Reading Test

65 MINUTES, 52 QUESTIONS

Turn to Section 1 of your answer sheet to answer the questions in this section.

DIRECTIONS

Each passage or pair of passages below is followed by a number of questions. After reading each passage or pair, choose the best answer to each question based on what is stated or implied in the passage or passages and in any accompanying graphics (such as a table or graph).

Questions 1-10 are based on the following passage.

This passage is from Carlos Ruiz Zafón, *The Angel's Game*. ©2008 by Dragonworks, S.L. Translation ©2009 by Lucia Graves. The narrator, a writer, recalls his childhood in early twentieth-century Barcelona.

Even then my only friends were made of paper and ink. At school I had learned to read and write long before the other children. Where my school friends saw notches of ink on incomprehensible pages, I saw light, streets, and people. Words and the mystery of their hidden science fascinated me, and I saw in them a key with which I could unlock a boundless world, a safe haven from that home, those streets, and those troubled days in which even I could sense that only a limited fortune awaited me. My father didn't like to see books in the house. There was something about them—apart from the letters he could not decipher—that offended him. He used to tell me that as soon as I was ten he would send me off to work and that I'd better get rid of all my scatterbrained ideas if I didn't want to end up a loser, a nobody. I used to hide my books under the mattress and wait for him to go out or fall asleep so that I could read. Once he caught me reading at night and flew into a rage. He tore the book from my hands and flung it out of the window.

"If I catch you wasting electricity again, reading all this nonsense, you'll be sorry."

My father was not a miser and, despite the hardships we suffered, whenever he could he gave me a few coins so that I could buy myself some treats like the other children. He was convinced that I spent them on licorice sticks, sunflower seeds, or sweets, but I would keep them in a coffee tin under the bed, and when I'd collected four or five reales I'd secretly rush out to buy myself a book.

My favorite place in the whole city was the Sempere & Sons bookshop on Calle Santa Ana. It smelled of old paper and dust and it was my sanctuary, my refuge. The bookseller would let me sit on a chair in a corner and read any book I liked to my heart's content. He hardly ever allowed me to pay for the books he placed in my hands, but when he wasn't looking I'd leave the coins I'd managed to collect on the counter before I left. It was only small change—if I'd had to buy a book with that pittance, I would probably have been able to afford only a booklet of cigarette papers. When it was time for me to leave, I would do so dragging my feet, a weight on my soul. If it had been up to me, I would have stayed there forever.

One Christmas Sempere gave me the best gift I have ever received. It was an old volume, read and experienced to the full.

"*Great Expectations*, by Charles Dickens," I read on the cover.

I was aware that Sempere knew a few authors who frequented his establishment and, judging by the care with which he handled the volume, I thought perhaps this Mr. Dickens was one of them.

"A friend of yours?"

"A lifelong friend. And from now on, he's your friend too."

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CONTINUE

That afternoon I took my new friend home, hidden under my clothes so that my father wouldn't see it. It was a rainy winter, with days as gray as lead, and I read *Great Expectations* about nine times, partly because I had no other book at hand, partly because I did not think there could be a better one in the whole world and I was beginning to suspect that Mr. Dickens had written it just for me. Soon I was convinced that I didn't want to do anything else in life but learn to do what Mr. Dickens had done.

1

Over the course of the passage, the main focus shifts from a

A) general discussion of the narrator's love of reading to a portrayal of an influential incident.

B) depiction of the narrator's father to an examination of an author with whom the narrator becomes enchanted.

C) symbolic representation of a skill the narrator possesses to an example of its application.

D) tale about the hardships of the narrator's childhood to an analysis of the effects of those hardships.

2

The main purpose of lines 1-10 ("Even . . . awaited me") is to

A) introduce the characters who play a part in the narrator's story.

B) list the difficult conditions the narrator endured in childhood.

C) describe the passion that drives the actions the narrator recounts.

D) depict the narrator's aspirations before he met Sempere.

3

With which of the following statements about his father would the narrator most likely agree?

A) He lacked affection for the narrator.

B) He disliked any unnecessary use of money.

C) He would not have approved of Sempere's gift.

D) He objected to the writings of Charles Dickens.

4

Which choice provides the best evidence for the answer to the previous question?

A) Lines 24-27 ("My father . . . children")

B) Lines 35-37 ("The bookseller . . . content")

C) Lines 37-38 ("He hardly . . . hands")

D) Lines 59-61 ("That afternoon . . . see it")

5

It can reasonably be inferred from the passage that the main reason that the narrator considers *Great Expectations* to be the best gift he ever received is because

A) reading the book convinced him that he wanted to be a writer.

B) he'd only ever been given sweets and snacks as gifts in the past.

C) the gift meant that Sempere held him in high regard.

D) Sempere was a friend of the book's author.

6

Which choice provides the best evidence for the answer to the previous question?

A) Lines 38-40 ("when . . . left")

B) Lines 48-49 ("It was . . . full")

C) Lines 52-55 ("I was . . . them")

D) Lines 66-68 ("Soon . . . done")

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7

The narrator indicates that he pays Sempere

A) less than Sempere expects him to pay for the books.

B) nothing, because Sempere won't take his money.

C) the money he makes selling sweets to the other children.

D) much less for the books than they are worth.

8

As used in line 44, "weight" most nearly means

A) bulk.

B) burden.

C) force.

D) clout.

9

The word "friend" is used twice in lines 57-58 to

A) underline the importance of the narrator's connection to Sempere.

B) stress how friendships helped the narrator deal with his difficult home situation.

C) emphasize the emotional connection Sempere feels to reading.

D) imply that the narrator's sentiments caused him to make an irrational decision.

10

Which statement best characterizes the relationship between Sempere and Charles Dickens?

A) Sempere models his own writing after Dickens's style.

B) Sempere is an avid admirer of Dickens's work.

C) Sempere feels a personal connection to details of Dickens's biography.

D) Sempere considers himself to be Dickens's most appreciative reader.

Questions 11-21 are based on the following passage and supplementary material.

This passage is adapted from Jeffrey Mervis, "Why Null Results Rarely See the Light of Day." ©2014 by American Association for the Advancement of Science.

The question of what to do with null results—when researchers fail to see an effect that should be detectable—has long been hotly debated among those conducting medical trials, where the results can have a big impact on lives and corporate bottom lines. More recently, the debate has spread to the social and behavioral sciences, which also have the potential to sway public and social policy. There were little hard data, however, on how often or why null results were squelched. "Yes, it's true that null results are not as exciting," political scientist Gary King of Harvard University says. "But I suspect another reason they are rarely published is that there are many, many ways to produce null results by messing up. So they are much harder to interpret."

In a recent study, Stanford political economist Neil Malhotra and two of his graduate students examined every study since 2002 that was funded by a competitive grants program called TESS (Time-sharing Experiments for the Social Sciences). TESS allows scientists to order up Internet-based surveys of a representative sample of US adults to test a particular hypothesis (for example, whether voters tend to favor legislators who boast of bringing federal dollars to their districts over those who tout a focus on policy matters).

Malhotra's team tracked down working papers from most of the experiments that weren't published, and for the rest asked grantees what had happened to their results. In their e-mailed responses, some scientists cited deeper problems with a study or more pressing matters—but many also believed the journals just wouldn't be interested. "The unfortunate reality of the publishing world [is] that null effects do not tell a clear story," said one scientist. Said another, "Never published, definitely disappointed to not see any major effects."

Their answers suggest to Malhotra that rescuing findings from the file drawer will require a shift in expectations. "What needs to change is the culture—the author's belief about what will happen if the research is written up," he says.

Not unexpectedly, the statistical strength of the findings made a huge difference in whether they were ever published. Overall, 42% of the experiments

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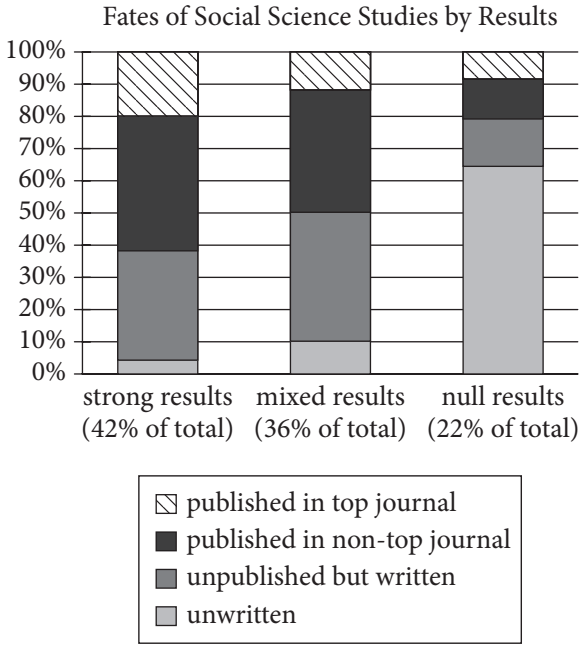
produced statistically significant results. Of those, 62% were ultimately published, compared with 21% of the null results. However, the Stanford team was surprised that researchers didn't even write up 65% of the experiments that yielded a null finding.

Scientists not involved in the study praise its "clever" design. "It's a very important paper" that "starts to put numbers on things we want to understand," says economist Edward Miguel of the University of California, Berkeley.

He and others note that the bias against null studies can waste time and money when researchers devise new studies replicating strategies already found to be ineffective. Worse, if researchers publish significant results from similar experiments in the future, they could look stronger than they should because the earlier null studies are ignored. Even more troubling to Malhotra was the fact that two scientists whose initial studies "didn't work out" went on to publish results based on a smaller sample. "The non-TESS version of the same study, in which we used a student sample, did yield fruit," noted one investigator.

A registry for data generated by all experiments would address these problems, the authors argue. They say it should also include a "preanalysis" plan, that is, a detailed description of what the scientist hopes to achieve and how the data will be analyzed. Such plans would help deter researchers from tweaking their analyses after the data are collected in search of more publishable results.



Adapted from Annie Franco, Neil Malhotra, and Gabor Simonovits, "Publication Bias in the Social Sciences: Unlocking the File Drawer." ©2014 by American Association for the Advancement of Science.

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11

The passage primarily serves to

A) discuss recent findings concerning scientific studies and dispute a widely held belief about the publication of social science research.

B) explain a common practice in the reporting of research studies and summarize a study that provides support for a change to that practice.

C) describe the shortcomings in current approaches to medical trials and recommend the implementation of a government database.

D) provide context as part of a call for stricter controls on social science research and challenge publishers to alter their mindsets.

12

As used in line 21, "allows" most nearly means

A) admits.

B) tolerates.

C) grants.

D) enables.

13

As used in line 43, "strength" most nearly means

A) attribution.

B) exertion.

C) toughness.

D) significance.

14

The passage indicates that a problem with failing to document null results is that

A) the results of related studies will be misleading.

B) researchers may overlook promising areas of study.

C) mistakes in the collection of null results may be overlooked.

D) the bias against null results will be disregarded.

15

Which choice provides the best evidence for the answer to the previous question?

A) Lines 38-40 ("Their . . . expectations")

B) Lines 48-50 ("However . . . finding")

C) Lines 56-59 ("He and . . . ineffective")

D) Lines 59-62 ("Worse . . . ignored")

16

Based on the passage, to which of the following hypothetical situations would Malhotra most strongly object?

A) A research team refuses to publish null results in anything less than a top journal.

B) A research team excludes the portion of data that produced null results when reporting its results in a journal.

C) A research team unknowingly repeats a study that produced null results for another research team.

D) A research team performs a follow-up study that expands the scope of an initial study that produced null results.

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CONTINUE

17

Which choice provides the best evidence for the answer to the previous question?

A) Lines 36-37 ("Said . . . effects")
B) Lines 45-48 ("Overall . . . null results")
C) Lines 62-68 ("Even . . . investigator")
D) Lines 69-73 ("A registry . . . analyzed")

18

The last paragraph serves mainly to

A) propose a future research project to deal with some of the shortcomings of current publishing practices noted in the passage.
B) introduce a possible solution to problems discussed in the passage regarding the reporting of social science studies.
C) summarize the findings of a study about experimental results explained in the passage.
D) reinforce the importance of reexamining the results of all social science trials.

19

According to the graph, social science studies yielding strong results were

A) unwritten over 50 percent of the time.
B) unpublished but written 50 percent of the time.
C) published in a top journal approximately 20 percent of the time.
D) published in a non-top journal almost 80 percent of the time.

20

Which of the following statements is supported by the graph?

A) Studies with mixed results were just as likely to be published as they were to be left either unpublished or unwritten.
B) Studies with mixed results occurred more frequently than did studies with strong and null results combined.
C) Studies with mixed results were more likely to be published in top journals than they were to be published in non-top journals.
D) Studies with mixed results were the most common type of social science studies.

21

Which statement from the passage is most directly reflected by the data presented in the graph?

A) Lines 30-33 ("In their . . . interested")
B) Lines 33-36 ("The unfortunate . . . scientist")
C) Lines 43-45 ("Not unexpectedly . . . published")
D) Lines 52-55 ("It's a . . . Berkeley")

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Questions 22-31 are based on the following passage and supplementary material.

This passage is adapted from Rachel Ehrenberg, "Salt Stretches in Nanoworld." ©2009 by Society for Science & the Public. The "nanoworld" is the world observed on a scale one billionth that of ordinary human experience.

Inflexible old salt becomes a softy in the nanoworld, stretching like taffy to more than twice its length, researchers report. The findings may lead to new approaches for making nanowires that could end up in solar cells or electronic circuits. The work also suggests that these ultra-tiny salt wires may already exist in sea spray and large underground salt deposits.

"We think nanowires are special and go to great lengths to make them," says study coauthor Nathan Moore of Sandia National Laboratories in Albuquerque. "Maybe they are more common than we think."

Metals such as gold or lead, in which bonding angles are loosey-goosey, can stretch out at temperatures well below their melting points. But scientists don't expect this superplasticity in a rigid, crystalline material like salt, Moore says.

This unusual behavior highlights that different forces rule the nanoworld, says theoretical physicist Krzysztof Kempa of Boston College. "Forget about gravity. It plays no role," he says. Surface tension and electrostatic forces are much more important at this scale.

Moore and his colleagues discovered salt's stretchiness accidently. They were investigating how water sticks to a surface such as salt and created a super-dry salt sample for testing. After cleaving a chunk of salt about the size of a sugar cube with a razor, the scientists guided a microscope that detects forces toward the surface. When the tip was far away there was no measured force, but within about seven nanometers a very strong attraction rapidly developed between the diamond tip of the microscope and the salt. The salt actually stretched out to glom on to the microscope tip. Using an electron microscope to see what was happening, the researchers observed the nanowires.

The initial attraction between the tip and salt might be due to electrostatic forces, perhaps good old van der Waals interactions,[1] the researchers speculate. Several mechanisms might lead to the elasticity, including the excessive surface tension found in the nanoworld (the same tension that allows a water strider to skim the surface of a pond).

The surface tension is so strong that as the microscope pulls away from the salt, the salt stretches, Kempa says. "The inside has no choice but to rearrange the atoms, rather than break," he says.

This bizarre behavior is actually mirrored in the macroworld, the researchers say. Huge underground deposits of salt can bend like plastic, but water is believed to play a role at these scales. Perhaps salty nanowires are present in these deposits as well.

"Sodium chloride[2] is everywhere—in the air, in our bodies," Moore says. "This may change our view of things, of what's happening at the nanoscale."

The work also suggests new techniques for making nanowires, which are often created through nano-imprinting techniques, Kempa says. "We invoke the intuition of the macroworld," he says. "Maybe instead of stamping [nanowires] we should be nano-pulling them."

[1] Attractive forces between nearby atoms

[2] Common salt

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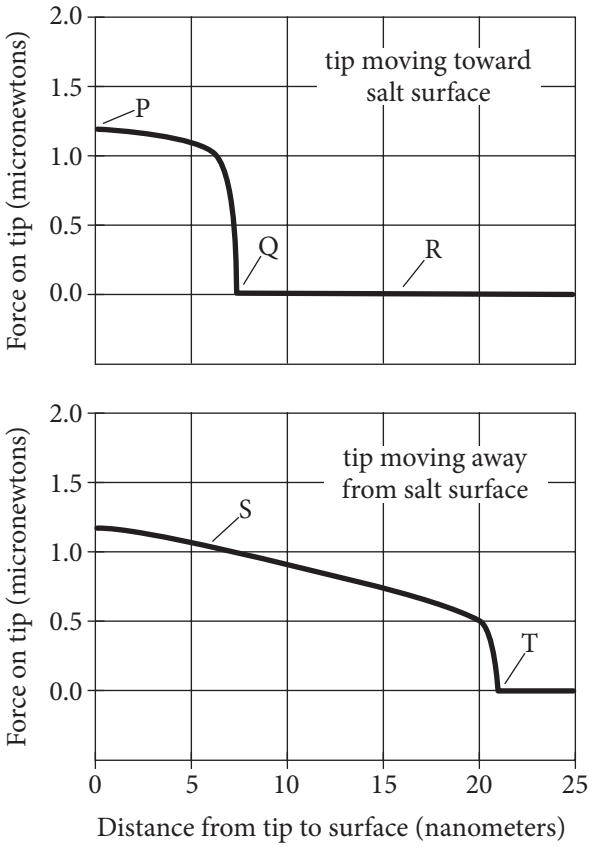
Interaction of Microscope Tip with Salt Surface



Adapted from Moore et al., "Superplastic Nanowires Pulled from the Surface of Common Salt." ©2009 by American Chemical Society.

22

One central idea of the passage is that

A) sometimes materials behave contrary to expectations.

B) systems can be described in terms of inputs and outputs.

C) models of materials have both strengths and weaknesses.

D) properties of systems differ from the properties of their parts.

23

Which choice best describes the overall structure of the passage?

A) A list of several ways in which salt's properties differ from researchers' expectations

B) A presentation of a hypothesis regarding salt behavior, description of an associated experiment, and explanation of why the results weaken the hypothesis

C) A description of two salt crystal experiments, the apparent disagreement in their results, and the resolution by more sensitive equipment

D) An introduction to an interesting salt property, description of its discovery, and speculation regarding its application

24

Which choice provides the best evidence for the claim that Moore's group was surprised to observe salt stretching?

A) Lines 17-18 ("But . . . says")

B) Lines 26-28 ("They were . . . testing")

C) Lines 36-38 ("Using . . . nanowires")

D) Lines 55-56 ("Sodium . . . says")

25

As used in line 20, "rule" most nearly means

A) mark.

B) control.

C) declare.

D) restrain.

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26

According to the passage, researchers have identified which mechanism as potentially responsible for the initial attraction between the microscope tip and the salt?

A) Gravity
B) Nano-imprinting
C) Surface tension
D) Van der Waals interactions

27

As used in line 42, "lead to" most nearly means

A) guide to.
B) result in.
C) point toward.
D) start with.

28

Based on the passage, which choice best describes the relationship between salt behavior in the nanoworld and in the macroworld?

A) In both the nanoworld and the macroworld, salt can be flexible.
B) Salt flexibility is expected in the nanoworld but is surprising in the macroworld.
C) Salt nanowires were initially observed in the nanoworld and later observed in the macroworld.
D) In the nanoworld, salt's interactions with water lead to very different properties than they do in the macroworld.

29

Which choice provides the best evidence for the answer to the previous question?

A) Lines 12-13 ("Maybe . . . think")
B) Lines 22-24 ("Surface . . . scale")
C) Lines 39-42 ("The initial . . . speculate")
D) Lines 51-53 ("Huge . . . scales")

30

According to the information in the graph, when the microscope tip is moving away from the salt surface and is 15 nanometers from the surface, what is the approximate force on the microscope tip, in micronewtons?

A) 0
B) 0.25
C) 0.75
D) 1.25

31

Based on the passage and the graph, which label on the graph indicates the point at which a salt nanowire breaks?

A) P
B) Q
C) R
D) T

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Questions 32-41 are based on the following passages.

These passages are adapted from the Lincoln-Douglas debates. Passage 1 is from a statement by Stephen Douglas. Passage 2 is from a statement by Abraham Lincoln. Douglas and Lincoln engaged in a series of debates while competing for a US Senate seat in 1858.

Passage 1

Mr. Lincoln likens that bond of the Federal Constitution, joining Free and Slave States together, to a house divided against itself, and says that it is contrary to the law of God, and cannot stand. When did he learn, and by what authority does he proclaim, that this Government is contrary to the law of God and cannot stand? It has stood thus divided into Free and Slave States from its organization up to this day. During that period we have increased from four millions to thirty millions of people; we have extended our territory from the Mississippi to the Pacific Ocean; we have acquired the Floridas and Texas, and other territory sufficient to double our geographical extent; we have increased in population, in wealth, and in power beyond any example on earth; we have risen from a weak and feeble power to become the terror and admiration of the civilized world; and all this has been done under a Constitution which Mr. Lincoln, in substance, says is in violation of the law of God; and under a Union divided into Free and Slave States, which Mr. Lincoln thinks, because of such division, cannot stand. Surely, Mr. Lincoln is a wiser man than those who framed the Government. . . .

I now come back to the question, why cannot this Union exist forever, divided into Free and Slave States, as our fathers made it? It can thus exist if each State will carry out the principles upon which our institutions were founded; to wit, the right of each State to do as it pleases, without meddling with its neighbors. Just act upon that great principle, and this Union will not only live forever, but it will extend and expand until it covers the whole continent, and makes this confederacy one grand, ocean-bound Republic. We must bear in mind that we are yet a young nation, growing with a rapidity unequalled in the history of the world, that our national increase is great, and that the emigration from the old world is increasing, requiring us to expand and acquire new territory from time to time, in order to give our people land to live upon. If we live upon the principle of State rights and State sovereignty, each State regulating its own affairs and minding its own business, we can go on and extend indefinitely, just as fast and as far as we need the territory. . . .

Passage 2

In complaining of what I said in my speech at Springfield, in which he says I accepted my nomination for the Senatorship . . . he again quotes that portion in which I said that "a house divided against itself cannot stand." Let me say a word in regard to that matter. He tries to persuade us that there must be a variety in the different institutions of the States of the Union; that that variety necessarily proceeds from the variety of soil, climate, of the face of the country, and the difference in the natural features of the States. I agree to all that. Have these very matters ever produced any difficulty among us? Not at all. Have we ever had any quarrel over the fact that they have laws in Louisiana designed to regulate the commerce that springs from the production of sugar? Or because we have a different class relative to the production of flour in this State? Have they produced any differences? Not at all. They are the very cements of this Union. They don't make the house a "house divided against itself." They are the props that hold up the house and sustain the Union.

But has it been so with this element of slavery? Have we not always had quarrels and difficulties over it? And when will we cease to have quarrels over it? Like causes produce like effects. It is worth while to observe that we have generally had comparative peace upon the slavery question, and that there has been no cause for alarm until it was excited by the effort to spread it into new territory. Whenever it has been limited to its present bounds, and there has been no effort to spread it, there has been peace. All the trouble and convulsion has proceeded from efforts to spread it over more territory. It was thus at the date of the Missouri Compromise. It was so again with the annexation of Texas; so with the territory acquired by the Mexican War; and it is so now. Whenever there has been an effort to spread it there has been agitation and resistance. . . . Do you think that the nature of man will be changed, that the same causes that produced agitation at one time will not have the same effect at another?

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CONTINUE

32

In the first paragraph of Passage 1, the main purpose of Douglas's discussion of the growth of the territory and population of the United States is to

A) provide context for Douglas's defense of continued expansion.

B) suggest that the division into free and slave states does not endanger the Union.

C) imply that Lincoln is unaware of basic facts concerning the country.

D) account for the image of the United States as powerful and admirable.

33

What does Passage 1 suggest about the US government's provisions for the institution of slavery, as framed in the Constitution?

A) They included no means for reconciling differences between free states and slave states.

B) They anticipated the Union's expansion into western territories.

C) They provided a good basic structure that does not need to be changed.

D) They were founded on an assumption that slavery was necessary for economic growth.

34

Which choice provides the best evidence for the answer to the previous question?

A) Lines 10-16 ("we have . . . earth")

B) Lines 25-27 ("I now . . . made it")

C) Lines 35-39 ("We must . . . increasing")

D) Lines 41-45 ("If we . . . territory")

35

As used in line 67, "element" most nearly means

A) ingredient.

B) environment.

C) factor.

D) quality.

36

Based on Passage 2, Lincoln would be most likely to agree with which claim about the controversy over slavery?

A) It can be ended only if Northern states act unilaterally to abolish slavery throughout the United States.

B) It would abate if attempts to introduce slavery to regions where it is not practiced were abandoned.

C) It has been exacerbated by the ambiguity of laws regulating the holding of slaves.

D) It is fueled in part by differences in religion and social values from state to state.

37

Which choice provides the best evidence for the answer to the previous question?

A) Lines 56-61 ("I agree . . . sugar")

B) Lines 64-66 ("They don't . . . Union")

C) Lines 74-76 ("Whenever . . . peace")

D) Lines 83-86 ("Do you . . . another")

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CONTINUE

38

As used in line 84, "nature" most nearly means

A) force.
B) simplicity.
C) world.
D) character.

39

Which choice identifies a central tension between the two passages?

A) Douglas proposes changes to federal policies on slavery, but Lincoln argues that such changes would enjoy no popular support.
B) Douglas expresses concerns about the economic impact of abolition, but Lincoln dismisses those concerns as irrelevant.
C) Douglas criticizes Lincoln for finding fault with the Constitution, and Lincoln argues that this criticism misrepresents his position.
D) Douglas offers an interpretation of federal law that conflicts with Lincoln's, and Lincoln implies that Douglas's interpretation is poorly reasoned.

40

Both passages discuss the issue of slavery in relationship to

A) the expansion of the Union.
B) questions of morality.
C) religious toleration.
D) laws regulating commerce.

41

In the context of each passage as a whole, the questions in lines 25-27 of Passage 1 and lines 67-69 of Passage 2 primarily function to help each speaker

A) cast doubt on the other's sincerity.
B) criticize the other's methods.
C) reproach the other's actions.
D) undermine the other's argument.

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Questions 42-52 are based on the following passage.

This passage is adapted from Daniel Chamovitz, *What a Plant Knows: A Field Guide to the Senses*. ©2012 by Daniel Chamovitz.

The Venus flytrap [*Dionaea muscipula*] needs to know when an ideal meal is crawling across its leaves. Closing its trap requires a huge expense of energy, and reopening the trap can take several hours, so *Dionaea* only wants to spring closed when it's sure that the dawdling insect visiting its surface is large enough to be worth its time. The large black hairs on their lobes allow the Venus flytraps to literally feel their prey, and they act as triggers that spring the trap closed when the proper prey makes its way across the trap. If the insect touches just one hair, the trap will not spring shut; but a large enough bug will likely touch two hairs within about twenty seconds, and that signal springs the Venus flytrap into action.

We can look at this system as analogous to short-term memory. First, the flytrap encodes the information (forms the memory) that something (it doesn't know what) has touched one of its hairs. Then it stores this information for a number of seconds (retains the memory) and finally retrieves this information (recalls the memory) once a second hair is touched. If a small ant takes a while to get from one hair to the next, the trap will have forgotten the first touch by the time the ant brushes up against the next hair. In other words, it loses the storage of the information, doesn't close, and the ant happily meanders on. How does the plant encode and store the information from the unassuming bug's encounter with the first hair? How does it remember the first touch in order to react upon the second?

Scientists have been puzzled by these questions ever since John Burdon-Sanderson's early report on the physiology of the Venus flytrap in 1882. A century later, Dieter Hodick and Andreas Sievers at the University of Bonn in Germany proposed that the flytrap stored information regarding how many hairs have been touched in the electric charge of its leaf. Their model is quite elegant in its simplicity. In their studies, they discovered that touching a trigger hair on the Venus flytrap causes an electric action potential [a temporary reversal in the electrical polarity of a cell membrane] that induces calcium channels to open in the trap (this coupling of action potentials and the opening of calcium channels is similar to the processes that occur during communication between human neurons), thus causing a rapid increase in the concentration of calcium ions.

They proposed that the trap requires a relatively high concentration of calcium in order to close and that a single action potential from just one trigger hair being touched does not reach this level. Therefore, a second hair needs to be stimulated to push the calcium concentration over this threshold and spring the trap. The encoding of the information requires maintaining a high enough level of calcium so that a second increase (triggered by touching the second hair) pushes the total concentration of calcium over the threshold. As the calcium ion concentrations dissipate over time, if the second touch and potential don't happen quickly, the final concentration after the second trigger won't be high enough to close the trap, and the memory is lost.

Subsequent research supports this model. Alexander Volkov and his colleagues at Oakwood University in Alabama first demonstrated that it is indeed electricity that causes the Venus flytrap to close. To test the model they rigged up very fine electrodes and applied an electrical current to the open lobes of the trap. This made the trap close without any direct touch to its trigger hairs (while they didn't measure calcium levels, the current likely led to increases). When they modified this experiment by altering the amount of electrical current, Volkov could determine the exact electrical charge needed for the trap to close. As long as fourteen microcoulombs—a tiny bit more than the static electricity generated by rubbing two balloons together—flowed between the two electrodes, the trap closed. This could come as one large burst or as a series of smaller charges within twenty seconds. If it took longer than twenty seconds to accumulate the total charge, the trap would remain open.

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CONTINUE

42

The primary purpose of the passage is to

A) discuss findings that offer a scientific explanation for the Venus flytrap's closing action.

B) present research that suggests that the Venus flytrap's predatory behavior is both complex and unique among plants.

C) identify the process by which the Venus flytrap's closing action has evolved.

D) provide a brief overview of the Venus flytrap and its predatory behavior.

43

Based on the passage, a significant advantage of the Venus flytrap's requirement for multiple triggers is that it

A) enables the plant to identify the species of its prey.

B) conserves the plant's calcium reserves.

C) safeguards the plant's energy supply.

D) prevents the plant from closing before capturing its prey.

44

Which choice provides the best evidence for the answer to the previous question?

A) Lines 3-7 ("Closing . . . time")

B) Lines 7-11 ("The large . . . across the trap")

C) Lines 11-14 ("If the . . . action")

D) Lines 16-18 ("First . . . hairs")

45

The use of the phrases "dawdling insect" (line 6), "happily meanders" (line 27), and "unassuming bug's encounter" (lines 28-29) in the first two paragraphs establishes a tone that is

A) academic.

B) melodramatic.

C) informal.

D) mocking.

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CONTINUE

46

In the second paragraph (lines 15-31), the discussion of short-term memory primarily functions to

A) clarify an explanation of what prompts the Venus flytrap to close.

B) advance a controversial hypothesis about the function of electric charges found in the leaf of the Venus flytrap.

C) stress the distinction between the strategies of the Venus flytrap and the strategies of human beings.

D) emphasize the Venus flytrap's capacity for retaining detailed information about its prey.

47

According to the passage, which statement best explains why the Venus flytrap requires a second trigger hair to be touched within a short amount of time in order for its trap to close?

A) The second trigger produces an electrical charge that reverses the charge produced by the first trigger.

B) The second trigger stabilizes the surge of calcium ions created by the first trigger.

C) The second trigger prompts the calcium channels to open.

D) The second trigger provides a necessary supplement to the calcium concentration released by the first trigger.

48

Which choice describes a scenario in which Hodick and Sievers's model predicts that a Venus flytrap will NOT close around an insect?

A) A large insect's second contact with the plant's trigger hairs results in a total calcium ion concentration above the trap's threshold.

B) A large insect makes contact with a second trigger hair after a period of inactivity during which calcium ion concentrations have diminished appreciably.

C) A large insect's contact with the plant's trigger hairs causes calcium channels to open in the trap.

D) A large insect's contact with a second trigger hair occurs within ten seconds of its contact with the first trigger hair.

49

As used in line 67, "demonstrated" most nearly means

A) protested.

B) established.

C) performed.

D) argued.

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CONTINUE

50

Based on the passage, what potential criticism might be made of Volkov's testing of Hodick and Sievers's model?

A) Volkov's understanding of Hodick and Sievers's model was incorrect.

B) Volkov's measurements did not corroborate a central element of Hodick and Sievers's model.

C) Volkov's direct application of an electrical current would have been objectionable to Hodick and Sievers.

D) Volkov's technology was not available to Hodick and Sievers.

51

Which choice provides the best evidence for the answer to the previous question?

A) Lines 66-69 ("Alexander . . . close")

B) Lines 69-71 ("To test . . . trap")

C) Lines 71-74 ("This . . . increases")

D) Lines 74-77 ("When . . . close")

52

Based on the passage, in studying the Venus flytrap, Volkov and his colleagues made the most extensive use of which type of evidence?

A) Mathematical models to predict the electrical charge required to close the Venus flytrap

B) Analysis of data collected from previous researchers' work involving the Venus flytrap's response to electricity

C) Information obtained from monitoring the Venus flytrap's response to varying amounts of electrical current

D) Published theories of scientists who developed earlier models of the Venus flytrap

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