NJSLA–S Online Practice Test Answer and Alignment Document
Science: Grade 11 – Unit 3

Items 1–4

Domain: Life Science
Phenomenon: The populations of guppies and parasitic worms vary when humans are in their environment.

Item 1

UIN: 2311M006_01
Item Type: Technology Enhanced
Standards Alignment: DCI: LS2.C; SEP: AID; CCC: S,P, and Q
Key: B, C, F
Rationale:

Answer B is valid because the short-term noise treatment had the highest worm count compared to the other treatments.

Answer C is valid because the short-term noise treatment had the highest worm count compared to the other treatments, which means it would have more compromised immune systems and thus a lower survival rate compared to the other treatments.

Answer F is valid because the long-term noise treatment had a lower worm count compared to the short-term noise treatment, which means it would have less compromised immune systems and thus a higher survival rate compared to that treatment.

Answer A is invalid because the no noise treatment did not have a lower worm count than the long-term treatment.

Answer D is invalid because the no noise treatment had a higher worm count compared to the long-term noise treatment, which means it would have more compromised immune systems and thus a lower survival rate compared to that treatment.

Answer E is invalid because the long-term noise treatment had a lower worm count than the no noise treatment.

Item 2

UIN: 2311M006_03
Item Type: Technology Enhanced
Standards Alignment: DCI: LS2.C; SEP: EAE; CCC: PAT
ScreenReader/AssistiveTechnology/Paper Key: Box X: B; Box Y: A; Box Z: A
Key: A correct response will look like this:

Over time, guppies exposed to [short-term ⌄] noise should have the lowest reproduction rates. After the treatment period, average worm counts in this group [continued ⌄] to increase. Therefore the student's claim [is ⌄] supported.

Rationale:

Figure 1 shows that the short-term noise treatment had the highest worm counts, which means they also would have the biggest decrease in mating, and thus reproduction, in males. The worm count continued to increase after the treatment period in the short-term noise group. This would support the student's claim that short-term noise has the greatest negative impact on guppy reproduction over time.

Item 3

UIN: 2311M006_08
Item Type: Technology Enhanced
Standards Alignment: DCI: LS2.C; SEP: PACI; CCC: C and E
SR/AT/Paper Key: Box W: A; Box X: B; Box Y: B; Box Z: A
Key: A correct response will look like this:

Short-term Noise Impact	Increase	Decrease
Minnow population	●	○
Competition pressure on the minnows from guppies	○	●
Mosquitoes eaten by guppies	○	●
Parasite count in guppies	●	○

Rationale:

Figure 1 shows that the short-term noise treatment causes the highest worm count in guppies, which would cause the parasite count to increase. This negatively impacts the guppies' survival. If fewer guppies survive, then that means there is less competition on the minnows from the guppies. If competition on the minnows is decreased, then the pond will be able to support more minnows, causing their population to increase. If the guppies are less likely to survive, then the number of mosquitoes they can eat will decrease.

Item 4

UIN: 2311M006_06
Item Type: Multiple Choice
Standards Alignment: DCI: LS2.C; SEP: AQDP; CCC: C and E
Key: C
Rationale:

Answer C is valid. Table 1 shows information about the levels of parasite infection in guppies (infected or not infected) and several metrics used to measure mate selection data from female guppies, such as male guppy color, time spent near males, and response to mating displays.

Answer A is invalid because there is no information about how the worms respond to guppies changing colors in the table, and this explanation does not include information about the results of the female and male interactions.

Answer B is invalid because there is no information on the specific amount of time females spend looking for mates in the table, and this explanation does not include information about the worms.

Answer D is invalid because there is no information about worm counts in female guppies in the table, and this explanation does not include information about the results of the female and male interactions or the male's color.

Items 5–8

Domain: Physical Science
Phenomenon: Despite being in a cold room, coffee stays hot in a container for a long time.

Item 5

UIN: 2311M014_01
Item Type: Multiple Choice
Standards Alignment: DCI: PS3.A; SEP: UMCT; CCC: S,P, and Q
Key: B
Rationale:

Answer B is valid. Using the heat transfer equation, to increase 0.2 kg of coffee 50°C, from 20°C to 70°C, multiply 0.2 by 4,200 by 50, which equals Answer B: 42,000.

Answer A is invalid because 25,200 J of heat would be needed to raise the temperature 30°C, but raising the temperature of the coffee from 20°C to 70°C is 50°C.

Answer C is invalid because 58,800 J of heat would be needed to raise the temperature 70°C, but raising the temperature of the coffee from 20°C to 70°C is 50°C.

Answer D is invalid because 75,600 J of heat would be needed to raise the temperature 90°C, but raising the temperature of the coffee from 20°C to 70°C is 50°C.
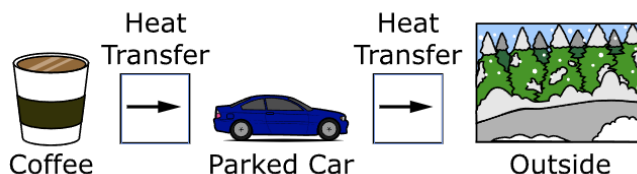
Item 6

UIN: 2311M014_04
Item Type: Technology Enhanced
Standards Alignment: DCI: PS3.B; SEP: DUM; CCC: S & SM
SR/AT/Paper Key: Box Y: A; Box Z: A
Key: A correct response will look like this:

Rationale:

Heat transfers only from warm areas to cool areas. The 70°C coffee will transfer heat to the 20°C car. The car is warmer than 0°C and thus will transfer heat to the outside.

Item 7

UIN: 2311M014_02
Item Type: Technology Enhanced
Standards Alignment: DCI: PS3.B; SEP: EAE; CCC: S,P, and Q
SR/AT/Paper Key: Box X: B; Box Y: B; Box Z: B
Key: A correct response will look like this:

Using the | conduction ▾ | equation, the larger cup

| increases ▾ | the rate of heat loss. Therefore, the claim is

| not supported ▾ | by the data.

Rationale:

The claim is about heat loss, and thus the conduction equation should be used. In the conduction equation, the amount of heat loss is dependent on the area of the radiating surface. Increasing the cup size increases the area of the radiating surface, and thus increases the amount of heat loss. Therefore, placing the same amount of coffee in a larger cup would cause the coffee to cool more quickly, which is the opposite of the claim.

Item 8

UIN: 2311M014_05
Item Type: Multiple Choice
Standards Alignment: DCI: PS3.A; SEP: UMCT; CCC: S,P, and Q
Key: C
Rationale:

Answer C is valid. Using the law of conservation of energy equation we can substitute the transfer of heat equation and get $m_{coffee}c_{coffee}\Delta T_{coffee} = m_{ice}c_{ice}\Delta T_{ice}$. Subbing in the information into this equation gives $(0.2)(4,200)(20) = m_{ice}(2,100)(50)$. Solving for the mass of ice gives Answer C: 0.16 kg.

Answer A is invalid because 0.06 kg would be the answer if incorrect values are used.

Answer B is invalid because 0.10 kg would be the answer if the coffee and ice had the same change in temperature, and the values for specific heat were swapped.

Answer D is invalid because a different change in temperature occurred for the coffee and ice, and they both have a different specific heat, so the mass of ice needed is different from the mass of coffee.

Items 9–11

Domain: Earth and Space Science

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

Item 9

UIN: 2311M025_01
Item Type: Multiple Choice
Standards Alignment: DCI: ESS1.A; SEP: OECI; CCC: C and E
Key: D
Rationale:

Answer D is valid. Figure 1 shows that during recombinations, electrons, protons, and neutrons combined to create hydrogen and helium atoms. Therefore, with the electrons now bonded to protons and neutrons, this supports answer D. The abundance of free electrons decreased.

Answer A is invalid because while the first stars did form after recombination, hydrogen and helium were needed to form those stars. This took some and was not the immediate effect of recombination.

Answer B is invalid because while the universe did cool down, cooling had to precede atom formation.

Answer C is invalid because no new matter was created, only rearranged and bonded to form atoms.

Item 10

UIN: 2311M025_03
Item Type: Technology Enhanced
Standards Alignment: DCI: ESS1.A; SEP: DUM; CCC: S & SM
SR/AT/Paper Key: C
Key: A correct response will look like this:

Order	Event
Earliest	Big bang
↓	Universe made up of plasma
	Recombination
Most Recent	First stars formed

Rationale:

Figure 1 shows the chronological order of how the universe was created, going from left to right with the left being the first event and the right being later events. The leftmost event was the big bang and thus should be placed in the first box as the earliest event. After the big bang, the universe existed in a state of plasma, making that the second event. Then, after the plasma cooled enough for atoms to form, recombination occurred. Then, after recombination, when hydrogen and helium atoms were formed, stars formed.

Item 11

UIN: 2311M025_06
Item Type: Multiple Choice
Standards Alignment: DCI: ESS1.A; SEP: PACI; CCC: C and E
Key: D
Rationale:

Answer D is valid because during recombination, free electrons combined with protons to create hydrogen atoms, reducing the density of free electrons, causing light to scatter less and travel farther.

Answer A is invalid because while the first stars were created after recombination, they were not created during recombination, and light that became the CMB existed before the stars were formed.

Answer B is invalid because during recombination, the density of free electrons in the universe decreased, causing light to be scattered less.

Answer C is invalid because while recombination did produce the first hydrogen atoms, the light that became the CMB existed before the stars were formed.

Items 12–15

Domain: Life Science
Phenomenon: A chemical treatment increases mitosis in a plant, yet the plant is less healthy than an untreated plant.

Item 12

UIN: 2211M009_08
Item Type: Technology Enhanced
Standards Alignment: DCI: LS1.B; SEP: DUM; CCC: SF
Key: B, C, D
Rationale:

Answer B, Answer C, and Answer D are valid. Table 1 shows that the process of mitosis allows a single cell to divide into two daughter cells, which produces new and additional cells. This allows dead cells to be replaced, which supports Answer B. It allows tissue to be repaired because new cells can replace the damaged cells in the tissue, which supports Answer C. It also creates additional new cells, which supports Answer D.

Answer A is invalid because mitosis produces new cells; it does not repair damaged cells.

Answer E is invalid because mitosis produces daughter cells with the same number of chromosomes as the parent cell.

Item 13

UIN: 2211M009_04
Item Type: Technology Enhanced
Standards Alignment: DCI: LS1.B; SEP: CEDS; CCC: C and E
Key: B
Rationale:

Answer B is valid. Table 2 shows the effects of Drug Y and Drug Z at different concentrations on the mitotic index, which is the rate of mitosis, and the number of mutations in chromosomes. The data shows that low concentrations of Drug Z have a higher mitotic index compared to the control, but as concentration of the drug increases, the mitotic index continues to decrease until it is below the control value at the highest Drug Z concentration, which supports Answer B.

Answer A is invalid because the mitotic index values do not follow a decreasing trend with increasing concentrations of Drug Y.

Answer C is invalid because the mitotic index value is above that of the control for several concentrations of both Drug Y and Drug Z.

Answer D is invalid because high concentrations of Drug Z cause lower mitotic index values compared to the control.

Item 14

UIN: 2211M009_05
Item Type: Multiple Choice
Standards Alignment: DCI: LS3.B; SEP: PACI; CCC: C and E
Key: B
Rationale:

Answer B is valid. To produce the fewest number of daughter cells, a drug that results in a low mitotic index should be chosen; to produce the highest percentage of chromosome changes, a drug that results in high levels of mutations should be selected. Table 2 shows that Drug Z at a concentration of 46.3 µM will yield the lowest mitotic index and the highest percentage of mutations, thus supporting Answer B.

Answer A is invalid because Drug Y at a concentration lower than 6.5 µM did not produce cells that either had the lowest mitotic index or the highest percentage of mutations.

Answer C is invalid because at the lowest concentrations, neither Drug Y nor Drug Z produced cells that had either the lowest mitotic index or the highest percentage of mutations.

Answer D is invalid because Drug Y at the highest concentration did not produce cells that either had the lowest mitotic index or the highest percentage of mutations, though Drug Z did.

Item 15

UIN: 2211M009_06
Item Type: Technology Enhanced
Standards Alignment: DCI: LS3.B; SEP: EAE; CCC: SF
SR/AT/Paper Key: Box U: A; Box V: A; Box W: B
Key: A correct response will look like this:

In normal circumstances, the number of mutations that occur during mitosis is very [low ▾] . Drug Z [shows ▾] that environmental factors can increase the mutation rate without increasing the rate of mitosis, which [does not support ▾] the claim.

Rationale:

The control treatment shows that there is a very low chance of chromosomal mutations under typical conditions. Drug Z shows that environmental factors can increase the mutation rate without increasing the rate of mitosis since the administration of a drug is an environmental factor and the highest concentrations of Drug Z increase the percentage of mutations but produce a lower mitotic index, and thus lower the rate of mitosis when compared to the control. Since the claim is that mutations remain constant and increases in rates of mitosis will also lead to increased mutations and Table 2 shows that Drug Z does not follow this trend, the claim is not supported.

Items 16–19

Domain: Physical Science
Phenomenon: A magnetic field and radiofrequency pulse applied to the body produces a highly detailed image of body tissues.

Item 16

UIN: 2211M021_01
Item Type: Technology Enhanced
Standards Alignment: DCI: PS2.B; SEP: EAE; CCC: E&M
SR/AT/Paper Key: Box X: C; Box Y: A; Box Z: B
Key: A correct response will look like this:

When [both MF and RF are ▾] applied during an MRI, [all ▾] of the water protons align in the same direction; however, outside the MRI, water protons in the body align [randomly in ▾] Earth's MF.

Rationale:

Figure 2B shows that inside the MRI, when only the MF is applied, the hydrogen protons in the body align parallel to each other, with some going in one direction and some going in the opposite direction. In Figure 2C, when the MF and RF pulse are both applied, the RF pulse turns the parallel protons 90 degrees so that they are now all aligned in the same direction. Outside of the MRI under normal conditions, the hydrogen protons in water inside the body align randomly, and under normal conditions, they are always in Earth's MF.

Item 17

UIN: 2211M021_04
Item Type: Multiple Choice
Standards Alignment: DCI: PS4.C; SEP: DUM; CCC: C and E
Key: A
Rationale:

Answer A is valid because all points are in the middle of the *x*-axis, which shows a middle- or intermediate-length relaxation time.

Answer B is invalid because while some of the points are in the middle, it shows about equal amounts of fat-containing tissue, water-containing tissue, and diseased tissue instead of primarily diseased tissue.

Answer C is invalid because the data represent primarily fat-containing tissue.

Answer D is invalid because the data represent primarily water-containing tissue.

Item 18

UIN: 2211M021_05
Item Type: Multiple Choice
Standards Alignment: DCI: PS2.B; SEP: CEDS; CCC: E&M
Key: C
Rationale:

Answer C is valid because increasing the Larmor frequency creates a clearer MRI image, and based on the Larmor frequency equation, to get a larger Larmor frequency, the strength of the applied MF must increase.

Answer A is invalid because while an increased Larmor frequency would create a clearer MRI image, based on the Larmor frequency equation, a weaker MF will decrease the Larmor frequency.

Answer B is invalid because while a weaker MF would decrease the Larmor frequency, based on the Larmor frequency equation, an increased Larmor frequency would create a less clear MRI image.

Answer D is invalid because while a stronger MF would create a clearer MRI image, based on the Larmor frequency equation, a stronger MF will increase the Larmor frequency, not decrease it.

Item 19

UIN: 2211M021_06
Item Type: Multiple Choice
Standards Alignment: DCI: PS4.C; SEP: PACI; CCC: SF
Key: D
Rationale:

Answer D is valid because using a T1-weighted view, the diseased brain white matter will show as dark and the healthy brain white matter will show as light, providing a good contrast for determining which white brain matter is diseased.

Answer A is invalid because when using a T2-weighted view, the diseased fatty tissue will show as bright and the healthy fatty tissue will show as light, which does not provide a good contrast for determining which tissues are diseased.

Answer B is invalid because when using a FLAIR view, the diseased brain gray matter will show as bright and the healthy brain gray matter will show as light gray, which does not provide a good contrast for determining which gray brain matter is diseased.

Answer C is invalid because when using a T1-weighted view, the diseased cerebrospinal fluid will show as dark and the healthy cerebrospinal fluid will show as dark, which does not provide a good contrast for determining if the cerebrospinal fluid is diseased.

Items 20–23

Domain: Earth and Space Science
Phenomenon: Some societal changes in the Yuan Dynasty of China may correlate with environmental changes from AD 1276–1367.

Item 20

UIN: 1911B002_01A
Item Type: Technology Enhanced
Standards Alignment: DCI: ESS3.B; SEP: AID; CCC: SC
Key: A, B
Rationale:
Answer B is valid. Figure 1 shows how temperature, drought frequency, and flood frequency changed over the course of the Yuan Dynasty. It shows that temperature increased over the time period, which supports Answer A, and that flood frequency was above or at the historic mean the entire time period, which supports Answer B.
Answer C is invalid because the drought frequency and temperature did not follow similar trends since temperature continued to increase and drought frequency increased then decreased during the time period.
Answer D is invalid because the frequency of droughts was higher than the historic mean for the entire time period.
Answer E is invalid because the flood frequency and temperature did not follow similar trends since temperature continued to increase and flood frequency increased then decreased during the time period.

Item 21

UIN: 1911B002_05A
Item Type: Multiple Choice
Standards Alignment: DCI: ESS3.B; SEP: EAE; CCC: SC
Key: C
Rationale:
Answer C is valid. Figure 1 shows that the drought frequency was higher than the historical mean for the entire time period, and Figure 2 shows that internal conflicts were higher than the historical mean for the entire time period, which supports Answer C.
Answer A is invalid because the price of rice was below the historic mean for most of the time period, but flood frequency was above the historic mean for the entire time period.
Answer B is invalid because internal conflicts and flood frequency are not shown to be below the historic mean during this time period.
Answer D is invalid because drought frequency is not shown to be below the historic mean during this time period.

Item 22

UIN: 1911B002_08B
Item Type: Constructed Response
Standards Alignment: DCI: ESS3.B; SEP: EAE; CCC: PAT
Sample Student Response:
(4pts)
Claim: Price of rice and external conflicts are positively correlated. (1 pt)
Support: From around 1280–1350, the price of rice decreased while external conflicts decreased (with the exception of a little blip from 1320–1330). From 1350–1367, both rice price and external conflicts similarly increased from lower-than-normal levels. (1 pt)

Claim: Price of rice and internal conflict are negatively correlated. (1 pt)
Support From A.D. 1280–1350, rice price decreased from normal to lower-than-normal levels, and the frequency of internal conflicts increased from normal to higher-than-normal levels. From AD 1350–1367, rice price increased from lower-than-normal levels and internal conflicts decreased from higher-than-normal levels. (1 pt)

Rationale:
Figure 2 shows that the price of rice and external conflicts trendlines follow similar trends, with both trends decreasing until 1350, then both trends sharply increasing from 1350 to the end of the time period. When data follow similar increases and decreases in trends, it is considered to be positively correlated.
Figure 2 shows the price of rice and internal conflicts trendlines follow opposite trends, with the price of rice decreasing until 1350, then increasing to the end of the time period and the internal conflicts increasing until 1350, then decreasing until the end of the time period. When data follow opposite increases and decreases in trends, it is considered to be negatively correlated.
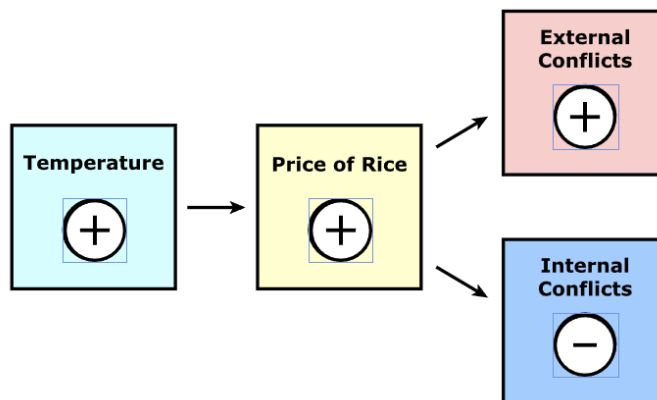
Item 23

UIN: 1911B002_10B
Item Type: Technology Enhanced
Standards Alignment: DCI: ESS3.B; SEP: DUM; CCC: S & SM
SR/AT/Paper Key: C
Key: A correct response will look like this:

Rationale:
Figure 1 shows that from 1350 to 1367, temperature was increasing (+). Figure 2 shows that from 1350 to 1367, the price of rice and external conflicts were increasing (+), but internal conflicts were decreasing (–).