Chapter 31
Practice Exam 4

*Make sure to download a bubble sheet for this test via your online Student Tools.

ENGLISH TEST

45 Minutes—75 Questions

DIRECTIONS: In the five passages that follow, certain words and phrases are underlined and numbered. In the right-hand column, you will find alternatives for each underlined part. In most cases, you are to choose the one that correctly expresses the idea, makes the statement appropriate for standard written English, or is worded most consistently with the style and tone of the passage as a whole. If you think the original version is correct, choose "NO CHANGE." In some cases, you will find in the right-hand column a question about the underlined part of the passage. You are to choose the correct answer to the question.

You will also find questions about a section of the passage or the passage as a whole. These questions do not refer to an underlined portion of the passage, but rather are identified by a number or numbers in a box.

For each question, choose the alternative you consider correct and blacken the corresponding oval on your answer document. Read each passage through once before you begin to answer the questions that accompany it. For many of the questions, you must read several sentences beyond the question to determine the answer. Be sure that you have read far enough ahead each time you choose an alternative.

PASSAGE I

Lou Gehrig, All-American

Since their inception in 1913, the New York Yankees have long been regarded as a force in Major League Baseball. Love them or hate them, there is no denying the tradition of excellence that they have leveraged in order[1] to win 26 World Series championships, a league record.

The Yankees have had many great baseball players[2] contribute to the team, but one man stands out for his fortitude and good spirit: Lou Gehrig. Born to poor German immigrants in 1903, Gehrig received no encouragement to pursue baseball as a career. His mother considered business[3] a better line of work for her son, wanting him to excel academically, not physically. Gehrig followed her wishes, at least at first. He attended Columbia University, but after only two years, and without a degree, Gehrig left school.

1. Which of the following alternatives to the underlined portion would NOT be acceptable?

- **A.** so as
- **B.** as a means
- **C.** so that
- **D.** DELETE the underlined portion.

2.
- **F.** NO CHANGE
- **G.** players;
- **H.** players,
- **J.** players and

3.
- **A.** NO CHANGE
- **B.** His mother, considering business
- **C.** Business was considered by his mother to be
- **D.** Business considered his mother

GO ON TO THE NEXT PAGE.

However, he did have a job lined up before he withdrew from college. A Yankee scout had seen an intercollegiate game Gehrig played in[4]—coincidentally, on the very day Yankee Stadium first opened to the public in 1923—and immediately signed him to a contract. He played well in his first three years in the majors, but he did not become a true superstar until 1926. He broke many, long-standing records,[5] including those for runs batted in and extra-base hits, and even played in 2,130 consecutive games! His formidable skills and unflinching dedication to the sport interested[6] his teammates and the fans alike.

[1] The prognosis was a veritable death sentence. [2] Then suddenly, Gehrig's[7] amazing stamina and talent seemed to dissipate, leading one sports reporter to speculate[8] that something was physically wrong with the athlete. [3] Unfortunately, that reporter was right: Gehrig was diagnosed with amyotrophic lateral sclerosis, a degenerative disease that leads to paralysis of both voluntary muscles and involuntary muscles, like those needed to control breathing and swallowing. [9]

Most people faced with such daunting news would of withdrawn[10] from society and mourned their fates.

4. Which of the following alternatives to the underlined portion would be LEAST acceptable?

F. that featured Gehrig
G. that Gehrig played in
H. in which Gehrig played
J. and played Gehrig

5. **A.** NO CHANGE
B. many long-standing records,
C. many, long-standing, records
D. many long-standing records

6. Given that all the choices are true, which one most clearly communicates how positively Gehrig was viewed as a player?

F. NO CHANGE
G. impressed
H. offended
J. confused

7. **A.** NO CHANGE
B. suddenly Gehrig's
C. suddenly Gehrigs
D. suddenly, Gehrigs

8. Which of the following alternatives to the underlined portion would be LEAST acceptable?

F. writer to infer
G. sports reporter to infer
H. writer to speculate
J. sports reporter to imply

9. Which of the following sequences of sentences makes this paragraph most logical?

A. NO CHANGE
B. 1, 3, 2
C. 2, 1, 3
D. 2, 3, 1

10. **F.** NO CHANGE
G. of withdrew
H. have withdrawn
J. have withdrew

GO ON TO THE NEXT PAGE.

[11] However, on the day of Gehrig's retirement[12] from baseball, he delivered one of the most famous speeches of the time. He acknowledged his grim fate but paid tribute to the life-affirming support he'd received from his fans: "The ballplayer who loses his head, who can't keep his cool, is worse than no ballplayer at all."[13] He spoke highly of the encouragement his fans always provided and proudly proclaimed that, despite his fate, he didn't regret anything in his life or career. He was a man who's[14] eternal optimism and good spirit lived on as a legacy of hope and kindness for fans everywhere. We would all do well to learn that lesson.

11. At this point, the writer is thinking about adding the following true statement:

> I know when I had to put my dog to sleep when he got cancer, all I could do was cry in my room for days.

Should the writer make this addition here?

- **A.** Yes, because it provides a personal example comparable to the experience Lou Gehrig faced.
- **B.** Yes, because it helps clarify the concept of mourning mentioned in the previous sentence.
- **C.** No, because it detracts from the overall flow of the paragraph by adding irrelevant information.
- **D.** No, because Gehrig did not have cancer.

12.
- **F.** NO CHANGE
- **G.** Gehrig's retirement,
- **H.** Gehrigs retirement
- **J.** Gehrigs' retirement

13. Given that all the choices are quotations attributed to Gehrig, which one would most effectively support the preceding statement in this sentence?

- **A.** NO CHANGE
- **B.** "They're wishing me luck—and I'm dying."
- **C.** "I don't know if we're going to be successful or not, but we're going to give her a go."
- **D.** "Yet today I consider myself the luckiest man on the face of the earth."

14.
- **F.** NO CHANGE
- **G.** man whose
- **H.** man, who's
- **J.** man who

Question 15 asks about the preceding passage as a whole.

15. After reviewing this essay, the writer is thinking about deleting its opening phrase—"Since their inception in 1913,"—and revising the capitalization accordingly. Should this phrase be kept or deleted?

- **A.** Kept, because it explains why the New York Yankees have been so successful.
- **B.** Kept, because it establishes when in Yankees' history Gehrig lived and played.
- **C.** Deleted, because it provides information that is presented effectively later in the passage.
- **D.** Deleted, because it does not provide the years in which the Yankees won the World Series.

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PASSAGE II

A Quarter for Your Thoughts

Ever since I was a little girl, I could always count on my grandmother to initiate a wonderful field trip. We lived in Virginia and so had immediate access to hundreds of famous places. Nonetheless, she[16] took me to Civil War battlefields, historic homes, national monuments, anywhere that had a story to tell. Old lighthouses can be dangerous, with rickety stairs and rotting floorboards.[17]

My love of history has only grown over the years.[18] History was always so real for me, not the dull, dusty stuff other people seemed to think it was. My trips'[19] with my grandmother made me feel as if I were shivering with George Washington at Valley Forge, where the Revolutionary Army endured a brutal winter, or hearing the words to the Gettysburg Address from Abraham

16. **F.** NO CHANGE
G. She
H. However, she
J. On the contrary, she

17. Given that all the choices are true, which one best identifies a personal connection the narrator feels to the locations she visits?

A. NO CHANGE
B. National monuments are especially fun to visit, but the lines can be quite long.
C. Civil War battlefields feel so alive when you walk through them; you almost expect to see a soldier around every corner.
D. The historic homes we visited are so nice they have been featured in decorating magazines.

18. Given that all the choices are true, which one introduces the subject of this paragraph and reinforces the essay's presentation of the relationship between the narrator and her grandmother?

F. NO CHANGE
G. My grandmother never visited Washington, D.C. until she was in her twenties, even though she lived so close.
H. A proper understanding of history requires extensive reading.
J. My grandmother indulged my love of history and deepened my appreciation for all there is to learn from it.

19. **A.** NO CHANGE
B. trip's
C. trips,
D. trips

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Lincoln himself. [20] How could that ever be boring?

20. The writer is considering deleting the phrase "where the Revolutionary Army endured a brutal winter" from the preceding sentence (deleting the comma following the phrase). Should the phrase be kept or deleted?

F. Kept, because it maintains the passage's focus on history.
G. Kept, because it explains the significance of Valley Forge, which might otherwise cause confusion.
H. Deleted, because the narrator has already established her interest in history.
J. Deleted, because the information overstates the severity of the weather during the Revolution.

One day when I was visiting her, my grandmother took out a big, flat box. [21] "This is for you. I thought we could begin a new project," she told me, handing me a pamphlet to read. [22] The U.S. Mint was starting a project, minting brand new quarters for each of the 50 states bearing images significant and unique to each state's history. The box contained a map of the country, and each [23] state had a space where we could insert its quarter.

21. Given that all the choices are true, which one best introduces the subject of this paragraph?

A. NO CHANGE
B. In my opinion, anything that has happened in the last century isn't history; it's current events.
C. My grandmother originally wanted to be a history teacher.
D. Studying history has really encouraged me in my other studies, too.

22. **F.** NO CHANGE
G. told me to hand her a pamphlet to read.
H. read a pamphlet, telling me to hold it.
J. handed me a pamphlet, holding it.

23. **A.** NO CHANGE
B. and when each
C. for which each
D. each

My enthusiasm caused laughter [24] for a "quarter collection" project, my friends didn't understand my eagerness when I eagerly tromped to the bank every couple of months when a new quarter came out. I was so excited when the first three were released [25] Delaware, Pennsylvania, and New Jersey. My grandmother and I would insert each quarter in its proper place and look up the story behind each new image we saw. Amusingly, [26] as time progressed, even my friends liked to look at the growing collection of quarters on my map, asking

24. **F.** NO CHANGE
G. Laughing at my enthusiasm
H. So as to laugh about my enthusiasm
J. Finding humor

25. **A.** NO CHANGE
B. released;
C. released:
D. released,

26. Which of the following alternatives to the underlined portion would NOT be acceptable?

F. saw. I was amused to see that,
G. saw. To my utter amusement,
H. saw; amusingly,
J. saw, amusingly,

GO ON TO THE NEXT PAGE.

questions and appreciating with admiration (27) the pristine collection.

When the final quarter came out last year, my grandmother, my friends, and I had a small party, we wanted to (28) celebrate the complete collection. I think it is safe to say that

the party was a smashing success. (29) Now, my grandmother says we'll have to start planning to visit all 50 states. I wonder (30) where we'll go first!

27. **A.** NO CHANGE
B. admiring
C. lauding the high estimation of
D. adoring and praising

28. **F.** NO CHANGE
G. party, everyone wanted to
H. party to
J. party, let's

29. Given that all the choices are true, which one best makes a connection between the narrator's view of history and that of her friends?

A. NO CHANGE
B. my friends enjoyed themselves at the party.
C. my friends now firmly believe that history can be fun, just like me.
D. my friends are a little less negative about the study of history.

30. Which of the following alternatives to the underlined portion would be LEAST acceptable?

F. am curious
G. am anxious to see
H. am nervous about
J. can't wait to know

PASSAGE III

Aviation Princess

My daughter just turned nine last week. We went to the mall, and I gave her the best gift I could imagine: free rein to pick out anything she wanted and desired to have. (31) I expected her to pick out some clothes, a new video game, maybe even a

doll. However, she (32) insisted the only thing she wanted was a model airplane.

I guess about her request (33) I shouldn't be surprised. My

31. **A.** NO CHANGE
B. wanted, so that she could pick out her desire.
C. wanted.
D. wanted and had come to desire.

32. Which of the following alternatives to the underlined portion would NOT be acceptable?

F. doll; however, she
G. doll, but she
H. doll however she
J. doll. She

33. The best placement for the underlined phrase would be:

A. where it is now.
B. before the word *shouldn't*.
C. after the word *shouldn't*.
D. after the word *surprised* (ending the sentence with a period).

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daughter has grown up in a military household, the pride and joy
34

of her overly doting father. He finds it perfectly appropriate that,
35
from a very early age, she has shared his love of aviation. I'll never forget my utter dismay when he taught her to jump off the

swing set in our backyard, pretending she was a pilot and
36
shouting, "Airborne!" I believe she was four at the time, but even

then she would play pilot more than play house.
37

Yet soon stories and pictures of aircraft weren't enough;
38
she wanted to see the real thing. So my husband started taking her to the annual air show at the local military base

that happens every year. Most other children her age admired
39
how fast the planes flew or how nicely they were painted, but not

my daughter. [40] She would ask, "Daddy, when are they going to upgrade the avionics system in that F-22 Raptor?" or "Do you think unmanned drones will ever be as useful as manned aircraft?" I once overhead her correcting an older gentleman

whom was mistaken about the planned retirement date of the
41

34. **F.** NO CHANGE
G. has been growing
H. would have grown
J. had grown

35. Which of the following alternatives to the underlined portion would NOT be acceptable?

A. believes it appropriately
B. believes it appropriate
C. considers it entirely appropriate
D. deems it perfectly appropriate

36. **F.** NO CHANGE
G. backyard pretending,
H. backyard; pretending
J. backyard. Pretending

37. Which of the following alternatives to the underlined portion would NOT be acceptable?

A. house.
B. she would play house.
C. house was.
D. she played house.

38. **F.** NO CHANGE
G. Therefore,
H. Although
J. Instead,

39. **A.** NO CHANGE
B. that takes place each year.
C. which occurs every twelve months.
D. DELETE the underlined portion and end the sentence with a period.

40. The writer is considering deleting the phrase *other children her age* from the preceding sentence. Should this phrase be kept or deleted?

F. Kept, because it clarifies the types of questions children should be asking at air shows.
G. Kept, because it emphasizes how different the narrator's daughter is from other children her age.
H. Deleted, because it introduces information about aircraft but does not provide enough specific details.
J. Deleted, because it interrupts the flow of passage.

41. **A.** NO CHANGE
B. who
C. which
D. DELETE the underlined portion.

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F-15 Eagle. I would have been embarrassed about her presumption, if she hadn't been absolute and unequivocal right. [42]

42. **F.** NO CHANGE
G. absolute and unequivocally
H. absolutely and unequivocal
J. absolutely and unequivocally

Of course, my husband has big dreams [43] for his little aviatrix. She is going to be a military pilot, graduating at the top of her class from the Naval Academy. Then she's going

43. Which of the following alternatives to the underlined portion would be LEAST acceptable?

A. ambitious aims
B. impossible hopes
C. great aspirations
D. impressive plans

to be the individual to [44] design the next-generation supersonic fighter personally, while lecturing at Harvard about the history of

44. **F.** NO CHANGE
G. to
H. to individually accept a task in order to
J. to take the initiative to

fixed-wing aircraft. Otherwise, how [45] she's going to fit that in between being a surgeon and the president, I'll never know!

45. **A.** NO CHANGE
B. In contrast, how
C. How
D. Despite this, how

PASSAGE IV

Light Bright, Light Bright:
Turn on the Magic of Colored Light

As a child, I used to catch fireflies at dusk when I was young. [46] I

46. **F.** NO CHANGE
G. when I was a youth.
H. before I grew up.
J. DELETE the underlined portion and end the sentence with a period.

remember feeling a strange excitement which, [47] looking into my cupped hands, I would see the light grow brighter then dimmer as the fly flitted from one side to the other, trying to find an escape. What I should have felt, however, was amazement at the biological wonder I saw before me: bioluminescence.

47. **A.** NO CHANGE
B. when,
C. in which,
D. DELETE the underlined portion.

Bioluminescence literally means "living light," and [48] it refers to a strange adaptation found in some organisms. It allows these organisms to create a chemical reaction that generates and emits

48. **F.** NO CHANGE
G. simultaneously,
H. consider that
J. in addition,

GO ON TO THE NEXT PAGE.

light. Even though scientists know that this light is not intended to be a heat source, they're not totally certain what it is intended to do, either. Theorists hypothesize that organisms use their self-manufactured light for camouflaging themselves, illuminate their surroundings, attract mates and prey, repulse predators, and even communicate. [51] How the same adaptation can be designed to both attract and repulse, however, is still a matter of contention.

The number of terrestrial or land-based, organisms that exhibit bioluminescence is rather small, and many, such as fireflies and spiders, are fairly small in stature. In fact, the vast majority are single-cell organisms that cannot be seen with the naked eye. Unlike these smaller organisms, researchers are puzzled as to why most animals and humans did not evolve this unique trait. Apparently the adaptation was not universally necessary, given the bright rays of the sun that bathed the surface year-round.

However, sunlight clearly doesn't stop the development of bioluminescence. In total, ninety percent of all deep-sea marine lifeforms experience some sort of bioluminescence. Fish, sharks, eels, and octopi, to name only a few, have all been seen to bioluminesce in the murky depths. The most commonly emitted colors are blue and green, but red and yellow have also been observed. Its a veritable rainbow of color 1,800 meters

49. **A.** NO CHANGE
B. Scientists
C. In fact, scientists
D. Understand that scientists

50. **F.** NO CHANGE
G. in camouflaging theirselves,
H. to camouflage itself,
J. to camouflage themselves,

51. The writer is considering deleting the phrase "repulse predators" from the preceding sentence (deleting the comma after the phrase). Should the phrase be kept or deleted?

A. Kept, because it is an essential detail referred to directly in the next sentence.
B. Kept, because the evolutionary trait of repulsing predators is critical to survival of the fittest.
C. Deleted, because it repeats information previously provided in the essay.
D. Deleted, because it makes the sentence long and difficult to understand.

52. **F.** NO CHANGE
G. terrestrial or, land-based
H. terrestrial, or land-based,
J. terrestrial, or land-based

53. **A.** NO CHANGE
B. most animals
C. animal researchers seek to discover why most animals
D. researchers do not know why most animals

54. Given that all the choices are true, which one best indicates the focus of this paragraph?

F. NO CHANGE
G. conditions are quite different in the ocean.
H. there is no evidence that bioluminescence has ever developed anywhere other than on planet Earth.
J. humans do not need bioluminescence, because we can use our intellect to manipulate our surroundings.

55. **A.** NO CHANGE
B. green but
C. green; but
D. green but,

56. **F.** NO CHANGE
G. In it's
H. Its'
J. It's

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below the surface thanks to these organism's lights, even though almost no visible light can penetrate to that level.

The extreme depth at which most of these organisms exist represents the biggest obstacle researchers face in determining the primary function of bioluminescence. Undoubtedly, this will slow the pace of exploration more then lack of money. For that reason, it may be some time before this mysterious

adaptation is clarified.

57. **A.** NO CHANGE
B. organism's lights',
C. organisms' lights,
D. organisms lights,

58. **F.** NO CHANGE
G. then lack of money will.
H. than lack of money.
J. as lack of money.

59. Which of the following alternatives to the underlined word would be LEAST acceptable?

A. fully explained.
B. accounted for.
C. transmitted.
D. cleared up.

Question 60 asks about the preceding passage as a whole.

60. Suppose the writer's goal had been to write a brief essay focusing on a fascinating evolutionary adaptation that can be found in multiple habitats. Would this essay accomplish this goal?

F. Yes, because fireflies exhibit the adaptation and live in trees.
G. Yes, because bioluminescence is described, and it occurs in both marine and non-marine habitats.
H. No, because fireflies cannot live in both air and water.
J. No, because all the habitats described exist on the same planet.

PASSAGE V

Doctors Without Borders

In America, we take many things for granted. If we don't feel well, we see a doctor. If we're hungry, we eat something. If we're thirsty, we drink some water. These very basic actions can be amazingly difficult, if not impossible, in some parts of the

world. That is why a group of French physicians, started Doctors Without Borders in 1971.

61. **A.** NO CHANGE
B. (Do NOT begin new paragraph) Yet these
C. (Begin new paragraph) These
D. (Begin new paragraph) Yet these

62. **F.** NO CHANGE
G. physicians started,
H. physicians; started
J. physicians started

GO ON TO THE NEXT PAGE.

Doctors Without Borders started as a humanitarian aid organization designed to reach out to the innocent victims of wars in lesser-developed parts of the world. The doctors who first started the organization had been working in Nigeria during the country's very bloody civil war in the late 1960s. There, they saw everything from starvation, and disease, to death and outright murder happening in the streets, and neither the United Nations nor the Red Cross seemed to do anything to stop these atrocities.

[66] The doctors felt that, although they couldn't put an end to the fighting itself, they could at least help to alleviate the suffering, thus they declared themselves neutral in the conflict and entered war-torn areas to provide aid to anyone who needed it, regardless of which side of the conflict the person was on.

In contrast, the original mission was simply to provide health care as well as medical training to up-and-coming doctors

63. Which choice most effectively introduces the basic goal of Doctors Without Borders, as described elsewhere in the essay?

- **A.** NO CHANGE
- **B.** tends to specialize in trauma treatment, which helps the doctors in their personal medical practices when they return home.
- **C.** has never sought political support from the United States or other countries, because it wants to remain completely neutral.
- **D.** has never operated within the United States, although arguably there are many people here who could benefit from its services.

64. **F.** NO CHANGE
G. starvation, and disease
H. starvation and disease
J. starvation and disease,

65. Which of the following alternatives to the underlined portion would be LEAST acceptable?

- **A.** horrors.
- **B.** offenses.
- **C.** wrongs.
- **D.** alarms.

66. The writer is considering deleting the preceding sentence. Should this sentence be kept or deleted?

- **F.** Kept, because readers are used to hearing about murders and starvation anyway.
- **G.** Kept, because it provides a specific example of the type of actions that provoked the doctors to take action.
- **H.** Deleted, because it does not explain how the doctors actually stopped the fighting in Nigeria.
- **J.** Deleted, because it detracts from the actual foundation of Doctors Without Borders.

67. **A.** NO CHANGE
B. suffering thus
C. suffering. Thus
D. suffering and thus

68. **F.** NO CHANGE
G. The
H. Meanwhile, the
J. Finally, the

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in the various regions. [69] In desperate need of medical attention suffering in war-torn regions certainly felt the aid (70) Doctors Without Borders supplied was important. When not in the direct line of fire between (71) two opposing military groups, however, the organization puts special emphasis on the preventative aspects of health care, especially vaccinations, good nutrition, and sanitation. These seeming (72) simple goals have made substantial strides in the overall quality of health in Africa, where most of the work of Doctors Without Borders has been focused over the last 50 years.

Sadly, the noble effort expended by these selfless doctors have (73) not met universal support. In some conflicts, the aid workers—despite their political neutrality—have found themselves the victims of kidnappings, arrests, even murder. Doctors who volunteer to serve (74) in Doctors Without Borders know the dangers they face, yet they choose to try to help anyway. We can only hope (75) that eventually their dignified actions will become unnecessary.

69. The writer is considering deleting the phrase "to up-and-coming doctors" from the preceding sentence. Should the phrase be kept or deleted?

- **A.** Kept, because it clarifies to whom the medical training is being provided.
- **B.** Kept, because it is important to specify that there are doctors already practicing in the region.
- **C.** Deleted, because a person who has not successfully graduated from medical school cannot be considered a doctor.
- **D.** Deleted, because Doctors Without Borders should not take such a grandiose task on themselves without government sanction.

70.
- **F.** NO CHANGE
- **G.** attention who
- **H.** attention, and
- **J.** attention, individuals

71.
- **A.** NO CHANGE
- **B.** among
- **C.** across
- **D.** next

72.
- **F.** NO CHANGE
- **G.** more seemingly
- **H.** seemingly
- **J.** more seeming

73.
- **A.** NO CHANGE
- **B.** efforts expended by these selfless doctors have
- **C.** efforts expended by these selfless doctors has
- **D.** effort expended by these selfless doctors had

74.
- **F.** NO CHANGE
- **G.** distribute
- **H.** provide
- **J.** deliver

75. Given that all the choices are true, which one most clearly shows that the self-sacrifice of the doctors deserves praise?

- **A.** NO CHANGE
- **B.** I don't know if I would have that depth of conviction or level of courage.
- **C.** Such unsung courage truly speaks to the depth of human kindness, and should be a lesson to us all.
- **D.** It is truly a shame that they are put into dangerous positions.

END OF TEST 1

STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.

MATHEMATICS TEST

60 Minutes—60 Questions

DIRECTIONS: Solve each problem, choose the correct answer, and then darken the corresponding oval on your answer sheet.

Do not linger over problems that take too much time. Solve as many as you can; then return to the others in the time you have left for this test.

You are permitted to use a calculator on this test. You may use your calculator for any problems you choose, but some of the problems may best be done without using a calculator.

Note: Unless otherwise stated, all of the following should be assumed:

1. Illustrative figures are NOT necessarily drawn to scale.
2. Geometric figures lie in a plane.
3. The word *line* indicates a straight line.
4. The word *average* indicates arithmetic mean.

DO YOUR FIGURING HERE.

1. In a geometric sequence, the quotient of any two consecutive terms is the same. If the third term of a geometric sequence is 8 and the fourth term is 16, then what is the second term?

A. –8
B. –4
C. 2
D. 4
E. 8

2. If the function $f(a, b)$ is defined as $f(a, b) = 2ab - (a + b)$, then $f(3, 4) = ?$

F. 7
G. 17
H. 21
J. 24
K. 31

3. The Korean BBQ taco truck sells short rib tacos for 99¢. Christine has only pennies, nickels, dimes, and quarters in her purse. If she wants to pay with exact change, then what is the least number of coins Christine can use to buy a 99¢ taco?

(Note: Assume any sales tax is included in the price.)

A. 6
B. 7
C. 8
D. 9
E. 10

4. What is the area, in square inches, of a square with a side length of 8 inches?

F. 8
G. 16
H. 24
J. 32
K. 64

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

5. If $x = 3$, then the expression $\frac{(x+1)^2}{x^2-1}$ is equal to:

A. 2
B. $\frac{1}{2}$
C. 0
D. $-\frac{1}{2}$
E. -8

6. Which of the following is NOT a factor of 1,776 ?

F. 12
G. 16
H. 18
J. 24
K. 37

7. Lauren's world history teacher needs to select one of his 19 students to lead the class in song. Lauren's teacher decides that the song leader, who will be chosen at random, CANNOT be any of the 4 seniors in the class. What is the probability that Lauren, who is NOT a senior, will be chosen?

A. 0
B. $\frac{1}{19}$
C. $\frac{1}{15}$
D. $\frac{4}{19}$
E. $\frac{15}{19}$

8. If $4(x-5)+x=45$, then x = ?

F. 5
G. 8
H. 9
J. 10
K. 13

9. Joe rents a car to drive across the state to visit his family for Thanksgiving. The car rental company charges Joe $112 for the weekend rental, plus $0.99 for each mile he drives. If Joe drives the rental car m miles, then which of the following expressions gives Joe's total cost, in dollars, for renting the car?

A. $0.99m-112$
B. $0.99m+112$
C. $49.95m$
D. $112m+0.99$
E. $112.99m$

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

10. Stella wants to buy a scooter for $4,800. A loan company offers to finance the purchase in return for payments of $130 a month for 4 years. If Stella were to finance the scooter, then how much more than the purchase price of the scooter will Stella have paid at the end of the 4-year period?

F. $ 520
G. $ 780
H. $1,040
J. $1,300
K. $1,440

11. The expression $\frac{20y^8}{4y^2}$ is equivalent to:

A. $5y^4$
B. $5y^6$
C. $5y^8$
D. $16y^4$
E. $16y^6$

12. Which of the following is equal to $\frac{3-\frac{1}{2}}{2+\frac{3}{4}}$?

F. $\frac{10}{11}$
G. 2
H. 12
J. 20
K. $\frac{55}{2}$

13. Point C is at 3.5 on the real number line. If Point D is also on the real number line and is 8.5 units from C, then which of the following are the possible locations of D ?

A. –12 and –5
B. –12 and 5
C. –5 and 5
D. 12 and –5
E. 12 and 5

14. The mean of 4 numbers in a data set is 7. If 3 of these numbers are 2, 4, and 10, then which of the following is the fourth number?

F. 4
G. 7
H. 8
J. 10
K. 12

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

15. Motorcars, Inc. made $1,489,000 in net profit in 2007. In 2009, Motorcars, Inc. made $1,725,000 in net profit. If the net profit increased linearly from 2007 through 2009, then what was the net profit earned in 2008 ?

A. $1,607,000
B. $1,698,000
C. $1,724,000
D. $1,779,000
E. $1,842,000

16. The art teacher at Valley High School is decorating her classroom by reproducing famous pictures on her walls. She has a picture 8 inches wide and 10 inches tall that she wants to replicate to scale on the wall. If the painting on the wall will be 6 feet tall, then approximately how wide will the painting be, in feet?

F. 5
G. 7
H. 9
J. 11
K. 13

17. The formula for line l in standard form is $5x - y = 2$. Which of the following gives the formula for line l in slope-intercept form?

A. $y = 5x + 2$
B. $y = 5x - 2$
C. $y = 2x - 5$
D. $y = -5x - 2$
E. $y = -5x + 2$

18. The expression $|2 - 14| - |-25|$ is equal to:

F. 41
G. 37
H. 13
J. –13
K. –37

19. In ΔJKL the measure of $\angle J$ is exactly 37°, and the measure of $\angle K$ is less than or equal to 63°. Which of the following phrases best describes the measure of $\angle L$?

A. Exactly 120°
B. Exactly 100°
C. Exactly 80°
D. Greater than or equal to 80°
E. Less than or equal to 80°

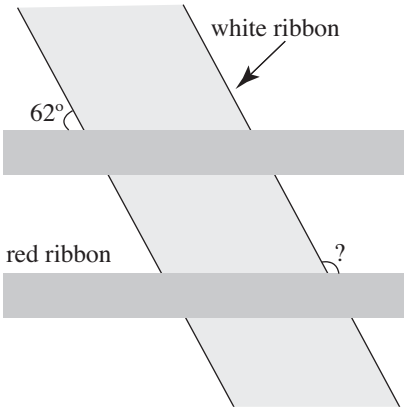
GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

20. If $3x - 1 > 26$, then which of the following is the smallest possible integer value of x ?

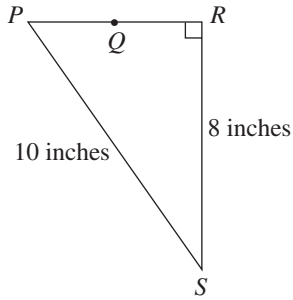
F. 6
G. 7
H. 8
J. 9
K. 10

21. Paul is tying red and white ribbons around a gift box. He begins by tying the white ribbon and one red ribbon around the box. These two ribbons intersect on one face of the box at a 62° angle, as shown in the figure below. Now Paul wants to tie a second red ribbon onto the box so that the two red ribbons are parallel. What is the degree measure of the angle, indicated below, between the white ribbon and the bottom red ribbon?



A. 62°
B. 76°
C. 90°
D. 104°
E. 118°

22. In right triangle PRS shown below, Q is the midpoint of $\overline{PR}$. What is the length of $\overline{QR}$, to the nearest inch?



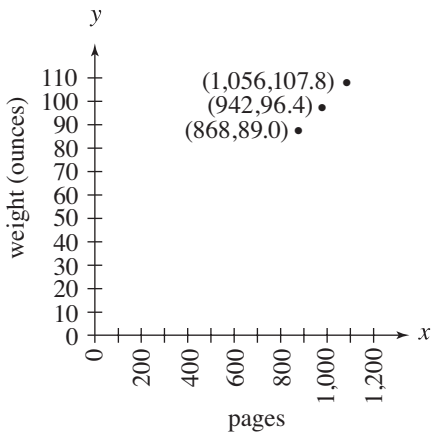
F. 2
G. 3
H. 4
J. 6
K. 36

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

Use the following information to answer questions 23–24.

Katie notices that the textbooks for her past 3 math courses have the same length and width, but each year's textbook has more pages and weighs more than the previous year's textbook. Katie weighs the textbooks, to the nearest 0.1 ounce, for her past 3 math courses and wonders about the relationship between the number of pages in math textbooks and the weights of those textbooks. She graphs the number of pages and corresponding weights of her 3 math textbooks in the standard (x,y) coordinate plane, as shown below, and discovers a linear relationship among these 3 points. She concludes that the equation of the line that passes through these 3 points is $y = 0.1x + 2.2$.



23. How much more, in ounces, does a math textbook with 1,056 pages weigh than one with 868 pages?

A. 18.8
B. 19.8
C. 54.1
D. 77.3
E. 107.8

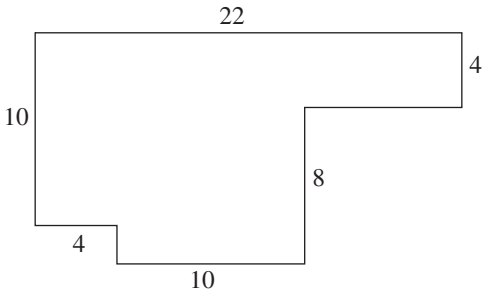
24. According to Katie's equation, how much would a math textbook with 1,338 pages weigh, in pounds?

(Note: 16 ounces = 1 pound)

F. 7.4
G. 8.5
H. 10.2
J. 13.6
K. 14.1

GO ON TO THE NEXT PAGE.

25. All line segments that intersect in the polygon below do so at right angles. If the dimensions given are in centimeters, then what is the area of the polygon, in square centimeters?



A. 168
B. 176
C. 184
D. 192
E. 200

DO YOUR FIGURING HERE.

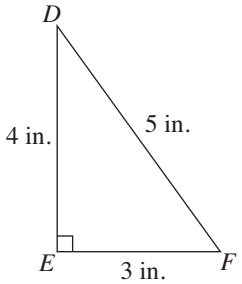
26. Mr. Baylor spent 6 days grading 996 essays. He averaged 178 essays per day for the first 3 days. Which of the following is closest to his average speed, in essays graded per day, for the final 3 days?

F. 154
G. 157
H. 160
J. 163
K. 166

27. For all values of y, which of the following is equivalent to $(y+1)(y^2-3y+2)$?

A. y^3+y^2-y-2
B. y^3+y^2+2y+2
C. y^3-2y^2-y+2
D. y^3-2y^2+y-2
E. y^3+2y+2

28. For $\angle D$ in ΔDEF below, which of the following trigonometric expressions has value $\frac{4}{5}$?



F. sin D
G. tan D
H. cos D
J. sec D
K. csc D

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

29. Over the weekend, Shawn bought 22 songs from an online music store. He spent a total of $17.90 on contemporary and classical songs. If contemporary songs cost $0.95 each and classical songs cost $0.75 each, then how many contemporary songs did Shawn buy?

(Note: There is no sales tax charged on these songs because they were purchased online.)

A. 7
B. 9
C. 10
D. 13
E. 15

30. If the operation # is defined as $x \# y = \frac{x^2 - y^2}{x + y}$, where x and y are real numbers such that $x \neq -y$, then what is the value of $(-3)\#(-7)$?

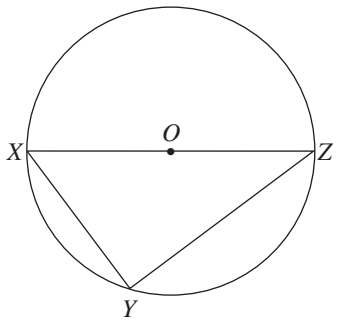
F. 10
G. 4
H. 1
J. –4
K. –10

31. Esther is making $2\frac{1}{4}$ gallons of punch for a large party. While mixing the punch, she uses $\frac{1}{2}$ gallon of pineapple juice. What fraction of the punch consists of pineapple juice?

A. $\frac{1}{9}$
B. $\frac{1}{6}$
C. $\frac{2}{9}$
D. $\frac{1}{3}$
E. $\frac{2}{3}$

32. Point O is the center of the circle shown below, and $\overline{XZ}$ is the diameter of the circle. If XZ = 8 ft, Y lies on the circle, and $\overline{OX} \cong \overline{XY}$, then what is the area, in square feet, of ΔXYZ?

F. $4\sqrt{2}$
G. $8\sqrt{3}$
H. 16
J. 32
K. 64



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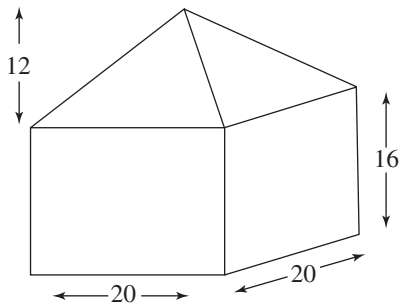
DO YOUR FIGURING HERE.

33. Which of the following values provides one of the roots for the equation $y^2 - 4y - 5 = 7$?

A. –12
B. –6
C. –2
D. –1
E. 5

34. The plastic model house shown below consists of a right pyramid atop a right rectangular prism. The length and width of the prism and of the pyramid are 20 millimeters. The height of the prism is 16 millimeters, and the height of the pyramid is 12 millimeters. Which of the following is closest to the volume of the plastic model house, in cubic millimeters?

(Note: The volume of a right pyramid is given by $\frac{1}{3}lwh$, where l is the length, w is the width, and h is the height. The volume of a right rectangular prism is given by lwh, where l is the length, w is the width, and h is the height.)



F. 6,900
G. 8,000
H. 9,100
J. 12,300
K. 25,600

35. An isosceles trapezoid has bases of length 5 inches and 11 inches. The area of the trapezoid is 40 square inches. What is the height of the trapezoid, in inches?

A. 4
B. 5
C. 7.5
D. 17.5
E. 35

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

36. What is the slope of the line that passes through the points (–2,6) and (3,–9) in the standard (*x*,*y*) coordinate plane?

F. $\frac{1}{15}$

G. $-\frac{1}{3}$

H. $-\frac{3}{5}$

J. –3

K. –5

37. Right triangle *WXY* is isosceles and has its right angle at Point *X*. Point *Z* is collinear with points *X* and *Y*, with *Y* between *X* and *Z*. What is the measure of $\angle WYZ$?

A. 45°
B. 90°
C. 120°
D. 135°
E. 145°

38. The decimal construction of $\frac{5}{13}$ repeats and can be written as 0.384615384615…. What is the 99th digit to the right of the decimal point in this decimal construction?

F. 1
G. 3
H. 4
J. 5
K. 6

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

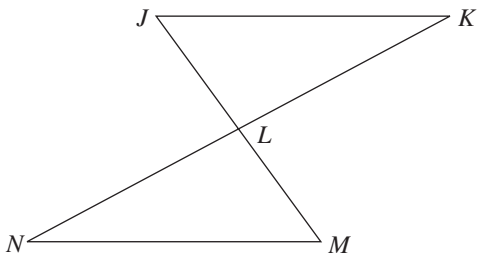
39. In unit vector notation, $\mathbf{u} = a\mathbf{i} + 5\mathbf{j}$, $\mathbf{v} = 2\mathbf{i} + b\mathbf{j}$, and $\mathbf{u} + \mathbf{v} = 4\mathbf{i} - 3\mathbf{j}$. What is the ordered pair (a,b) ?

A. $(-2, -5)$
B. $(2, -8)$
C. $(2, 5)$
D. $(4, -8)$
E. $(5, 2)$

40. Which of the following equations represents the vertical asymptote of the function $y = \frac{3x+2}{2x-6}$?

F. $x = 1$
G. $x = \frac{3}{2}$
H. $x = 3$
J. $x = 5$
K. $x = -4$

41. In the figure below, $\overline{JK} \| \overline{MN}$, and $\overline{JM}$ and $\overline{KN}$ intersect at L. Which of the following statements must be true?



A. $\overline{JK} \cong \overline{MN}$
B. $\overline{JL} \cong \overline{LM}$
C. $\Delta JKL \cong \Delta MNL$
D. ΔJKL is similar to ΔMNL
E. $\overline{JM}$ bisects $\overline{KN}$

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

Use the following information to answer questions 42–44.

The Wildcat athletic department at Wilson High School needs to raise $3,000.00 to fill a gap in its annual budget. The athletic department can choose 1 of the 2 options below to raise the needed funds.

Sell "Wildcat baseball caps" option: After paying a one-time fee of $23.00 to rent the necessary equipment, the athletic department can sell baseball caps featuring the school's logo. The athletic department will buy plain caps and print the school logo on each, at a cost of $3.50 per cap. The athletic department will sell each cap for $5.00.

Sell "Wildcat T-shirts" option: After paying a one-time fee of $19.00 to rent the necessary equipment, the athletic department can sell T-shirts featuring the school's logo. The athletic department will buy plain T-shirts and print the school logo on each, at a cost of $2.25 per T-shirt. The athletic department will sell each T-shirt for $4.00.

42. For the "Wildcat baseball caps" option, at least how many baseball caps must be sold in order to cover the one-time fee of renting the necessary equipment?

F. 14
G. 15
H. 16
J. 17
K. 23

43. The Wildcat athletic department sold 540 tickets to Friday's football game. Of those tickets, 60% were adult tickets and the remainder were student tickets. The revenue from these ticket sales had already been factored into the annual budget. Jordan suggested raising the price of the adult tickets $2.00 to help fill the budget gap. If the athletic department had raised the price of each adult ticket $2.00, then by approximately what percent would the budget gap have been filled?

A. 22%
B. 23%
C. 24%
D. 25%
E. 26%

GO ON TO THE NEXT PAGE.

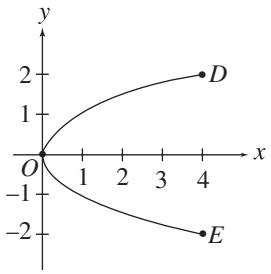
DO YOUR FIGURING HERE.

44. The Wildcat athletic department chose the "Wildcat T-shirt" option and successfully filled the budget gap. What is the minimum number of T-shirts the athletic department must have sold?

F. 1,480
G. 1,664
H. 1,709
J. 1,726
K. 1,812

45. The graph of $y^2 = x$ is shown in the standard (x,y) coordinate plane below for values of x such that $0 \leq x \leq 4$. The x-coordinates of points D and E are both 4. What is the area of ΔDEO, in square coordinate units?

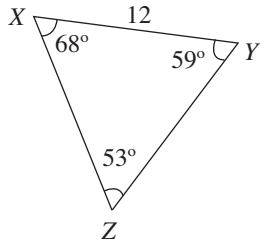
A. $\frac{5}{2}$
B. 4
C. 8
D. 12
E. 16



46. In ΔXYZ below, the length of $\overline{XY}$ is 12 centimeters. How long is $\overline{YZ}$, to the nearest tenth of a centimeter?

(Note: $\sin 53° \approx 0.799$, $\sin 59° \approx 0.857$, $\sin 68° \approx 0.927$)

F. 9.6
G. 10.3
H. 11.1
J. 12.9
K. 13.9



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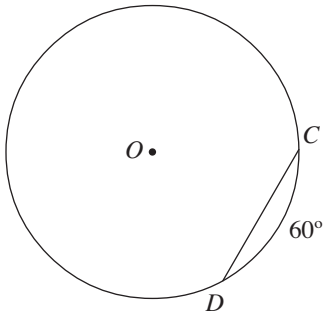
DO YOUR FIGURING HERE.

47. Jacob used the quadratic equation to find that the solutions to an equation are $x = 3 \pm \sqrt{-16c^2}$, where c is a positive real number. Which of the following expressions gives these solutions as complex numbers?

A. $3 \pm 1ci$
B. $3 \pm 2ci$
C. $3 \pm 4ci$
D. $3 \pm 8ci$
E. $3 \pm 16ci$

48. Points C and D are on the circle with center O as shown in the figure below. The length of $\overline{CD}$ is 12 millimeters and the measure of $\overset{\frown}{CD}$ is 60°. What is the length of the diameter of this circle?



F. 12
G. 16
H. 20
J. 24
K. 28

49. A nylon cord is stretched from the top of a vertical playground pole to the ground. The cord is 25 feet long and makes a 19° angle with the ground. Which of the following expressions gives the horizontal distance, in feet, between the pole and the point where the cord touches the ground?

A. $\frac{\sin 19°}{25}$
B. $\frac{\cos 19°}{25}$
C. $25\tan 19°$
D. $25\sin 19°$
E. $25\cos 19°$

50. What are the coordinates of the center of the circle with the equation $x^2 + 8x + y^2 - 2y + 8 = 0$ in the standard (x,y) coordinate plane?

F. (−4, 1)
G. (−1, −4)
H. (1, −4)
J. (4, −1)
K. (4, 1)

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

51. Scott's swimming pool has a depth of 8 feet and holds 13,000 gallons of water when full. Because of the warm weather, 10% of the water in the pool evaporates each day. Scott fills the pool with water and comes back the next day to measure the amount of water remaining in the pool. He considers this "Day 1" because it was taken 1 day after the pool was filled, and he labels his measurement as such. The next day, he measures the amount of water again, and he labels the results "Day 2" because it is now 2 days after he filled the pool. If Scott continues, on which day will he first measure that the pool is less than half full?

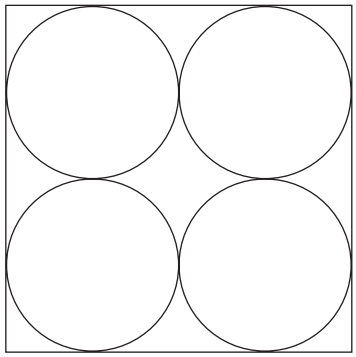
A. 5
B. 6
C. 7
D. 8
E. 9

52. What is the determinant of the matrix below?

$$\begin{bmatrix} 3 & -5 \\ -4 & 9 \end{bmatrix}$$

F. –33
G. –21
H. 7
J. 18
K. 47

53. The figure below shows 4 congruent circles, each tangent to 2 other circles and to 2 sides of the square. If the length of a side of the square is 24 inches, then what is the area, in square inches, of 1 circle?



A. 9
B. 9π
C. 36
D. 36π
E. 144

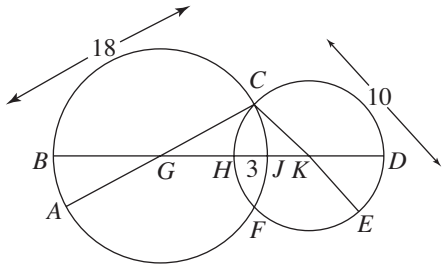
54. Andy has 30 collectible comic books, which he bought in 2005 for $28.95 each. These comic books are currently valued at $34.35 each. Andy will sell these 30 comic books when their combined value is exactly $600.00 more than he paid for them. How much more will the average value per comic book have risen when Andy sells these 30 comic books?

F. $14.60
G. $12.72
H. $10.05
J. $ 7.84
K. $ 5.40

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

55. Circles with centers G and K intersect at points C and F, as shown below. Points B, G, H, J, K, and D are collinear. The lengths of $\overline{AC}$, $\overline{CE}$, and $\overline{HJ}$ are 18 cm, 10 cm, and 3 cm, respectively. What is the length, in centimeters, of $\overline{BD}$?



A. 22
B. 25
C. 26
D. 28
E. 29

56. A parabola with vertex (–3,–2) and axis of symmetry $y = -2$ crosses the y-axis at $\left(0,-2+3\sqrt{3}\right)$. At what other point does the parabola cross the y-axis?

F. No other point
G. $\left(0, 2+3\sqrt{3}\right)$
H. $\left(0, 2-3\sqrt{3}\right)$
J. $\left(0, -2-3\sqrt{3}\right)$
K. Cannot be determined from the given information

57. If $z \neq 4$ and $z \neq -4$, then which of the following is equivalent to the expression $\dfrac{3z}{4-z}+\dfrac{3z}{z^2-16}$?

A. $\dfrac{3z^2+15z}{z^2-16}$
B. $\dfrac{9z^2-12z}{z^2-16}$
C. $\dfrac{-12z}{z^2-16}$
D. $\dfrac{-3z^2}{z^2-16}$
E. $\dfrac{-3z^2-9z}{z^2-16}$

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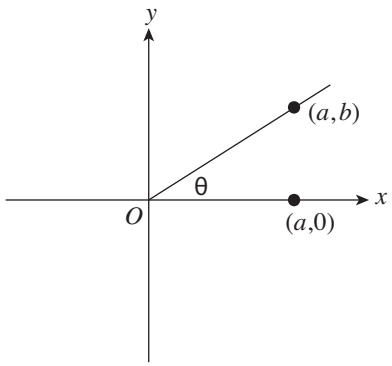
58. The point (a,b) is on the terminal side of an angle with radian measure θ. Which of the following is equal to the tangent of $\pi + \theta$?

DO YOUR FIGURING HERE.



F. $\frac{a}{b}$

G. $\frac{-b}{a}$

H. $\frac{b}{a}$

J. $-b$

K. b

59. The nth term of an arithmetic sequence, a_n, is given by $a_n = a_1 + dn - d$, where a_1 is the 1st term, and d is the common difference between terms. Which of the following expressions gives d in terms of a_n, a_1, and n ?

A. $\frac{a_n - a_1}{n-1}$

B. $\frac{n-1}{a_n - a_1}$

C. $\frac{a_n - a_1}{n}$

D. $\frac{a_n}{a_1 + n}$

E. $a_n - a_1 - n$

GO ON TO THE NEXT PAGE.

60. A deck of 54 cards has 4 suits, each with 13 cards and 2 jokers. Each suit has cards labeled 2 through 10, and an ace, jack, queen, and king. Susan draws five cards without replacement. What is the probability that Susan draws a ten, jack, queen, king, and then ace, all of the same suit and in that order?

F. $\frac{4}{4(54)(53)(52)(51)(50)}$

G. $\frac{1}{(13)(12)(11)(10)(9)}$

H. $\frac{4}{(54)(53)(52)(51)(50)}$

J. $\frac{4^5}{(54)(53)(52)(51)(50)}$

K. $\frac{4(13)(12)(11)(10)(9)}{54^5}$

DO YOUR FIGURING HERE.

END OF TEST 2

STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.

DO NOT RETURN TO A PREVIOUS TEST.

READING TEST

35 Minutes—40 Questions

DIRECTIONS: There are several passages in this test. Each passage is accompanied by several questions. After reading a passage, choose the best answer to each question and fill in the corresponding oval on your answer document. You may refer to the passages as often as necessary.

Passage I

LITERARY NARRATIVE: This passage is adapted from the novel *Oklahoma Sunrise* by Jack Elwyn Prouty (©2007 Jack Elwyn Prouty).

Rebecca stood and gazed out across the fields, into the unending horizon.

A warm breeze caressed the fields, causing the ears of the wheat to bend homeward, looking for all the world like they were listening to a conversation none but they could hear. The ears bent and bobbed as the breeze eddied about them. She stood, inhaling the fresh and savory scent of the almost-ripe wheat, mixed with the rich scent of the earth. Someone had plowed nearby; the newly uncovered earth always smelled more alive. She could hear bees—there was a hive somewhere not far away—and birds and men, all faintly but as much a part of the image in her mind as was the wheat itself. And underneath everything else, that slight tang in the air that said it would rain soon. Not even a tang, really—almost a feeling but somehow a smell, too.

The evening, just as dusk was falling, was always the best time to visit the fields alone. Earlier in the day there were too many people, and too many chores to do to justify standing silently in the middle of the field. Later it was too still, too quiet. It felt as if the field itself had gone to sleep; not an unpleasant feeling, really, but not the feeling of being embraced by a living, breathing entity that she had wanted today. That she liked best of all.

Of course, the earth hadn't always been a friend to the people that cultivated it. Any farmer knows that there will be good years and bad years, and that sometimes one bad year will follow another and then another, to the point where you wonder if a good year will ever come again. Growing up far away from the soil that had held her people for generations, Rebecca had known all of that. Known how the land had turned on her parents and driven them far from the only home they knew, seeking work on a stranger's land, doing unfamiliar work. Still, she had felt the draw. Even as a child, she had known that someday, she would return. It was in her blood, really. Her great-grandparents had claimed the land as their own, poured their blood, sweat, and tears into it, and turned it from a wild tract of prairie into productive fields of wheat and corn. Her grandparents had inherited the fields, and her parents in their turn had as well. They would have gone to Rebecca next, had her parents been able to hold on to what was theirs. Even when they had left, they had claimed the land as their own and had sworn that they'd return to it someday. Both her mother and father had been prevented from returning home, but now Rebecca was here in their place, trying to reclaim her family's heritage.

She stood still, thinking about the past and the present, breathing in the heat and the life that surrounded her. The land might not always be kind, but it is always good. She flinched a little bit as a bee landed on her cheek, inspecting this large thing that didn't seem to be a part of the field. She let it explore her face, knowing it would move on once it had ascertained that she was no flower. The feel of the bee's feet tramping across her nose made her want to sneeze but she held her breath, not wanting to frighten it into stinging her.

When the bee ventured on in pursuit of more profitable discoveries, she opened her eyes and gazed out across her fields. They were hers, in truth if not writing, and would one day be hers in every sense. For a moment, her stomach began to clench as her mind turned unwillingly but naturally to the realities of what lay ahead. The loans, the mortgage payments, the possibility of a bad crop ruining all her plans. Firmly, she pushed those thoughts aside. She had acknowledged them before and would acknowledge them again, when she sat before her ledger or reviewed the accounts. This moment was for enjoying the sheer bounty of life, not for fears and numbers. Without the former, she could never face the latter. It was for the warm reality of the growing, breathing crops that she was determined to deal with the men from the bank, to go without new things, and work until her back ached every day, only to get up and do the same the next morning, before the sun was up.

She breathed deeply, trying to take in the strength and life that surrounded her, trying to store it inside herself. This was her people's land; she knew that in her bones. Whatever else might happen, that would not change.

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1. Which of the following statements best expresses Rebecca's feelings during her visit to the fields, as expressed in lines 1–42 ?

   A. Overjoyed by the idea of ownership
   B. Connected with the land and her heritage
   C. Dismayed by her looming financial problems
   D. Exhausted and frustrated from hard work

2. The word *that* in line 28 most directly refers to:

   F. "someday, she would return " (lines 31–32).
   G. "far away from the soil" (lines 26–27).
   H. "it would move on once it had ascertained that she was no flower" (lines 48–49).
   J. "sometimes one bad year will follow another" (lines 24–25).

3. The main purpose of the information in lines 30–42 is to explain why Rebecca believes that the land is:

   A. her rightful heritage, passed down through her family, whose hard work forms the foundation for her claim.
   B. an entity unto itself, alive and free, and beyond the control of anyone.
   C. not worth the trouble that she and her predecessors have gone to in an attempt to claim it.
   D. beautiful, whether wild or cultivated, and filled with creatures that create a harmonious whole.

4. In the first four paragraphs (lines 1–42), the narrator describes all of the following aspects of Rebecca's surroundings EXCEPT the:

   F. different scents in the evening air.
   G. feel of freshly plowed earth.
   H. reason her family had left the area.
   J. best time of day to visit the fields.

5. The passage can best be described as a fictional depiction of a woman's impression of the land that:

   A. uses rich, suggestive detail to show that the land is a vital and cherished component of her personal life and family heritage.
   B. reveals a painful family history and explains why her ancestors had opted to give up all claims on the land.
   C. offers metaphors and similes to convey a deeper meaning than the one suggested by the events narrated in the story.
   D. explains exactly how one family can lose everything due to circumstances beyond the control of its members.

6. The narrator's statement in lines 62–63 ("Without the former, she could never face the latter") most directly refers back to Rebecca's:

   F. opinion about different times of the day and how that changes the atmosphere (lines 15–21).
   G. concern about the bee described in the fifth paragraph (lines 43–51).
   H. anxiety over financial matters being outweighed by her love of the land (lines 54–61).
   J. enjoyment of the scents described in the second paragraph (lines 3–14).

7. One of the main purposes of the last two paragraphs (lines 52–71) is for the narrator to describe Rebecca's attitude towards the land in a way that:

   A. explains the importance of the stranger's land that is mentioned previously in the passage.
   B. purposefully identifies the mistakes made by Rebecca's parents, referenced earlier in the passage, which Rebecca cannot correct.
   C. deepens the reader's understanding of the challenges and rewards the land presents to Rebecca.
   D. invites the reader to draw a parallel between Rebecca and the land itself and perhaps the reader as well.

8. The point of view from which the passage is told can best be described as that of a narrator who:

   F. is aware of what Rebecca is thinking and feeling.
   G. suspects that Rebecca is not sincere in her plans.
   H. is personally involved in the events being described.
   J. is Rebecca's close relative who didn't move.

9. As it is used in line 34, the word *wild* most nearly means:

   A. unconquerable.
   B. unrestrained.
   C. uncultivated.
   D. irrepressible.

10. When Rebecca realized that "a bee landed on her cheek" (line 46), her first response is to:

    F. brush it away from her face.
    G. feel frightened that it will sting her.
    H. hope that it will fly away.
    J. flinch, then try not to respond.

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Passage II

SOCIAL SCIENCE: This passage is adapted from the article "Illuminating the Dark Ages" by Krista Correa (©2003 Krista Correa).

The period that began with the fall of the Roman Empire in the fifth century and ended with the Renaissance in the fourteenth century has been referred to by many names: the Medieval period, the Middle Ages, and the Dark Ages. The writer Petrarch coined the latter name in the fourteenth century in an attempt to differentiate the culture of Medieval Europe from his own time. The popular conception at that time was that Europe was finally emerging from a cultural wasteland during which much of the ancient learning had been lost; Petrarch, like many other writers and artists of his time, wanted to connect his studies with those of antiquity, rather than those of more recent years. The name stuck, as did the idea that very little of cultural or intellectual importance took place during the years so described.

Recent scholars have begun to challenge that idea, however, asserting that while it is true that certain fields of study did go into decline during the Middle Ages (the term they prefer), other areas flourished. These historians advocate the more neutral term "Middle Ages" because they feel that it more accurately describes the centuries during which Europe began to transition slowly from a Rome-based, empire-dominated system into the modern states that exist today. According to them, using a negative term like "Dark Ages" serves only to underscore misconceptions about the era. This argument represents a sharp break from the past.

Many scholars have used the term "Dark Ages" to identify the lack of information available about the years between the fall of Rome and the Renaissance. Few written records exist from the early years and the documents that do exist don't always shed a great deal of light on the larger picture of what was happening in Europe. Some scholars, such as William Jordan in his new edition of the *Dictionary of the Middle Ages*, have argued that the term "Dark Ages" needn't be negative—it simply refers to the darkness caused by this lack of information.

That view, however, has been largely discredited. Even when used in a seemingly neutral way, "Dark Ages" has an inherently negative connotation in most people's minds. Moreover, other scholars point out that it is no longer accurate. Research continues to uncover information about the era that allows scholars to gain an ever more accurate idea of what life was like during the Middle Ages, while other research has helped historians gain a better understanding of the evidence they already possessed.

Other scholars have preferred the term "Dark Ages" to describe the decline in learning that they believe to have taken place during this era. These scholars assumed that without the advances of Roman society, learning must have virtually halted. Modern historians such as David Lindberg and Ronald Numbers, however, point out that this view is very far from the truth. Evidence abounds that, although some knowledge was indeed lost, much was retained and that intellectual studies continued throughout the Middle Ages. Their books, such as Lindberg's *Science in the Middle Ages* and Numbers's *Galileo Goes to Jail and Other Myths about Science and Religion*, debunk many popular misconceptions about the Middle Ages, such as that people widely believed the Earth was flat (they didn't) and that they largely abandoned the field of mathematics (they didn't).

The goal of scholars such as Lindberg and Numbers is not to idealize the medieval world, or claim that it was filled with light and learning, but rather to balance the overly pessimistic views that are held by so many even today. No one would seriously dispute that, in some areas, learning did go into a decline after the fall of Rome. What modern medievalists, or medieval scholars, would point out is that while some areas diminished, others were able to flourish. For example, three-dimensional, realistic art certainly became less common, and the ability to build a self-sustaining dome was lost for hundreds of years. However, symbolic art developed to such a level that a skilled artist could convey an entire legend in a single picture. Architects in the Middle Ages developed the flying buttress along with some of the most intricate stonework ever seen before or since. The key to understanding the Middle Ages is to avoid making assumptions based on prior assertions or possibly biased historians from the past, and to instead look at what was actually created.

Perhaps it is finally time, then, for the term "Dark Ages" to pass out of not only scholarly but also casual speech. If the goal of historical study is to illuminate, not judge, a descriptive yet neutral term like "Middle Ages" might well serve more effectively. In the meantime, medievalists will continue studying the evidence they have in an attempt to understand the era that saw Western European culture transition into the modern era.

11. Based on the passage, which of the following scholars most directly contributed to the popularity of the term "Dark Ages"?

- **A.** Jordan
- **B.** Lindberg
- **C.** Petrarch
- **D.** Numbers

12. The passage most strongly implies that which of the following activities flourished during the Middle Ages?

- **F.** The construction of free-standing domes
- **G.** Skilled and detailed stonework
- **H.** Three-dimensional, realistic art
- **J.** The field of mathematics

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13. The passage indicates that, contrary to the historians with a traditional view of the Middle Ages, scholars today believe the Middle Ages were:

- **A.** a transitional period between the classical era and the modern.
- **B.** an era in which significant scientific discoveries were made.
- **C.** an epoch that suffered a decline in learning, art, and architecture.
- **D.** a time when much of the world lived in ignorance.

14. The passage states that an accurate picture of the Middle Ages will likely develop as a result of:

- **F.** reconsidering existing evidence and discovering new evidence.
- **G.** relying on written documents from the Renaissance.
- **H.** new excavations throughout the European countryside.
- **J.** disregarding all Renaissance accounts.

15. According to the passage, people during the Middle Ages did NOT:

- **A.** keep written documents.
- **B.** study advanced mathematics.
- **C.** know how to carve stone well.
- **D.** believe the world was flat.

16. The main purpose of the first paragraph (lines 1–13) is to:

- **F.** compare the advances of the Renaissance and the classical period with the failings of the Middle Ages.
- **G.** list all of the terms used to describe the period between the fifth and fourteenth century.
- **H.** demonstrate that Petrarch and other writers of the Renaissance lived in a cultural wasteland.
- **J.** introduce the era under discussion and some of the ways it has been described.

17. The passage identifies which of the following as two areas in which learning truly did go into decline during the Middle Ages?

- **A.** Symbolic art and architecture
- **B.** Astronomy and mathematics
- **C.** Dome-building and three-dimensional art
- **D.** Stonework and science

18. It can reasonably be inferred from the first paragraph (lines 1–13) that Renaissance writers such as Petrarch believed that their work would benefit from:

- **F.** association with the classical era.
- **G.** an in-depth study of science.
- **H.** the creation of a well-educated middle class.
- **J.** the new culture of the Renaissance.

19. As it is used in line 5, the word *coined* most nearly means:

- **A.** counterfeited.
- **B.** plagiarized.
- **C.** spent.
- **D.** created.

20. It can reasonably be inferred from the fourth and fifth paragraphs (lines 33–54) that before the work of modern scholars such as Numbers and Lindberg, some scholars tended to see educational pursuits during the Middle Ages as:

- **F.** insignificant.
- **G.** scientific.
- **H.** advanced.
- **J.** well-documented.

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Passage III

HUMANITIES: Passage A is adapted from the essay "Much Ado About Shakespeare" by Arthur Coyle Thompson. Passage B is adapted from the essay "No Kidding This Theory Is Looney" by Amanda Combs Truelove.

Passage A by Arthur Coyle Thompson

Since his death, the 17th century playwright William Shakespeare has been considered one of the greatest, if not the greatest, writers in the English language. His many plays have not only shaped the course of the arts and the theater, they may have shaped the way that people in the modern world think of themselves. But when we talk about all that this playwright has done, we cannot help but notice that the playwright himself remains a mystery. Certainly there was a man named William Shakespeare who lived in Stratford-upon-Avon, but could this man, who came from these humble origins, possibly have written all the great works that are attributed to him?

A group of critics and scholars known as the Anti-Stratfordians believe that Shakespeare's authorship of these great plays is nearly impossible. They argue that Shakespeare couldn't have had the education, aristocratic sensibility, or the familiarity with the royal court that pervade his many works. Shakespeare's works were much more likely written by someone, or some group of people, that had these qualities, someone like Shakespeare's contemporary Christopher Marlowe or the English philosopher and statesman Francis Bacon. There are even some who surmise that Shakespeare's oceanic grasp of the totality of Elizabethan England means that his works could only have come from one source: Queen Elizabeth herself.

According to these Anti-Stratfordians, Shakespeare's sole authorship is the stuff of myth, a belief that has either been lazily accepted since Shakespeare's lifetime or a vast conspiracy to hide the true identity of the author. Because the historical record obviously contains no account of Sir Francis Bacon writing *Hamlet*, for instance, the Anti-Stratfordians rely instead upon what they call a "rhetoric of accumulation." In other words, the Anti-Stratfordians seek to decode Shakespeare's texts for hints as to the author's true identity.

The controversy began in the mid-1800s, when a slew of books and articles began to question Shakespeare's authorship. The first comprehensive theory of alternate authorship was formulated by Delia Bacon, who suggested that the plays were written by a group of authors under the direction of Sir Francis Bacon. The group, according to this theory, was constructed to promote philosophical and political ideas that were too dangerous for any one man to espouse publicly.

Other theories have emerged since. Since the 1920s and the publication of J. Thomas Looney's *Shakespeare Identified*, the second leading candidate has been Edward de Vere, 17th-century Earl of Oxford. The "Oxfordians," as they are known, cite certain passages from *Hamlet* that depict the author as an eccentric aristocrat and poet who had traveled extensively in Italy. Oxford had some poetry of his own, which Looney used to identify parallels with Shakespeare's sonnets and some of his plays.

While it may be impossible for anyone to know for sure, the Anti-Stratfordians nonetheless raise some interesting questions about Shakespeare's authorship and the question of authorship in general. How reasonable is it to think that the average townsman could have written the generation-defining, even language-defining, works for which William Shakespeare has been given credit?

Passage B by Amanda Combs Truelove

Arthur Coyle Thompson asks, "How reasonable is it to think that the average townsman could have written the…works for which William Shakespeare has been given credit?" The answer is simple: it's not reasonable, but that is the nature of genius, especially genius of Shakespeare's magnitude. As difficult as it might be to believe, all evidence points toward William Shakespeare as the sole author of Shakespeare's works. If the authorship of Shakespeare's work was in doubt, why did no one identify this doubt until 200 years after Shakespeare's death? Why did none, not a single one, of Shakespeare's contemporaries speak up? The theater world is a small but collaborative one: if something had been suspicious about the authorship of Shakespeare's plays, someone would certainly have said something.

If anything, the Anti-Stratfordians, whether explicitly or implicitly, have been making a blatantly classist argument. The idea that a man of Shakespeare's level of genius must have come from the upper echelons of society is snobbish at best. All of these Anti-Stratfordians are teachers—do they assume that their most intelligent students are also the wealthiest? In our own age, when the greatest discoveries are made in some eighteen-year-old's garage, we should see the fallacy in the argument that William Shakespeare "could not have" written his plays. One does not need money, after all, to feel emotions deeply or to observe the behaviors of others. And Shakespeare's work is so powerful, and it continues to resonate today, precisely because of his eloquence in describing the indescribable. One does not need a fluency in Ancient Greek or the natural sciences to read Shakespeare, so why would Anti-Stratfordians suppose that Shakespeare himself must have needed it or that he couldn't have acquired it on his own?

In addition, these Anti-Stratfordians must understand how misleading it is to identify "parallels" in the texts of Shakespeare and the authors whom the Anti-Stratfordians propose. Certainly these texts should have parallel vocabularies: they were written in the same place in the same era! Words like "app" and "iPhone" are spoken all the time: can we really suppose that those who speak them are all the same technological expert?

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No, the Anti-Stratfordians must instead resort to accusations of conspiracy and deception. Why, they ask, have generations hidden the real story from us? Why has all the evidence of our claims been destroyed? Well, because the claims of these Anti-Stratfordians amount to what King Lear would've called "an O without a figure." The evidence for an alternate author is tough to find for a simple reason: it doesn't exist.

Questions 21–24 ask about Passage A.

21. Based on the passage, the primary reason that some critics and scholars doubt the identity of the playwright William Shakespeare is that:

- **A.** the most accomplished playwrights in the 16th century were also the most successful and wealthy.
- **B.** a man of Shakespeare's relatively humble station is not likely to have produced works with such breadth.
- **C.** some of the ideas that Shakespeare's plays advanced were too dangerous to appear in novels.
- **D.** some readers in the 19th century wanted to connect the plays of Shakespeare to their own lives.

22. According to Thompson, critics cite Queen Elizabeth as the possible author of Shakespeare's plays because the plays:

- **F.** have unusually strong female characters.
- **G.** demonstrate an intimate knowledge of natural sciences.
- **H.** depict the era of Elizabeth's reign with notable breadth.
- **J.** were popular among dukes and other royalty of the time.

23. Thompson refers to Shakespeare as "the average townsman" (lines 52–53) in order to suggest that Shakespeare:

- **A.** may have been too unsophisticated to have written such sophisticated plays.
- **B.** was active in civic affairs as well as in theatrical ones.
- **C.** was probably too well-liked by his neighbors to be revealed as a fraud.
- **D.** may have disguised himself in his daily life in Stratford-upon-Avon.

24. As it is used in line 21, the word *oceanic* most nearly means:

- **F.** natural.
- **G.** informal.
- **H.** salty.
- **J.** comprehensive.

Questions 25–27 ask about Passage B.

25. Based on Truelove's account, the main reason that Shakespeare's authorship is difficult to understand is that Shakespeare:

- **A.** was only one of many authors who wrote under the name Shakespeare.
- **B.** appeared in the literary world before plays were considered serious works of art.
- **C.** is a genius who cannot be characterized in normal terms.
- **D.** disapproved of royalty and other nobles without sufficient knowledge of how they lived.

26. According to Truelove, the Anti-Stratfordians give a classist account of Shakespeare's authorship in that they:

- **F.** insist that only a royal or noble could have written a good play.
- **G.** assume that literary ability is based on the author's economic class.
- **H.** disapprove of their own low-income students.
- **J.** show that Shakespeare did not earn sufficient royalties from his plays.

27. Truelove critiques arguments against Shakespeare's authorship that are based on "parallels" with other authors' writing by suggesting that:

- **A.** the Anti-Stratfordians have been focusing on the wrong texts in their analysis.
- **B.** the Anti-Stratfordians have not sufficiently spoken of economics in their books and articles.
- **C.** the evidence used for such claims is not as meaningful as Anti-Stratfordians believe.
- **D.** the evidence for Francis Bacon's authorship is far less compelling than the evidence for Edward de Vere's.

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Questions 28–30 ask about both passages.

28. One of the most obvious differences between Thompson's and Truelove's points of view is that Thompson:

- **F.** believes the theories of the Anti-Stratfordians, while Truelove is more compelled by the theories of the Oxfordians.
- **G.** criticizes the authors he describes, while Truelove is more interested in finding the merits in Looney's and Bacon's arguments.
- **H.** doubts the claims of the Anti-Stratfordians, while Truelove considers them interesting intellectual exercises.
- **J.** presents a skeptical view on Shakespeare's authorship, while Truelove criticizes such skepticism as misguided.

29. By which of the following means does Truelove disagree with the theories presented in Thompson's passage?

- **A.** Personal attack and intellectual banter
- **B.** Direct response and rhetorical questions
- **C.** Emotional appeal and ironic exaggeration
- **D.** Historical data and archival research

30. Based on the passages, which pair of phrases best compares Thompson's and Truelove's responses to alternative theories of Shakespeare's authorship?

- **F.** Understated approval versus firm neutrality
- **G.** Dramatic appeal versus scholarly debate
- **H.** Staunch advocacy versus tentative support
- **J.** Receptive exploration versus decisive critique

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Passage IV

NATURAL SCIENCE: This passage is adapted from the article "Does an Amoeba Have a Choice?" by Wilbur Stewart (©2007 Wilbur Stewart).

The question of how much freedom of choice humans exercise has long vexed scientists. Once the model of humans as the only thinking beings on the planet was abandoned, a new model of humans as higher-level animals took its place as the dominant theory. According to the new theory, certain organisms, such as amoebas and plants, act unconsciously, according to almost mechanical impulses. Other organisms, such as dogs or horses, display a certain level of consciousness combined with instinct. Above them all stand humans—maybe not the only thinking beings but still the most highly evolved, exercising "free will" when determining life choices.

Today, however, scientists are beginning to question that model as well. Could it be that much of what we take for conscious decision-making can actually be accounted for biologically? Are we in truth not all that different from animals that act largely out of instinct? How separate are humans, really, from the rest of the natural world?

The human ability to form lasting romantic bonds is one of the primary proofs given in support of free will. Some theorists argue that remaining with a single partner because of an emotional commitment is clearly unnatural and thus a sign of our higher development: social and emotional needs overpowering a base, animal instinct. Evolutionary biologists, however, have recently uncovered evidence that suggests that working as a pair has many evolutionary advantages that may outweigh the disadvantages. Pair-bonding allows one party to remain behind and guard the offspring while the other seeks food and shelter; it increases the odds that an injured party will be cared for and thus survive; it even increases the chances that offspring will live long enough to mature and become self-sufficient. Moreover, recent research seems to indicate that many of the feelings that humans experience when falling in love are in fact biologically motivated and that other animals finding a mate experience similar physical symptoms.

The truly staggering aspect of this new realization, however, is that it could extend not only to individuals but also to societies as a whole. If humans are instinctual animals, driven by biological imperatives much of the time, then the interplay between cities and even nations might also be open to biological interpretation. After all, governments are composed of humans. The possible repercussions that such a discovery could have on international relations are truly astonishing. For example, perhaps in time scientists will determine which hormones cause humans to feel friendship, along with a way to administer those hormones to a nation. Decade-long wars could be ended, amicably, in a matter of days.

Still other scientists, mainly chemists and physicists, have asserted that it's not so much that humans are like other animals as that all living things are relatively predictable on a cellular level. Those scientists believe that all human interaction is, on some level, based in the laws of physics. Strange as that may sound at first, it's not as outrageous as it seems. Hormones and other natural chemicals are released in response to some kind of stimulus, causing biological impulses. In order for the body to process those stimuli, however, a whole array of reactions has to take place. At the most basic level, those reactions are caused by cells sending out and responding to electrical impulses. Those electrical impulses become chemical impulses, or neurotransmitters, which eventually trigger biological impulses. All matter is made up of protons, neutrons, and electrons, so by extension, all matter reacts to electrical impulses on some level. Advocates of the electro-chemical theory claim that studies involving large groups of people demonstrate their point most effectively. Human interaction can be compared to the interaction between different particles—some are attracted to each other while others are repulsed, while the whole mass moves as a single entity. If it's true that group interactions can be compared to the mingling of different particles, then an entirely new background could be created against which national and international dynamics could be newly considered.

One practical example of the convergence of scientific theory and human practice is the increasing involvement of scientists in the arena of criminal pursuit. Many police departments have realized that human behavior, even in flight, is startlingly predictable, if one knows how to find the patterns. That's where the academics come in; they're hired to look at the data accumulated by detectives and apply their knowledge of science to the case, trying to identify patterns. These academics consider the behavior of other animals, but they also compare the data to the movement of particles and perform complex mathematical calculations. And, more often than might be expected, they help solve the cases.

31. According to the author of the passage, "free will" describes behavior such as:

- **A.** falling in love by a series of natural and biological processes.
- **B.** the study of pattern behavior to understand criminal behavior.
- **C.** the choice of one mate based on a mutual emotional connection.
- **D.** group efforts by all members of a city to improve that city.

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32. Based on the passage, what relationship does the recent discovery described in the third paragraph (lines 30–34) have to the electro-chemical theory?

- **F.** It directly supports the electro-chemical theory.
- **G.** It supports another theory that is connected to the electro-chemical theory.
- **H.** It undermines the central claims of the electro-chemical theory.
- **J.** It is unrelated to the electro-chemical theory.

33. The author characterizes scientific contributions to police work as:

- **A.** charming but ultimately useless.
- **B.** mundane but logically unconvincing.
- **C.** alarming but theoretically persuasive.
- **D.** new and potentially helpful.

34. The supporters of the electro-chemical theory claim that humans are like particles in that both:

- **F.** are ultimately driven to action by electrical impulses.
- **G.** are potentially capable of conscious decision-making.
- **H.** can more adequately be understood in groups than individually.
- **J.** respond to outside stimuli without intermediate thought.

35. In terms of where and how frequently they occur, electrical impulses are described by the author of the passage as:

- **A.** possible in humans and animals but not in other types of matter.
- **B.** common to humans, animals, and other types of matter.
- **C.** present in cellular interactions but absent from human interactions.
- **D.** the basis of a theory of group activity for non-human matter.

36. The chemists and physicists define biological impulses as:

- **F.** apparently unconnected to decisions based in free will.
- **G.** apparently central to whether humans exercise free will.
- **H.** the basis for chemical impulses, which in turn cause electrical impulses.
- **J.** caused by chemical impulses, which are caused by electrical impulses.

37. Lines 26–30 are best characterized as describing an explanation that:

- **A.** slowly developed as the primary method of childrearing among all higher-level organisms.
- **B.** rapidly emerged as the leading cause of the successful evolution of lower-level animals.
- **C.** alternatively offers a reason for behavior that had previously been attributed to free will.
- **D.** recently undermined the traditional belief that human behavior was biologically motivated.

38. The main point of the sixth paragraph (lines 71–81) is that:

- **F.** the new theories discussed in the passage have been put into practice effectively in at least one field.
- **G.** recent research has indicated that academic theories tend to be difficult to put into practice.
- **H.** academic theories can be evaluated more fully when they are put into practice.
- **J.** police work has relied on academic help since before the debates over free will.

39. The passage states that in response to the suggestion that the tendency to remain with a single mate demonstrates humanity's free will, evolutionary biologists:

- **A.** added several new elements to their theory.
- **B.** accepted that their initial idea was deeply flawed.
- **C.** redefined the term "free will" to fit their theory.
- **D.** suggested an alternative interpretation of pair-bonding.

40. Lines 12–17 mainly emphasize what quality?

- **F.** Confidence
- **G.** Uncertainty
- **H.** Ignorance
- **J.** Contentment

END OF TEST 3

STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.

DO NOT RETURN TO A PREVIOUS TEST.

SCIENCE TEST

35 Minutes–40 Questions

DIRECTIONS: There are several passages in this test. Each passage is followed by several questions. After reading a passage, choose the correct answer to each question and fill in the corresponding oval on your answer document. You may refer to the passages as often as necessary.

You are NOT permitted to use a calculator on this test.

Passage I

The *mean high water* (MHW) of a tidal station is the average height of all high tides at a station over an *epoch* (a specific 19-year period used by the National Ocean Service to calculate official tidal data). The *daily mean high water* is the average of the two high tides in a single day. Tidal heights vary with season, weather conditions, and moon phases. Figure 1 shows the daily mean high water for a two-month period at a station where the MHW is 3.083 feet (37 inches).

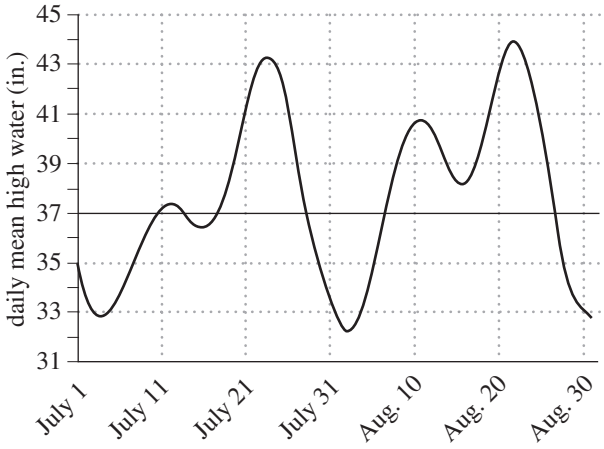

Figure 1

Figure 2 shows how the difference between the *yearly mean high water* (cumulative average of all observed high tides in a given calendar year) and the MHW varied throughout two months at the tidal station.

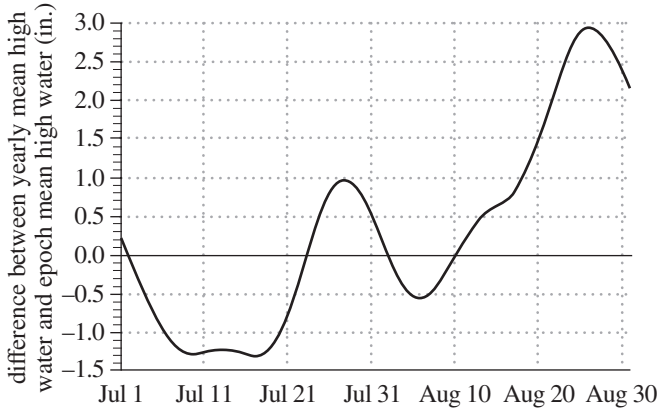

Figure 2

Note: If the difference between yearly mean high water and MHW is positive, the yearly mean high water is above the MHW; if the difference is negative, the yearly mean high water is below the MHW.

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1. Based on Figure 2, on how many days in July and August was the yearly mean high water exactly 0.6 inches above the MHW?

A. 2
B. 3
C. 4
D. 5

2. According to Figure 2, on which of the following dates was the yearly mean high water at the station the same as the MHW?

F. July 8
G. July 15
H. July 30
J. August 2

3. During the month of July, was the yearly mean high water more often below the MHW or above the MHW?

A. Below; the difference between yearly mean high water and MHW is more often negative during the month of July.
B. Below; the difference between yearly mean high water and MHW is more often positive during the month of July.
C. Above; the difference between yearly mean high water and MHW is more often negative during the month of July.
D. Above; the difference between yearly mean high water and MHW is more often positive during the month of July.

4. According to Figure 1, on which of the following dates was the daily mean high water higher than the MHW?

F. July 4
G. July 24
H. August 1
J. August 28

5. Based on Figure 2, for approximately how many total days in July and August was the yearly mean high water below the MHW?

A. 7
B. 21
C. 28
D. 42

6. According to Figure 1, the highest daily mean high water in July and August was approximately how much higher than the lowest daily mean high water during this period?

F. 4 in.
G. 7 in.
H. 12 in.
J. 16 in.

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Passage II

When grown in industrial wastewater, the alga *Chlorella vulgaris* can convert atmospheric carbon dioxide to organic compounds used to produce biofuels. In an experiment, 7 bioreactors filled with *C. vulgaris* were studied to examine how pH and average solar radiation affected average daily carbon dioxide uptake, U_D, and volume of biofuels produced in the reactor after processing. All the reactors contained the same quantity of algae and were maintained at the same temperature. The table shows the results of the experiment.

Reactor number	pH	Average solar radiation (W/m^2)*	Average U_D † (L)	Volume of biofuel (L)
1	7.0	80	14.8	31.3
2	7.0	120	18.1	38.7
3	7.0	200	22.5	47.0
4	5.1	40	6.7	15.2
5	6.0	40	9.9	21.1
6	6.4	40	11.8	24.9
7	7.0	40	12.3	26.0

* watts per square meter
† U_D = (volume of CO_2 pumped into reactor) – (volume of CO_2 emitted)

7. Based on the table, for which 2 reactors was the average U_D value less than 15 L and the volume of biofuel greater than 25 L ?

A. Reactor 1 and Reactor 4
B. Reactor 1 and Reactor 7
C. Reactor 2 and Reactor 3
D. Reactor 2 and Reactor 6

8. Consider Reactors 1–3. Based on the table, as average solar radiation increased, did average U_D decrease or increase, and did the volume of biofuel decrease or increase?

	average U_D	volume of biofuel
F.	decrease	decrease
G.	decrease	increase
H.	increase	decrease
J.	increase	increase

9. Consider the 4 reactors for which the average U_D values were greater than 12.0 L. What is the order of these reactors from the reactor with the greatest average U_D value to the reactor with the least average U_D value?

A. Reactor 2, Reactor 1, Reactor 7, Reactor 6
B. Reactor 2, Reactor 7, Reactor 3, Reactor 1
C. Reactor 3, Reactor 2, Reactor 1, Reactor 7
D. Reactor 3, Reactor 6, Reactor 2, Reactor 1

10. Based on the table, the volume of biofuel produced by the *C. vulgaris* was approximately how many times as great in Reactor 4 as the volume produced in Reactor 3 ?

F. $\frac{1}{3}$
G. $\frac{1}{2}$
H. 2
J. 3

11. Suppose Reactor 1 was maintained at a temperature of 25°C. What was the temperature at which Reactor 5 was maintained?

A. 5°C
B. 25°C
C. 125°C
D. Cannot be determined from the given information

12. What was the average U_D, in *milliliters* (mL), for a reactor containing algae maintained at a pH of 7.0 and an average solar radiation level of 120 W/m^2 ?

F. 0.0181 mL
G. 18.1 mL
H. 18,100.0 mL
J. 181,000.0 mL

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Passage III

Three experiments were conducted to determine the effects of *salinity* (concentration of salt) on 3 properties of water.

Researchers prepared 5 mixtures of freshwater and saltwater, labeled Solutions A–E, as shown in Table 1.

Table 1

Solution	Percent by mass of:	
	freshwater	saltwater
A	100	0
B	80	20
C	50	50
D	20	80
E	0	100

Experiment 1

A polystyrene foam container with a maximum capacity of 200 mL was filled with 100 mL of Solution A and then covered with a polystyrene foam lid through which a thermometer and an electrical heater were inserted into Solution A. The electrical heater was turned on at a constant power of 300 W until the solution was heated to a temperature of 100°C. After all of the water in the solution was converted to steam, the solution's *heat of vaporization* (energy required to convert a substance from the liquid to gas phase) was calculated.

This process was then repeated with Solutions B–E. The results are shown in Table 2.

Table 2

Solution	Heat of vaporization (J/g)
A	2,301
B	2,260
C	2,195
D	2,137
E	2,098

Experiment 2

Another 100 mL of Solution A was transferred into a clean glass beaker.

The beaker was placed inside a plastic dish with 50 mL of acetone and 2 g of solid CO_2. A clean thermometer was placed into the solution. When ice appeared inside the beaker and the temperature shown by the thermometer stopped decreasing, the temperature was recorded as the freezing point of the solution.

This process was then repeated with Solutions B–E. The results are shown in Table 3.

Table 3

Solution	Freezing point (°C)
A	0.0
B	–0.3
C	–0.6
D	–1.1
E	–1.8

Experiment 3

The beakers used in Experiment 2 were removed from the cold bath. A 200 mL graduated cylinder was placed onto an analytical balance and the balance was adjusted so that it read 0.000 g. The ice created from Solution A was warmed for 3 min until all of the ice melted, and the liquid was transferred into the graduated cylinder. The new mass was recorded to the nearest 0.001 mg, and the volume was recorded to the nearest 0.1 mL. The density of the liquid was then calculated.

This process was then repeated with the ice created from Solutions B–E. The results are shown in Table 4.

Table 4

Melted ice from Solution:	Density (kg/m^3)
A	998
B	1,012
C	1,037
D	1,059
E	1,076

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13. Which of the following is the most likely reason that each solution was placed in a polystyrene foam container in Experiment 1 ?

A. To prevent the solution from freezing
B. To ensure that the solution froze
C. To prevent the solution from absorbing heat other than that from the electrical heater
D. To ensure that the solution absorbed heat other than that from the electrical heater

14. In Experiment 3, the graduated cylinders were filled with:

F. liquid water but not ice.
G. ice but not liquid water.
H. neither liquid water nor ice.
J. both liquid water and ice.

15. Based on the results of Experiment 1, if a solution containing 75% by mass freshwater had been examined in Experiment 1, the heat of vaporization of the solution would most likely have been:

A. less than 2,195 J/g.
B. between 2,195 J/g and 2,260 J/g.
C. between 2,260 J/g and 2,301 J/g.
D. more than 2,301 J/g.

16. Experiment 1 differed from Experiment 2 in which of the following ways?

F. In Experiment 1, a greater volume of each solution was used than in Experiment 2.
G. In Experiment 2, a greater volume of each solution was used than in Experiment 1.
H. In Experiment 1, each solution was brought to a lower temperature than in Experiment 2.
J. In Experiment 2, each solution was brought to a lower temperature than in Experiment 1.

17. According to the results of Experiment 3, would a 10 m^3 volume of Solution B or Solution D have a greater mass?

A. Solution B, because it is more dense.
B. Solution B, because it is less dense.
C. Solution D, because it is more dense.
D. Solution D, because it is less dense.

18. Consider the solution with the highest freezing point in Experiment 2. According to the results of Experiment 3, was the density of this solution greater than, less than, or equal to 1,000 kg/m^3 ?

F. Greater than
G. Less than
H. Equal to
J. Cannot be determined from the given information.

19. Consider the statement "The percent by mass of freshwater in the solution with the *lowest* heat of vaporization was the same as the percent by mass of freshwater in the solution with the melted ice that had the highest density." Do the results of Experiments 1 and 3 support this statement?

A. Yes; 0% by mass freshwater had the lowest heat of vaporization and the highest density.
B. Yes; 50% by mass freshwater had the lowest heat of vaporization and the highest density.
C. No; 0% by mass freshwater had the lowest heat of vaporization but 50% by mass freshwater had the highest density.
D. No; 50% by mass freshwater had the lowest heat of vaporization but 0% by mass freshwater had the highest density.

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Passage IV

An electric charge in motion will generate an invisible *magnetic field.* Iron filings are *ferromagnetic*, meaning they become tiny magnets and align themselves to a magnetic field. These filings can be used to represent the magnetic field lines that run from the north to the south poles around a magnet: the closer the lines are, the stronger the magnetic field. Figure 1 shows two patterns of magnetic field lines that form around magnets of different poles: attractive (between two opposite poles) and repulsive (between two identical poles).

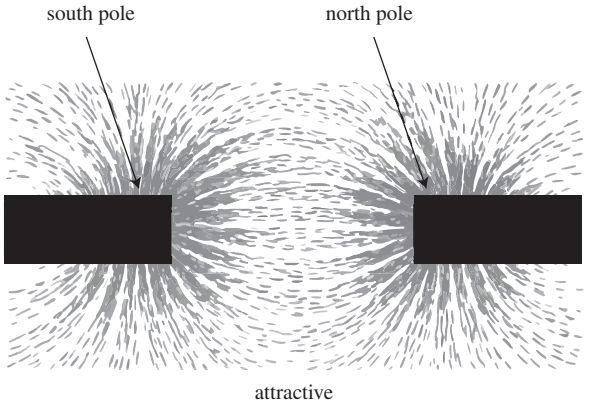

Figure 1

Researchers performed 2 experiments to study the patterns formed when iron filings were exposed to magnets.

Experiment 1

The researchers obtained 7 bar magnets of varying lengths but with the same nickel composition, width of 5.0 cm, and height of 2.0 cm. First, they fixed one of the bar magnets to a flat surface. Then, they performed a trial with each of the 6 remaining magnets using the following procedure: a trial bar magnet was placed 10.0 cm away from the fixed magnet with the identical poles facing each other and the two magnets were covered with a sheet of paper. Finally, 2.0 grams of iron filings were poured evenly over the piece of paper, and the pattern that developed was observed. The trial magnet was then rotated 180 degrees so the opposite pole was facing the fixed magnet, and the procedure was repeated. The experiment was repeated with both poles of the other 5 trial magnets and the same fixed magnet. Table 1 shows the distance from the center of the trial magnet to the center of the outermost magnetic *field line* for each trial.

Table 1

Magnet length (cm)	Distance (cm) from center of magnet to center of outermost field line:	
	attractive	repulsive
8.0	10.2	9.1
10.0	12.3	11.1
12.0	13.4	12.7
14.0	17.1	16.5
16.0	18.4	17.8
18.0	20.0	19.3

Experiment 2

The researchers performed 8 more trials with the 14.0 cm trial magnet. In each trial, the magnet was placed 5.0 cm from the fixed magnet, and the procedures used in Experiment 1 were repeated. The magnet was then moved further away from the fixed magnet in 5.0 cm intervals, and the attractive and repulsive patterns were reestablished after each move. Figure 2 shows the results for each trial, as well as a line of best fit for each pattern.

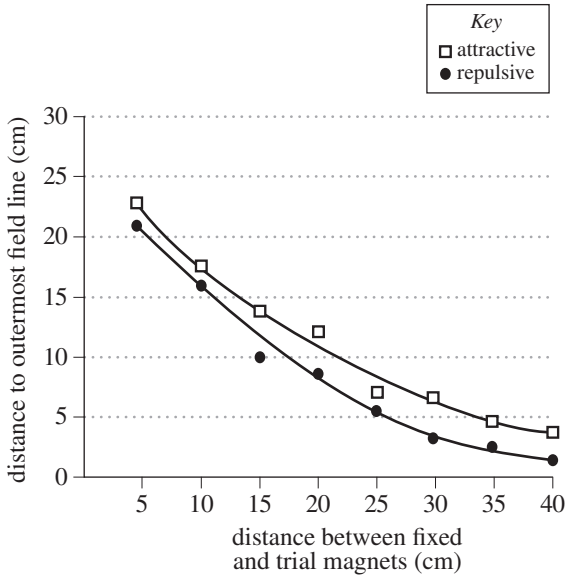

Figure 2

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20. Based on the results of Experiment 1, for how many of the magnet lengths tested was the distance from the center of the magnet to the center of the outermost field line for the attractive patterns *less* than that for the repulsive patterns?

F. 0
G. 1
H. 2
J. 5

21. Which of the following questions about either magnet length or magnet distance can be answered by the results of Experiment 2 ? What effect did the:

A. magnet length have on the distance to the outermost field line?
B. magnet length have on the number of field lines?
C. distance between the fixed and trial magnets have on the number of field lines?
D. distance between the fixed and trial magnets have on the distance to the outermost field line?

22. Suppose that in Experiment 2 a trial had been performed with the attractive patterns in which the distance to the outermost field line was 15.0 cm. Based on Figure 2, the distance between the magnets would most likely have been closest to which of the following?

F. 5.0 cm
G. 10.0 cm
H. 14.0 cm
J. 16.0 cm

23. Experiments 1 and 2 differed in which of the following ways? In Experiment 1:

A. 7 magnets were used, whereas in Experiment 2, 2 magnets were used.
B. 7 magnets were used, whereas in Experiment 2, 8 magnets were used.
C. magnet composition was varied and distance to outermost field line was held constant, whereas in Experiment 2, magnet composition was held constant and distance to outermost field line was varied.
D. magnet composition was held constant and distance to outermost field line was varied, whereas in Experiment 2, magnet composition was varied and distance to outermost field line was held constant.

24. Based on the results of Experiment 1, for the magnet with a length of 16.0 cm, what was the difference between the distance to the outermost field line for the attractive patterns and the distance between the fixed and trial magnets in Experiment 1 ?

F. 7.8 cm
G. 8.4 cm
H. 17.8 cm
J. 18.4 cm

25. Magnets come in many different shapes and sizes depending on the purpose they serve. One common magnet shape is a *horseshoe magnet*, a U-shaped magnet with north and south poles pointed in the same direction. Suppose that, for a trial magnet with a length of 8.0 cm set 10.0 cm away from a fixed horseshoe magnet, the distance to the outermost field line of the magnetic field is 1.4 times the same distance if a fixed bar magnet was used. Based on the results of Experiment 1, what would the distance to the outermost field line most likely be with the attractive patterns?

A. 9.1 cm
B. 10.2 cm
C. 12.7 cm
D. 14.3 cm

26. A student claimed that the greater the length of the trial magnet, the more *field lines* in the magnetic field for a certain type of magnetic force. Is this claim supported by the results for the repulsive patterns from Experiment 1 ?

F. Yes; as the magnet length was increased, the distance to the outermost field line for the repulsive patterns increased.
G. Yes; as the magnet length was increased, the distance to the outermost field line for the repulsive patterns decreased.
H. No; as the magnet length was increased, the distance to the outermost field line for the repulsive patterns increased.
J. No; as the magnet length was increased, the distance to the outermost field line for the repulsive patterns decreased.

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Passage V

A horse's base coat color is determined by a single gene with 2 alleles: *red* and *black*. If an allele for each color is present, only the dominant color is expressed. In addition, a base coat color can be diluted by the cream gene, C, which also has two alleles: C^{Cr} for cream and C^{N} for non-cream. Palomino horses have golden coats that are produced by a red base coat with cream dilution.

A horse breeder provided 3 veterinary scientists a genealogy diagram of his horses showing the inheritance of the palomino coat (see Figure 1). The base coat color and presence or absence of palomino coloring are shown for each horse, numbered 1–28. Based on the horse breeder's diagram, each scientist offered an explanation regarding the inheritance pattern of palomino coloring.

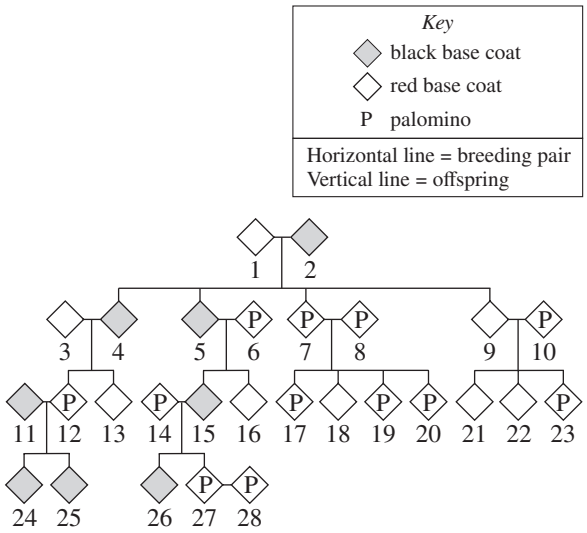

Figure 1

Scientist 1

All horses with at least one copy of the *red* allele will have a red base coat color, and all horses with at least one copy of the C^{Cr} allele will have cream dilution to their base coat. Therefore, all horses with palomino coloring inherited at least one *red* allele and at least one C^{Cr} allele. Table 1 shows the possible C genotypes with red and black base coats and indicates whether the horse will have palomino coloring.

Table 1

Base coat color	Gene C genotype	Coloring
Red	$C^{N}C^{N}$	not palomino
	$C^{Cr}C^{N}$	palomino
	$C^{Cr}C^{Cr}$	palomino
Black	$C^{N}C^{N}$	not palomino
	$C^{Cr}C^{N}$	not palomino
	$C^{Cr}C^{Cr}$	not palomino

Note: Red base coat horses can have the genotype *red*/*red* or *red*/*black*, while black base coat horses must be *black*/*black*.

Scientist 2

The red coat color requires two *red* alleles to be present in a horse, but the cream gene will be expressed in any horse with at least one C^{Cr} allele. Therefore, all palomino horses inherited two copies of the *red* allele and 1 or 2 copies of the C^{Cr} allele.

Scientist 3

Both the red base coat color and the cream dilution require two copies of the respective alleles to be present. Therefore, all horses with palomino coloring inherited two copies of the *red* allele and two copies of the C^{Cr} allele.

27. Which scientist, if any, would be likely to predict that Horse 12 has the C genotype of $C^{N}C^{N}$?

A. Scientist 1
B. Scientist 2
C. Scientist 3
D. None of the scientists

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28. Which of the following tables is most consistent with Scientist 2's explanation for the C genotypes that produce palomino coloring in horses with red base coats?

F.

Gene C genotype	Coloring
C^NC^N	not palomino
$C^{Cr}C^N$	palomino
$C^{Cr}C^{Cr}$	palomino

G.

Gene C genotype	Coloring
C^NC^N	not palomino
$C^{Cr}C^N$	not palomino
$C^{Cr}C^{Cr}$	palomino

H.

Gene C genotype	Coloring
C^NC^N	palomino
$C^{Cr}C^N$	not palomino
$C^{Cr}C^{Cr}$	not palomino

J.

Gene C genotype	Coloring
C^NC^N	palomino
$C^{Cr}C^N$	palomino
$C^{Cr}C^{Cr}$	not palomino

29. Which of Scientist 1 or Scientist 2 implied that red base coats are dominant to black base coats?

A. Scientist 1, because Scientist 1 stated that horses must inherit two copies of the *red* allele to have a red base coat.
B. Scientist 1, because Scientist 1 stated that horses with only one copy of the *red* allele will have a red base coat.
C. Scientist 2, because Scientist 2 stated that horses must inherit two copies of the *red* allele to have a red base coat.
D. Scientist 2, because Scientist 2 stated that horses with only one copy of the *red* allele will have a red base coat.

30. Suppose that Horse 27 and Horse 28 produce a large number of offspring, all with red base coats. Based on Scientist 3's explanation, approximately what proportion of their offspring would be expected to be palomino?

F. $\frac{1}{2}$ of the offspring
G. $\frac{3}{4}$ of the offspring
H. All of the offspring
J. Cannot be determined from the given information

31. Based on Scientist 1's explanation, does a horse with a single *red* allele and the Gene C genotype $C^{Cr}C^N$ have a red or black base coat, and is the horse palomino?

A. Black; yes
B. Black; no
C. Red; yes
D. Red; no

32. Which of the scientists proposed an inheritance pattern in which the breeding of two black base coat horses could result in offspring with a red base coat?

F. Scientist 1 only
G. Scientist 3 only
H. Scientist 1 and 2 only
J. Scientist 2 and 3 only

33. Consider Horses 7 and 8 and their offspring. Does this portion of the horse breeder's diagram more support the explanation of Scientist 2 or Scientist 3 ?

A. Scientist 2; this portion of the diagram suggests that the C^{Cr} allele that dilutes red to palomino is dominant.
B. Scientist 2; this portion of the diagram suggests that the C^{Cr} allele that dilutes red to palomino is recessive.
C. Scientist 3; this portion of the diagram suggests that the C^{Cr} allele that dilutes red to palomino is dominant.
D. Scientist 3; this portion of the diagram suggests that the C^{Cr} allele that dilutes red to palomino is recessive.

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Passage VI

The bacterium *Streptomyces griseus* can be cultured to produce *streptomycin* (an antibiotic whose effectiveness increases with concentration). Researchers examined the effects of glucose supplementation and pH on the production of streptomycin by three different strains of *S. griseus*—S4, S5, and S6.

Study

Researchers separated 60 mg of S4 spores into 4 equal portions, and each portion was placed into a culture solution inside one of 4 petri dishes, color-coded with red, blue, green, and yellow labels, respectively. The procedure was repeated with strains S5 and S6, using 4 separate color-coded petri dishes for each strain. Each petri dish was kept at a constant temperature of 27°C. After placing the spores, researchers added a glucose solution to all the red and green petri dishes. Immediately afterwards, 0.05 g potassium bicarbonate was added to all the red and blue petri dishes to make the pH of the solution alkaline. The green and yellow petri dishes were kept at a neutral pH. Table 1 shows, for each label of petri dish, whether the bacteria were supplemented with glucose and the pH of the culture solution after the potassium bicarbonate was added.

Table 1

Petri dish label color	Glucose supplementation	pH of culture solution
red	glucose added	alkaline
blue	no glucose added	alkaline
green	glucose added	neutral
yellow	no glucose added	neutral

After 5 days, each petri dish was heated to 50°C and a mixture of methanol and acetone was added to stop bacterial growth and extract the streptomycin. The solution from each petri dish was then filtered into a separate test tube, and the contents of each test tube were then purified through column chromatography. The concentration of streptomycin, in micrograms of purified streptomycin per milliliter of culture solution (μg/mL), was calculated for each strain in each set of experimental conditions. Table 2 shows the results of the experiment.

Table 2

Strain	Label color	Streptomycin concentration (μg/mL)
S4	red	215
	blue	93
	green	118
	yellow	76
S5	red	101
	blue	21
	green	44
	yellow	5
S6	red	198
	blue	56
	green	102
	yellow	33

34. The *S. griseus* with the least effective antibacterial properties was likely which strain grown in which petri dish?

F. The S4 strain grown in the red-labeled petri dish, because it had the highest streptomycin concentration.
G. The S4 strain grown in the red-labeled petri dish, because it had the lowest streptomycin concentration.
H. The S5 strain grown in the yellow-labeled petri dish, because it had the highest streptomycin concentration.
J. The S5 strain grown in the yellow-labeled petri dish, because it had the lowest streptomycin concentration.

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35. The effectiveness of an antibiotic can be reported as *zone of inhibition* (ZOI). For solutions of streptomycin, the higher the streptomycin concentration, the larger the ZOI. Based on the results of the experiment for S4 in the petri dishes without added glucose, would the ZOI likely have been larger for the solutions in the petri dishes with neutral or alkaline pH?

A. Neutral; the streptomycin concentration in the red-labeled petri dishes was higher than in the green-labeled petri dishes.
B. Neutral; the streptomycin concentration in the blue-labeled petri dishes was higher than in the yellow-labeled petri dishes.
C. Alkaline; the streptomycin concentration in the red-labeled petri dishes was higher than in the green-labeled petri dishes.
D. Alkaline; the streptomycin concentration in the blue-labeled petri dishes was higher than in the yellow-labeled petri dishes.

36. Consider the statement "For a given strain of *S. griseus* grown with glucose supplementation, the streptomycin concentration produced by bacteria grown in neutral solution is generally higher than that produced by bacteria grown in alkaline solution." Are the results of the experiment for S6 consistent with this statement?

F. No, because the streptomycin concentration in the red-labeled petri dishes was higher than that in the green-labeled petri dishes.
G. No, because the streptomycin concentration in the blue-labeled petri dishes was higher than that in the yellow-labeled petri dishes.
H. Yes, because the streptomycin concentration in the red-labeled petri dishes was higher than that in the green-labeled petri dishes.
J. Yes, because the streptomycin concentration in the blue-labeled petri dishes was higher than that in the yellow-labeled petri dishes.

37. Assume that 1 mL of glucose solution was added to each of the petri dishes that was supplemented with glucose in the experiment. Suppose additional petri dishes color-coded with orange labels containing 2 mL of the same concentration glucose solution had been included in the experiment. Immediately after the addition of glucose, 0.05 g of potassium bicarbonate was added to each of these dishes. The results are shown in the following table.

Strain	Streptomycin concentration (μg/mL)
S4	239
S5	135
S6	210

Based on the table, how did the streptomycin concentration in the petri dishes change as the amount of glucose solution decreased from 2 mL to 1 mL to 0 mL? For each strain, the streptomycin concentration:

A. increased only.
B. decreased only.
C. remained constant.
D. increased, then decreased.

38. For each of the 3 *S. griseus* strains, which petri dishes were most likely to serve as a control for the effect of glucose supplementation on bacteria grown in an alkaline solution?

F. The red-labeled petri dishes
G. The blue-labeled petri dishes
H. The green-labeled petri dishes
J. The yellow-labeled petri dishes

39. Based on the description of the study, what amount of *S. griseus* spores was placed in each petri dish?

A. 4 mg
B. 15 mg
C. 60 mg
D. Cannot be determined from the given information

40. Assume that the petri dishes used to grow the S5 strain contained 5 mL of culture solution each. The mass, in micrograms, of purified streptomycin produced from the red-labeled petri dish used to grow the S5 strain was closest to which of the following?

F. 20 μg
G. 100 μg
H. 500 μg
J. 2,000 μg

END OF TEST 4
STOP! DO NOT RETURN TO ANY OTHER TEST.
THERE IS NO ESSAY FOR THIS TEST.