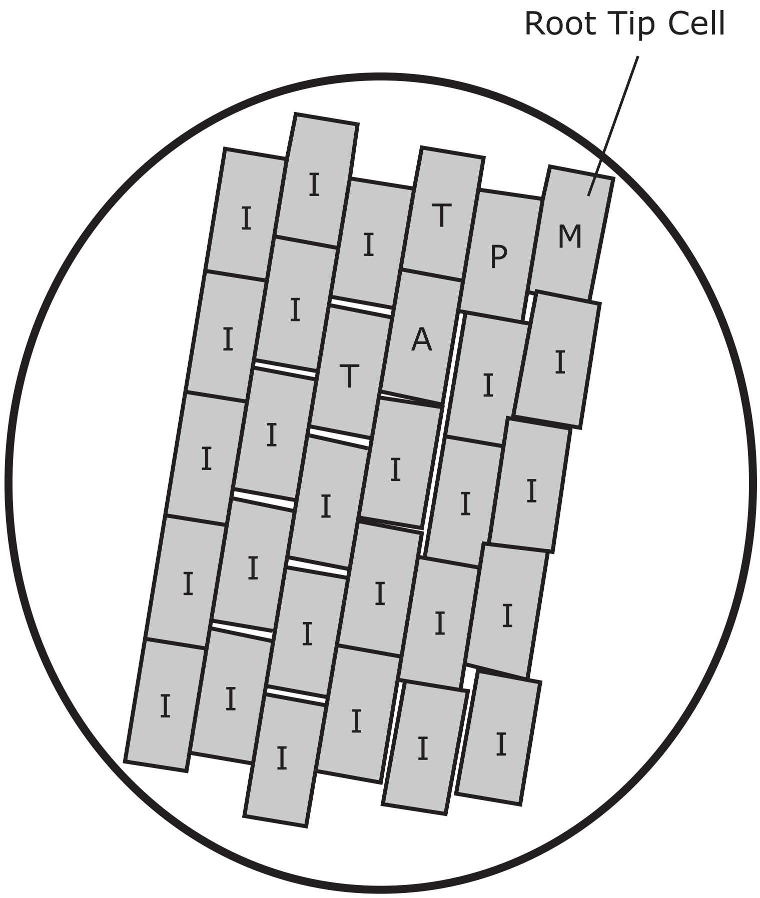
Table 1 shows the four different phases of mitosis: prophase, metaphase, anaphase, and telophase. Interphase is the phase before and after mitosis in which the cell grows in size, replicates its DNA, and prepares for mitosis.

Table 1. Plant Mitosis

Phase	Appearance
Interphase	
Prophase	
Metaphase	
Anaphase	
Telophase	
After Telophase	

GO ON →

Viewed at 400X magnification, Figure 1 shows a sample of cells from the onion root tip, and in different phases of the cell cycle.



KEY
A = cell in Anaphase I = cell in Interphase M = cell in Metaphase P = cell in Prophase T = cell in Telophase

Figure 1. Sample of Onion Cells

Researchers studied the effects of two experimental drugs (Y and Z) on the onion (*Allium cepa*), a plant commonly used as a model to study cell division. Table 2 shows data on mitosis and chromosomal changes in treated and untreated root tip cells over 48 hours.

Table 2. Data on Mitosis over Time

Treatment (Concentration, μM[1])	Cells Sampled (N)	Mitotic Index	Total Chromosomal Mutations (%)
Control (0)	1,000	4.1	0
Y (6.5)	736	6.5	56.3
Y (16.3)	744	5.5	55.8
Y (32.5)	737	7.6	56.1
Z (9.3)	503	5.3	56.0
Z (23.1)	361	4.1	60.0
Z (46.3)	429	2.9	66.7

The mitotic index, which indicates the amount of mitosis occurring in a population of cells at the time of sampling, is calculated using the formula:

$$\frac{(P + M + A + T)}{N} \times 100$$

Where:

Variable	Description
P	total number of cells in prophase
M	total number of cells in metaphase
A	total number of cells in anaphase
T	total number of cells in telophase
N	total number of cells

[1]μM—a concentration of 10^{-6} moles of substance in a liter of liquid

12. Based on Table 1, how can completing mitosis benefit an organism?

Select **three (3)** of the five statements.

Completing mitosis allows an organism to

A. heal injured cells.

B. replace dead cells.

C. repair damaged tissues.

D. grow by adding new cells.

E. double chromosomes in daughter cells.

13. A higher-than-normal mitotic index may be an indication of abnormal cell growth in tissues.

Based on Table 2, which statement about effects of the drugs on the onion root tip is correct?

A. Abnormal growth rate decreases with increasing concentrations of Drug Y.

B. Abnormal growth rate decreases with increasing concentrations of Drug Z.

C. Neither Drug Y nor Drug Z cause abnormally high growth in root tip cells at any concentration.

D. Both Drug Y and Drug Z always cause abnormally high growth in root tip cells at all concentrations.

14. Researchers want to do more studies on mitosis using the onion root tip cell model. For these new experiments, they want to produce the fewest daughter cells containing the highest percentage of chromosome changes.

Based on Table 2, which drug should the researchers use to produce cells for the additional studies?

A. Drug Y at a concentration lower than 6.5 μM

B. Drug Z at a concentration higher than 46.3 μM

C. either Drug Y or Drug Z at the lowest concentration in Table 1

D. either Drug Y or Drug Z at the highest concentration in Table 1

15. A student claims that the rate of mutations remains constant and that increased mutations are a result of increased mitosis. Identify whether this claim is supported or is not supported by the data in Table 2.

Complete the sentences by choosing the correct answer from each box.

In normal circumstances, the number of mutations that occur during mitosis is very [U]. Drug Z [V] that environmental factors can increase the mutation rate without increasing the rate of mitosis, which [W] the claim.

[U]

A. low

B. high

[V]

A. shows

B. does not show

[W]

A. supports

B. does not support

Use the information below to answer questions 16–19.

A magnetic field and radiofrequency pulse applied to the body produces a highly detailed image of body tissues.

Figure 1 shows how magnetic resonance imaging (MRI) produces detailed, multi-dimensional images that are used to detect, diagnose, and monitor diseases in body tissues.

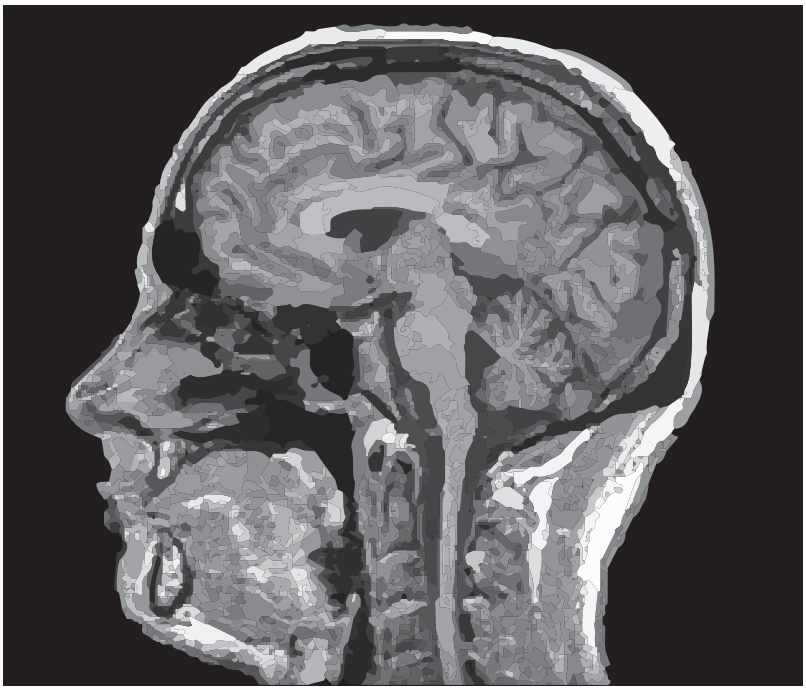


Figure 1. MRI of Head

During an MRI, a person is placed in a large scanning machine that applies a very strong magnetic field (MF), typically 1.5 to 3 teslas (T) in strength, followed by a radiofrequency (RF) pulse. Radiofrequency pulses change the alignment of protons in tissues. When the protons return to their original alignment, they release energy that is measurable. Figure 2 shows the alignment of hydrogen protons in water in the human body under 2A) normal conditions, 2B) exposed to the MF in the MRI, and 2C) exposed to both the MF and RF in the MRI.

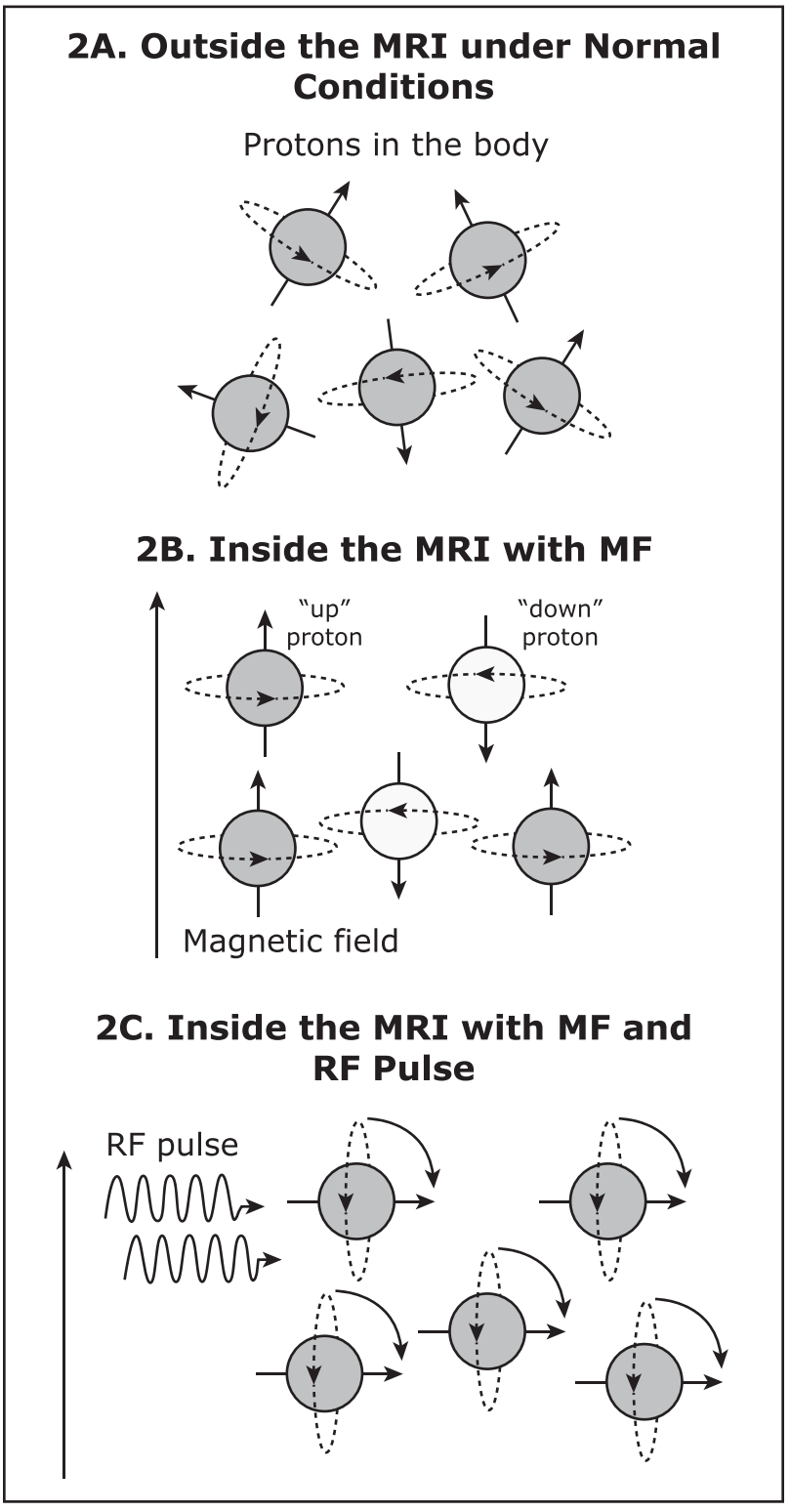


Figure 2. Hydrogen Protons under Different Conditions

GO ON →

The spinning of a hydrogen proton around its own axis when in an MF, shown in Figure 2, is known as precession. The precessional velocity of the spinning proton is called the Larmor frequency (f), measured in megahertz (MHz), and calculated using the equation:

$$f = \gamma \times B_0$$

Where:

- γ = gyromagnetic ratio, which is a specific constant for each particle that consists of the ratio of the magnetic moment and rotational momentum, in MHz/T, and
- B_0 = strength of applied MF, in teslas.

16. A student claims that each hydrogen proton in a water molecule acts like a tiny magnet due to its rotation and orientation. Based on Figure 2, identify the data that support this claim.

Complete the sentence by choosing the correct answer from each box.

When **X** applied during an MRI, **Y** of the water protons align in the same direction; however, outside the MRI, water protons in the body align **Z** Earth's MF.

X

A. only the MF is

B. only the RF is

C. both MF and RF are

Y

A. all

B. some

C. none

Z

A. with

B. randomly in

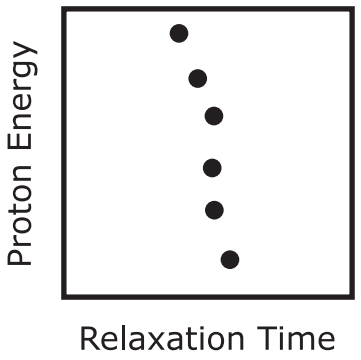
17. After the RF pulse, the protons in an MRI's MF give off small amounts of energy and then return to their original alignment, a process called relaxation. Different types of tissues look different in the image because they relax at different rates:

- Fat-containing tissue has a short relaxation time.
- Water-containing tissue has a long relaxation time.
- Diseased tissue has an intermediate-length relaxation time.

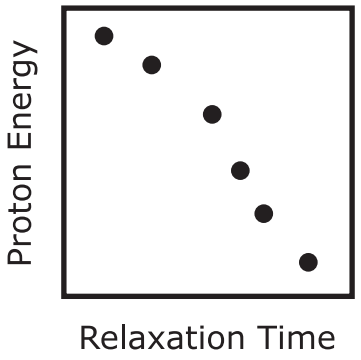
Based on the data, which proton data **most likely** represent MRI samples of primarily diseased tissue?

(Item 17 continued)

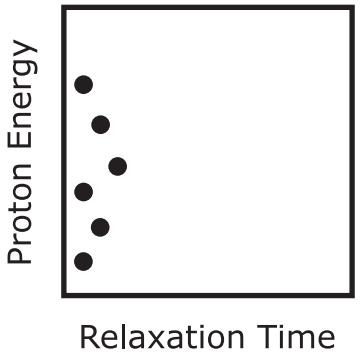
A.



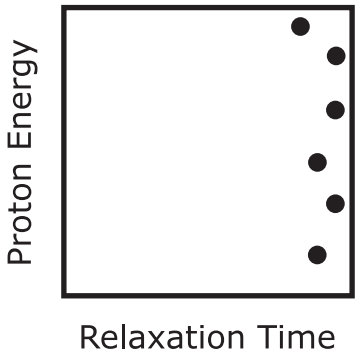
B.



C.



D.



18. Based on the data, how could the magnetic field be changed to create a clearer MRI image?

A. A weaker magnetic field should be used so that the Larmor frequency increases.

B. A weaker magnetic field should be used so that the Larmor frequency decreases.

C. A stronger magnetic field should be used so that the Larmor frequency increases.

D. A stronger magnetic field should be used so that the Larmor frequency decreases.

19. Table 1 describes the color and/or brightness of the images produced by the three most commonly used MRI scanning techniques.

Table 1. Description of Tissue Appearance Based on MRI Technique

Tissue	T1-weighted	T2-weighted	FLAIR
Brain: white matter	Light	Dark gray	Dark gray
Cerebrospinal fluid	Dark	Bright	Dark
Brain: gray matter	Gray	Light gray	Light gray
Fatty tissue	Bright	Light	Light
Diseased	Dark	Bright	Bright

Different MRI techniques can change proton relaxation times, thus changing the appearance and contrast of tissues. A researcher plans to do additional MRI studies, and needs to choose a technique and tissue type that shows the most contrast between healthy tissue and diseased tissue.

Based on the Table 1, which combination of MRI technique and tissue type would achieve this goal?

A. A T2-weighted view of diseased fatty tissue and healthy fatty tissue

B. A FLAIR view of diseased brain gray matter and healthy brain gray matter

C. A T1-weighted view of diseased cerebrospinal fluid and healthy cerebrospinal fluid

D. A T1-weighted view of diseased brain white matter and healthy brain white matter

Use the information below to answer questions 20–23.

Some societal changes in the Yuan Dynasty of China may correlate with environmental changes from AD 1276–1367.

Figure 1 shows changes in mean temperature and frequency of environmental factors during the Yuan Dynasty, spanning AD 1276–1367.

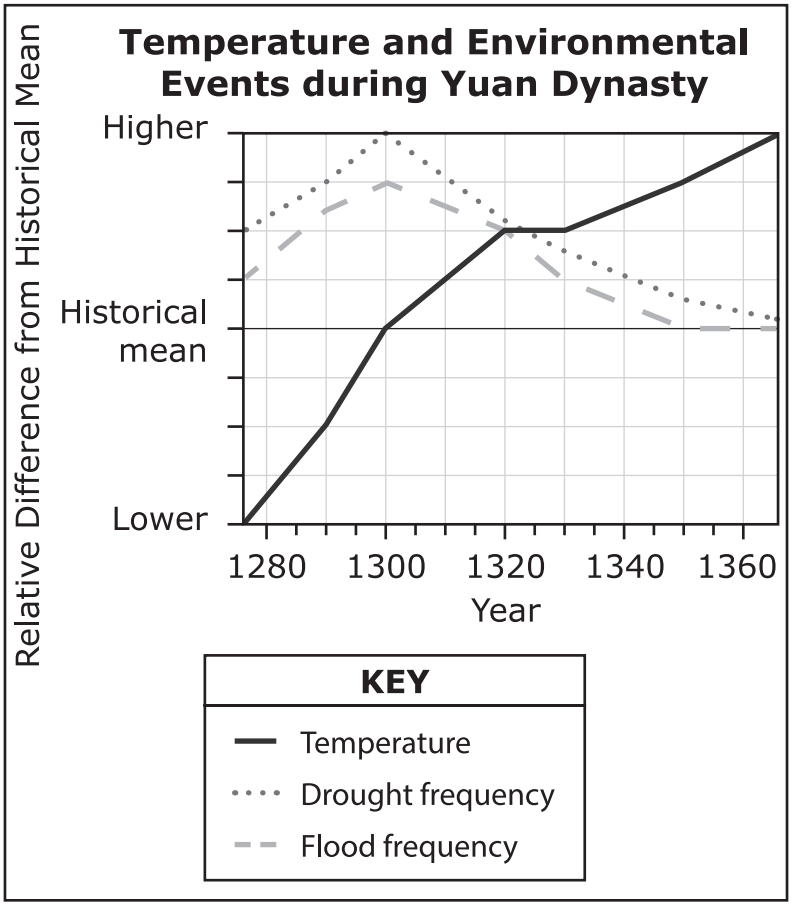


Figure 1.

Figure 2 shows changes in mean temperature and societal factors during the same period. During this time span, droughts and floods often caused failures of staple crops, such as rice.

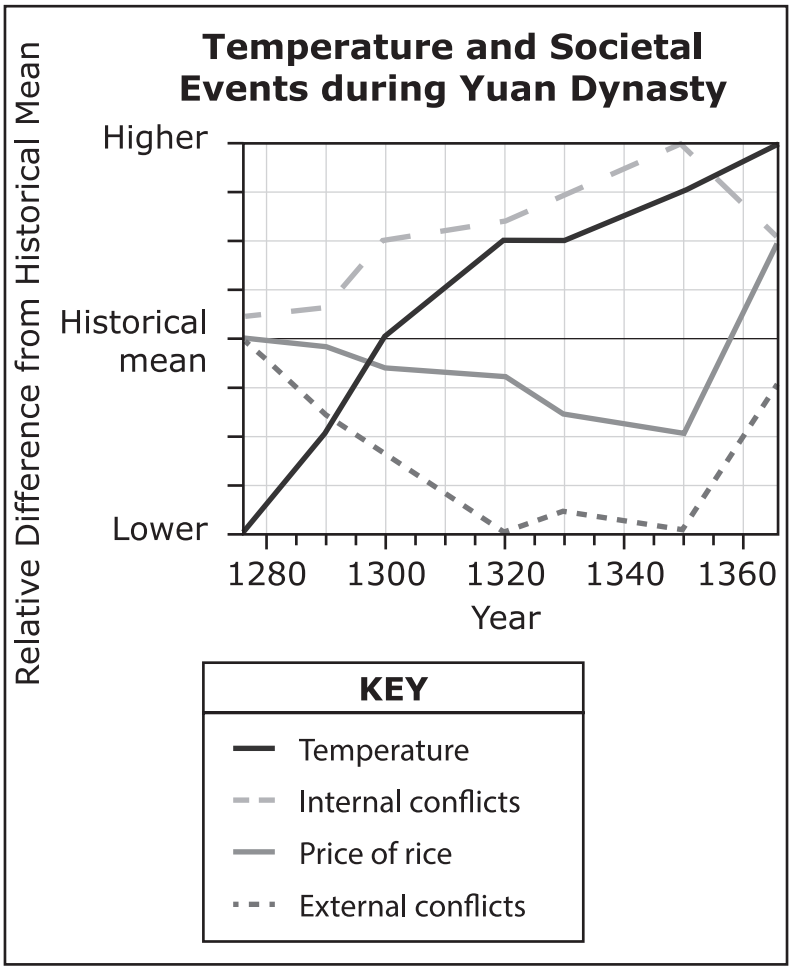


Figure 2.

GO ON →

20. Based on Figure 1, which environmental trends were generally experienced throughout the span of the Yuan Dynasty?

Select **two (2)** of the five statements.

A. Temperature increased.

B. Flood frequency was higher than or at the historical mean.

C. Drought frequency and temperature followed similar patterns of variation.

D. Droughts occurred as often as or less frequently than the historical mean.

E. Flood frequency and temperature followed similar patterns of variation.

21. Which claim about possible associations between societal and environmental factors is **best** supported by the data?

A. Times of higher than historical mean price of rice are associated with times of higher than historical mean floods.

B. Times of lower than historical mean internal conflicts are associated with times of lower than historical mean floods.

C. Times of higher than historical mean internal conflicts are associated with times of higher than historical mean droughts.

D. Times of lower than historical mean external conflicts are associated with times of lower than historical mean droughts.

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22. Make a valid claim about the correlation between the price of rice and the frequency of external conflicts in the Yuan Dynasty. Support your claim using evidence from Figure 1 and Figure 2.

Enter your answer in the box.

(Item 22 continued)

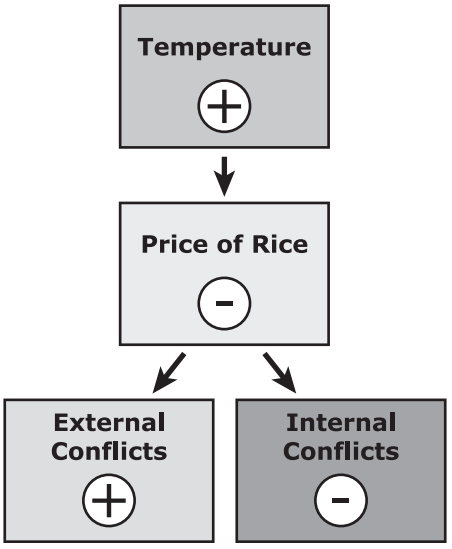
Make a valid claim about the correlation between the price of rice and the frequency of internal conflicts in the Yuan Dynasty. Support your claim using evidence from Figure 1 and Figure 2.

Enter your answer in the box.

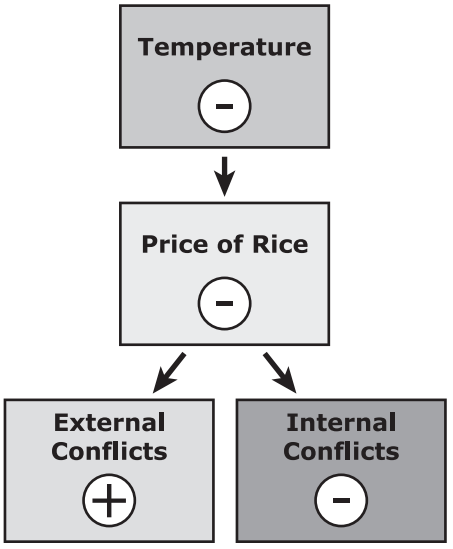
23. A model describing correlations that support the claim that temperature indirectly affected all conflicts during years AD 1350–1367 can be developed from the data. The positive (+) symbol represents increasing and the negative (–) symbol represents decreasing.

Choose the answer that correctly shows the symbols in the correct boxes.

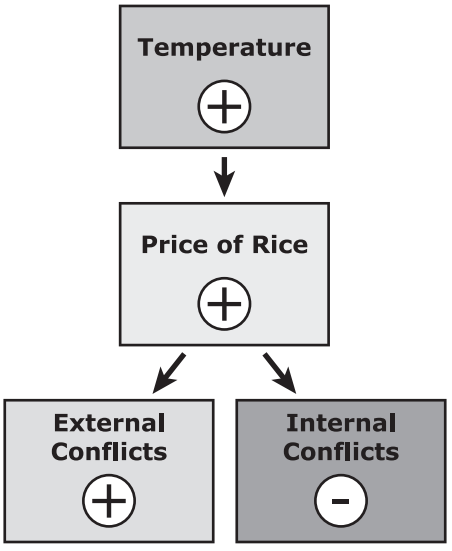
A.



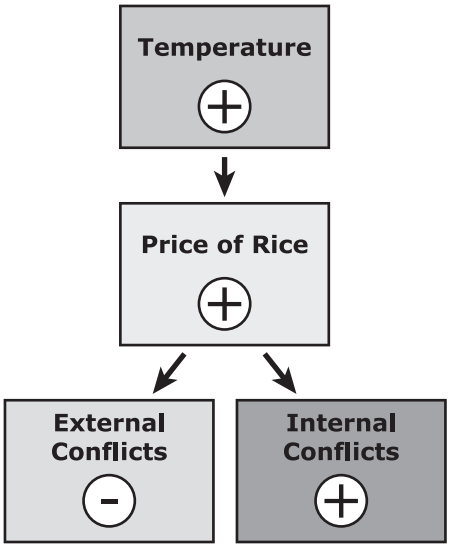
B.



C.



D.



You have reached the end of Unit 3 of the test.

- **Review your answers from Unit 3.**