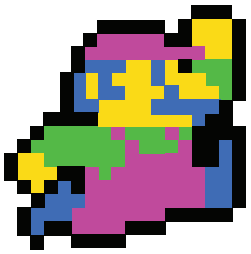
ACT PRACTICE

TEST 1



K20 LEARN

ENGLISH TEST

35 minutes – 50 Questions

Directions: In the ACT-like passage that follows, certain words and phrases are underlined and numbered. On the right, you will see suggested corrections for each underlined part. For the most part, you are to choose the option that best 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. "No Change" is a valid option if you think the original is the best choice. Along with grammar, there will also be questions about the passage's content. Choose the best answer. You may also find questions about a section of the passage or about the entirety of it. These questions do not refer to any underlined part of the passage but are identified by numbers in a box.

Read the passage thoroughly before answering the questions. For some questions, you must read several sentences beyond the question to determine the correct answer.

Passage I

Stories at the Crossroads

In the dim glow of Mississippi juke joints, where cigarette smoke curled toward tin ceiling fans and the sound of clinking bottles blended with rough laughter, a young Robert Johnson first tried to make himself heard. [1]

Born in 1911 in Hazlehurst, Mississippi, Johnson grew up poor. Drifting[2] between small towns and the bustling streets of Memphis.

He spent his earliest years pressing his ear to the music of others, begging seasoned bluesmen to let him hold there guitars[3]. His own hands—long-fingered and eager—could coax only clumsy, uneven notes from the six strings. Though he could play the harmonica well enough, the guitar refused to reveal its secrets.

1. If the writer were to delete the preceding sentence, the paragraph would primarily lose:
   A. a vivid sense of setting that establishes mood
   B. an explanation of why Johnson struggled with music
   C. factual information about Johnson's birthplace
   D. details necessary to understand Johnson's later success

2. Which choice makes the sentence most grammatically acceptable?
   F. No Change
   G. poor; drifting
   H. poor, drifting
   J. poor and drifting

3. Which choice makes the sentence most grammatically acceptable?
   A. No Change
   B. their guitars
   C. they're guitars
   D. his guitars

One night in 1930 and after yet another failed attempt to impress the crowd[4] inside a packed juke joint, Robert quietly slipped away. No one knew where he went.

In communities where stories traveled[5] faster than trains, silence invited imagination. Some said he wandered into the countryside, ashamed. Others whispered about darker possibilities, about places where the veil between the ordinary and the supernatural thinned under the moonlight.

[1] The metamorphosis was so sudden, so complete, that explanations rooted in the natural world felt inadequate. **[2]** Weeks later, Johnson returned**.** **[3]** He could play anything—melodies he had heard only once, rhythms so intricate that they seemed inexplicable. **[4]** Those same musicians who once rolled their eyes at his clumsy playing now froze in disbelief as his fingers moved effortlessly across the fretboard. [6]

Legend has it that Robert Johnson had gone to the crossroads—where Highways 61 and 49 cut through the Delta—and met the devil himself. Johnson's own songs, filled with eerie references to evil spirits, hellhounds, and bargains[7] made in the night, only deepened the mystery.

No one could say, whether[8] he intended the lyrics as confession or clever showmanship.

4. Which choice makes the sentence most grammatically acceptable?
   F. No Change
   G. One night in 1930 after yet
   H. One night in 1930, after yet
   J. One night in 1930 but after yet

5. Which choice makes the sentence most grammatically acceptable?
   A. No Change
   B. will travel
   C. have traveled
   D. travel

6. Which sequence of sentences makes this paragraph most logical?
   F. No Change
   G. 2, 4, 3, 1
   H. 3, 2, 1, 4
   J. 4, 2, 3, 1

7. Which choice makes the sentence most grammatically acceptable?
   A. No Change
   B. spirits; hellhounds, and bargains
   C. spirits hellhounds and bargains
   D. spirits, hellhounds, and bargains,

8. Which choice makes the sentence most grammatically acceptable?
   F. No Change
   G. say—whether
   H. say, whether,
   J. say whether

For the next few years, Johnson, along with countless audiences, have wandered[9] the Delta, guitar slung across his back. He recorded just twenty-nine songs before dying at twenty-seven, a mysterious and agonizing end that fueled the legend even further. To many, it seemed the devil had finally come to collect on the deal.

9. Which choice is clearest and most precise in context?
   A. No Change
   B. wandered
   C. wander
   D. were wandering

Question 10 asks about the preceding passage as a whole.

10. Suppose the writer's primary purpose had been to elaborate about Robert Johnson's rise to musical fame while composing a descriptive essay. Would this essay accomplish that purpose?
   F. Yes, because it explains how Johnson gained widespread recognition for his music.
   G. Yes, because it traces his career from obscurity to professional success.
   H. No, because it emphasizes the legend surrounding Johnson more than his rise to fame.
   J. No, because it focuses primarily on technical details of blues music.

Women and Marriage

Marriage during the Regency Era in England was often treated as a legal or financial arrangement rather than a romantic partnership. For families in the middle and upper-middle classes, marrying well was one of the few ways to rise in the higher social ranks. The laws of the time gave husbands almost complete authority over their wives. Under a rule called *coverture*, a married woman's legal and financial identity disappeared, and everything[11] she owned became her husband's property. [12]

Unmarried women faced their own challenges. A woman considered "past her prime"—usually between her mid to late twenties—was unfortunately labeled[13] a spinster, a term suggesting she had failed in her expected role.

Because women depended on marriage for social standing and financial security, those who never married relied upon relatives, such as brothers,[14] for support.

11. Which choice makes the sentence most grammatically acceptable?
    A. No Change
    B. disappeared, and,
    C. disappeared; and
    D. disappeared and

12. At this point, the writer is considering adding the following true sentence to clarify the term *coverture*:

    For example, a married woman could not sign contracts, file lawsuits, or control wages she earned.

    Should the writer make this addition?
    F. Yes, because it defines a legal term.
    G. Yes, because it provides examples illustrating the definition.
    H. No, because it introduces a counterargument.
    J. No, because it shifts the focus of the essay.

13. Which choice best maintains the formal and objective tone of the passage?
    A. No Change
    B. was labeled
    C. ended up being labeled
    D. got labeled

14. Which choice makes the sentence most grammatically acceptable?
    F. No Change
    G. relatives, such as brothers
    H. relatives such as brothers
    J. relatives such as, brothers

Men, meanwhile, often viewed marriage as a way to earn respect, achieve stability, and a well-behaved partner who would enhance their reputation. [15]

15. Which choice makes the sentence most grammatically acceptable?
    A. No Change
    B. earn respect, stability, and a well-behaved
    C. earn respect, achieve stability, and find a well-behaved
    D. respect, stability, and a well-behaved

Passage III

The Serve

[1]

[1] My grandfather used to take my family to a campground with cabins by the lake when I was young. [2] The campground also sold fishing bait and postcards near the entrance. [16] [3] The site had full amenities for campers, including a basketball court. [4] My sister and I loved basketball, so we immediately gravitated toward it. [5] The court could also be converted into a tennis court. [6] We were thrilled that we could play both sports just steps from our cabin. [17]

16. The writer is considering deleting the underlined sentence. Should the writer make this deletion?
    F. Yes, because it contradicts information given earlier about the campground's amenities.
    G. Yes, because it adds a detail that is not relevant to the paragraph's focus on the basketball and tennis courts.
    H. No, because it introduces a detail that helps the reader visualize the campground.
    J. No, because it explains why the family chose to stay in a cabin by the lake.

17. The writer wants to add the following sentence to this paragraph:

    My grandfather had been teaching us tennis for weeks.

    The sentence would most logically be placed:
    A. after Sentence 2.
    B. after Sentence 3.
    C. after Sentence 4.
    D. after Sentence 5.

[2]

We set up the court to play tennis, only to discover that my sister's racket had come partially unstrung. My grandfather knelt beside her and began working at restringing the racket. [18]

18. Which choice makes the sentence most grammatically acceptable?
    F. No Change
    G. working for
    H. work with
    J. working on

I stood about half a court away, eager to practice the serves I had been learning[19]. At fifteen, I felt confident in my growing skills and wanted to show off.

19. Which choice makes the sentence most grammatically acceptable?
A. No Change
B. tossing the ball into the air, eager to practice my serves
C. I eagerly tossed the ball into the air to practice my serves
D. the ball, eager to practice, was tossed

[3]

However[20], I bounced the ball, tossed it into the air, and swung what felt like the best overhead serve of my life. The instant my racket connected, I had a cold realization—too late—that I had aimed directly at my grandfather and sister.

20. Which transition word is most logical in context?
F. No Change
G. Next,
H. For example,
J. Similarly,

I could only watch[21] as the ball sailed through the air, knowing exactly where it was headed.

21. Which choice best emphasizes the narrator's fear?
A. I could only watch
B. I watched the ball
C. I could only watch helplessly
D. I saw the ball move

[4]

Thunk. The ball struck the back of my grandfather's neck at the base of his skull, and he collapsed onto the court. Time slowed as I froze, dropped my racket, and shouted his name. My sister screamed as the ball clattered away, going[22] toward the net.

22. Which choice best eliminates wordiness without losing meaning?
F. No Change
G. skittering
H. traveling
J. moving

[5]

I ran to him quickly and fast,[23] my chest tight and my hands shaking, calling "Papa" again and again. He didn't move.

23. Which choice best eliminates wordiness without losing meaning?
A. No Change
B. ran to him quickly
C. ran to him
D. ran fast quickly to him

For nearly a minute, he lay unconscious, and in that silence I felt a dread I had never known before. When he finally opened his eyes, I experienced another first: my grandfather swore. He was a man of immense self-discipline, and hearing him curse—something I had never heard before—made the moment feel even more surreal.

[6]

My sister and I wound up playing singles after that instead of doubles. Papa, understandably, decided to watch us from the sidelines on the other side of the chain-link fence.

[7]

That day changed how I saw my grandfather. Until then, he had always seemed steady and unbreakable, someone who could fix anything. Watching him lie there forced me to see him as human, and it taught me that carelessness, even when unintentional, has consequences.

24. Which choice makes the sentence the most grammatically acceptable?

F. No Change
G. For nearly, a minute he lay
H. For nearly a minute he, lay
J. For nearly a minute he lay

25. The writer wants to add a new sentence at the beginning of Paragraph 7 to clarify the main idea of the essay. Which choice would best accomplish that goal?

A. I will always remember that trip as the time I almost ruined our vacation
B. More than anything, that moment on the court taught me how fragile people could be.
C. I never thought tennis could be such a dangerous sport.
D. I still prefer basketball to tennis when I visit campgrounds today.

Passage IV

The Five Tribes

Oklahoma is home to a rich tapestry of Indigenous history and culture, which represents one of the most significant concentrations of Native American tribes in the United States. Today, 39 federally recognized tribes call Oklahoma home including the[26] Cherokee, Choctaw, Chickasaw, Muscogee (Creek), and Seminole Nations—often referred to collectively as the Five Tribes. These tribes, along with many others[27] have shaped the state's traditions, governance, and contributions to society.

Deeply intertwined with the era of forced removal in the 19th century, the story of Oklahoma's tribes tells of resilience.[28]

The Indian Removal Act of 1830 led to the infamous Trail of Tears during which thousands of Native Americans were displaced from their ancestral lands, and relocated[29] to what was then called Indian Territory.

26. Which choice makes the sentence most grammatically acceptable?
    F. No Change
    G. Today 39 federally recognized tribes call Oklahoma home, including
    H. Today, 39 federally recognized tribes call Oklahoma home, including
    J. Today 39 federally recognized tribes call Oklahoma home including,

27. Which choice makes the sentence most grammatically acceptable?
    A. No Change
    B. These tribes, along with many others,
    C. These tribes along with many others,
    D. These tribes; along with many others,

28. Which choice is clearest and most precise in context?
    F. No Change
    G. Deeply intertwined with the era of forced removal in the 19th century, Oklahoma's tribes tell a story of resilience.
    H. Oklahoma's tribes, deeply intertwined with the era of forced removal in the 19th century, tells of resilience.
    J. Oklahoma's tribes, deeply intertwined with the era of forced removal in the 19th century, tell a story of resilience.

29. Which choice makes the sentence most grammatically acceptable?
    A. No Change
    B. lands and relocated
    C. lands; and relocated
    D. lands relocated

Despite immense suffering and loss, these tribes rebuilt their communities, and they established schools, governments, and economies in their new homeland, which was a remarkable achievement that is impressive. [30]

Each tribe in Oklahoma maintains a distinct cultural heritage. The Cherokee Nation, for example, is renowned for its written language developed by Sequoyah, the Choctaw and Chickasaw peoples have preserved [31] oral traditions and ceremonial practices that date back centuries. Powwows, stomp dances, and storytelling remain vital expressions of identity, connecting [32] younger generations to their roots and preserving traditions.

Therefore, [33] Oklahoma tribes play a significant role today, both economically and politically.

At many powwows, vendors sell handmade jewelry and food to visitors from surrounding towns. [34] Tribal governments operate as sovereign nations managing healthcare systems, educational programs, and businesses that benefit both Native and non-Native communities alike. Casinos and tourism have become major economic drivers, but tribes also invest in cultural preservation, language revitalization, and environmental stewardship.

Challenges persist including efforts to protect treaty rights, address health disparities, and combat cultural erasure; however, tribes continue to demonstrate resilience

30. Which choice best eliminates wordiness without losing meaning?
    F. No Change
    G. was a remarkable achievement.
    H. was impressive and remarkable.
    J. was a remarkable achievement that impressed.

31. Which choice makes the sentence most grammatically acceptable?
    A. No Change
    B. Sequoyah, but the
    C. Sequoyah, so the
    D. Sequoyah, and the

32. Which choice makes the sentence most grammatically acceptable?
    F. No Change
    G. contacting
    H. covering
    J. changing

33. Which transition word is most logical in context?
    A. No Change
    B. However,
    C. In addition,
    D. Instead,

34. Given the focus of the paragraph, should this sentence be kept or deleted?
    F. Keep it, because it provides a specific example of cultural practices.
    G. Keep it, because it introduces the idea of local economic activity.
    H. Delete it, because it shifts focus away from tribal governments and their broader economic and political roles.
    J. Delete it, because it repeats information already provided in a previous paragraph.

and innovation. Initiatives such as language immersion schools and cultural centers ensure that traditions endure while advocacy for sovereignty strengthens tribal self-determination.

In essence, the Indigenous tribes of Oklahoma embody a legacy of perseverance and pride. Their contributions enrich the state's cultural landscape and remind us of the importance of honoring history while supporting the future of Native communities.

Question 35 asks about the preceding passage as a whole.

35. Suppose the writer's primary purpose had been to convince that the Native American tribes had been unfairly treated by white settlers. Would this essay accomplish that purpose?

A. Yes, because it explains the Trail of Tears that resulted in thousands of Native Americans being forcibly moved from their homelands.

B. Yes, because it explains how important powwows and stomp dances and storytelling remain and work to preserve traditions.

C. No, because Native Americans have enjoyed tourism and casinos and become wealthy because of the investment in these businesses.

D. No, because Native American communities educate their children in their native language and traditional customs.

Passage V

The Eastern Dragon

The Chinese dragon, called *loong* in China, has many animal characteristics. Images in early art and literature often show the dragon with the horns of a stag, the neck of a snake, the belly of a sea monster, the claws of an eagle, and the ears of an ox. 36

36. The writer wants to emphasize how the dragon's appearance combines features from many animals. If the writer were to delete the preceding sentence, the paragraph would primarily lose:

F. an explanation of the four theories about the dragon's origins.

G. specific visual detail illustrating how the dragon's appearance combines features from multiple animals.

H. a transition connecting the origin theories to the dragon's agricultural significance.

J. historical background on the development of early Chinese art.

There are four reliable[37] theories for how the *loong* came to be: first, it was a worshipped snake whose anatomy is a collage of otherworldly animals; second, it was a callback to the Chinese alligator found and respected in parts of China; third, it was a reference to thunder and a predictor of rain; and lastly, it was a by-product of nature worship.

37. Which choice is clearest and most precise in context?
A. No Change
B. prevailing
C. guaranteed
D. dependable

Most of these theories point to the dragon's supposed influence on water[38]. Because they were believed to be deities of that element, they became the farmer's symbol for a fruitful harvest.

38. The writer is considering deleting the underlined sentence. Should the writer make this deletion?
F. Yes, because it contradicts the theories listed in the first paragraph.
G. Yes, because the essay is primarily about the zodiac, not water.
H. No, because it provides a necessary transition between the theories and their agricultural significance.
J. No, because it suggests that dragons influence water.

Dragons are important to Chinese culture and are featured in their[39] zodiac calendar, which cycles every twelve years with a different animal, people[40] born in a dragon year are believed to be lucky. Dragons may only seem to be mythological creatures, but they are included in important festivals, like the Chinese New Year.

39. Which choice makes the sentence most grammatically acceptable?
A. No Change
B. its
C. they're
D. it's

40. Which choice makes the sentence most grammatically acceptable?
F. No Change
G. animal. People
H. animal; and people
J. animal people

Passage VI

Hurricane Laura

When my family and I moved to Louisiana, we bought an old house—one that was more than one hundred years old. It sat on the corner of two streets and was surrounded (41) by similar vintage homes. Our house became a kind of anchor for the neighborhood. We loved our house and our neighborhood. But like most things in life, there was a drawback to living on the Louisiana coast. Throughout the more than twenty years that we lived in that house, we experienced frequent severe and bad weather (42). Hurricanes forced us to evacuate several times during our early years. We had never suffered serious damage because we boarded our windows and secured anything that might blow away.

I did not realize until much later that its (43) fate that determines whose house survives and whose does not.

In the fall of 2020, Hurricane Laura—a Category 4 storm and the most powerful hurricane ever to make landfall in Louisiana—formed offshore. Being widowed the year before, (44) I was determined not to leave my house.

41. Which choice makes the sentence most grammatically acceptable?
    A. No Change
    B. is surrounded
    C. will be surrounded
    D. had been surrounded

42. Which choice best eliminates wordiness without losing meaning?
    F. No Change
    G. frequently experienced severe weather
    H. experienced weather that was severe and frequent
    J. experienced severe and frequently bad weather

43. Which choice makes the sentence most grammatically acceptable?
    A. No Change
    B. it's
    C. its'
    D. Delete underlined portion.

44. The writer is considering deleting the underlined phrase. Should the writer make this deletion?
    F. Yes, because the sentence would be grammatically incorrect without the phrase.
    G. Yes, because the information about being widowed is unrelated to the essay's focus on hurricanes and the fate of the house.
    H. No, because the phrase explains why the narrator prepared for the storm.
    J. No, because the phrase provides a necessary transition in the paragraph.

I made the preparations I knew I needed. I filled my car with gas, bought groceries and an extra bag of dog food, purchased plenty of water, checked my hurricane kit, gathered extra batteries for my flashlight, and boarded the large windows on the sun porch at the front of the house. The day before the storm arrived, my dog and I settled in for the duration.

But as the poet Robert Burns observed, "The best laid plans of mice and men often go awry." Late in the afternoon of the day the storm was predicted to make landfall, my nephew, who lived about fifty miles further inland with his wife, knocked on my door. When I opened it, he said, "Get your things. You're coming with me." I had not intended to leave, but he was insistent. I gathered a small bag and my dog and climbed into the cab of my nephew's Ford F-150 as they helped me lock up the house. I said goodbye, unsure whether I would see it again.

We arrived at his house shortly before the storm made landfall. The storm struck as predicted, delivering winds of up to 150 miles per hour and torrential rain. Objects that had not been secured—and even some that had—were blown away. My nephew his wife, my dog and I huddled on the floor of a central hallway, which was the only place without windows that was large enough to accommodate us. We listened to the wind and rain throughout the night.

The storm surge and winds wrought havoc, uprooting trees and ripping roofs from buildings near the house where we were sheltered. There was no electricity, and we used our flashlights sparingly, unsure how long it would be before power was restored.

Later that day, my nephew drove me the fifty miles back to my home. The journey revealed extensive devastation, and we maneuvered around pieces of people's houses

45. Which choice makes the sentence most grammatically acceptable?
A. No Change
B. bought groceries, an extra bag of dog food, and plenty of water, checked my hurricane kit, and gathered extra batteries
C. bought groceries and an extra bag of dog food, purchasing plenty of water, checked my hurricane kit, and gathering extra batteries
D. buying groceries and an extra bag of dog food, purchased plenty of water, checking my hurricane kit, gathered extra batteries

46. Which choice makes the sentence most grammatically acceptable?
F. No Change
G. them
H. he
J. him

47. Which choice makes the sentence most grammatically acceptable?
A. No Change
B. nephew, his wife, my dog, and I
C. nephew; his wife, my dog and I
D. nephew his wife; my dog, and I

48. Which choice makes the sentence most grammatically acceptable?
F. No Change
G. unsure of how
H. being unsure how
J. unsure about how

scattered across the road. When we arrived on my street—a street that had welcomed me for more than twenty years—I found that my house had not escaped unharmed. Part of the roof had been torn away; surprisingly, the windows remained intact. But the wind and water had left its calling card[49]. It was as if the storm had briefly lifted part of the roof, blew things around, dumped in a lot of rainwater and then decided to move on.

The damage was enough to make the house unlivable. Rather than spend my time, energy, and money repairing it, I chose to sell the house. I had done what I could to protect the house on Drew Street, just as I had done what I could to remain there. In the end, what remained was not loss itself but the cost of repairing the roof[50].

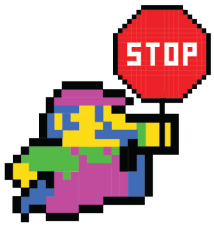
49. Which choice makes the sentence most grammatically acceptable?

A. No Change
B. left its calling card.
C. has left its calling card.
D. had left a calling card.

50. Which of the following choices best concludes the sentence and the essay?

F. No Change
G. the decision to sell the house on Drew Street.
H. the realization that Hurricane Laura caused widespread damage across Louisiana.
J. the understanding that even a well-lived life can require leaving.

You have reached the end of the English section. Pause your work now. If time is still available, check your answers for this section only.



MATHEMATICS TEST 1

50 minutes—45 Questions

Directions: Solve each problem and choose the correct answer. Don't spend too much time on problems. Solve as many as you can, then return to the ones you did not answer if you have time left for this test. You are allowed to use a calculator for any problems, but many will not need you to use one.

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

1. Illustrated figures are not 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. A small robot is placed on a standard (x, y) coordinate plane. The robot starts positioned at $(5, -3)$. The robot makes exactly 2 moves: first, horizontally in the negative x direction for 6 seconds at a speed of 0.5 coordinate units per second; then, vertically in the positive y direction for 4 seconds at the same speed. At what point is the robot located after these 2 moves?

   A. $(2, -1)$
   B. $(8, -1)$
   C. $(2, -5)$
   D. $(8, -5)$

2. For all nonzero values of x and y, which of the following expressions is equivalent to $\frac{21x^6y^4}{3x^3y}$?

   F. $7x^2y^4$
   G. $18x^3y^3$
   H. $7x^3y^3$
   J. $18x^2y^4$

3. Michael has started a new fitness program. On the first day of this new program, Michael runs 400 meters. Each successive day, he runs 100 meters more than the previous day. This is the only running Michael does each day. What is the total distance Michael runs by the end of day 10?

   A. 1,400 m
   B. 7,200 m
   C. 8,500 m
   D. 9,900 m

4. Of the 160 plots in a community garden, 5% of the plots are already assigned to a gardener. Of those not already assigned, 12 are being repaired due to hail damage from a recent storm. How many spaces are available because they are neither assigned nor being repaired?

   F. 112
   G. 116
   H. 128
   J. 140

DO YOUR FIGURING HERE

5. Ellie and Brittney started with 8 liters of motor oil to change the oil in their lawn mowers. During the morning, Ellie used 2 ½ liters of oil. In the afternoon, Brittney used 1 ¼ liters of oil. How many liters of oil were left when they finished?

   A. $4\frac{1}{4}$ liters

   B. $2\frac{1}{2}$ liters

   C. $3\frac{3}{4}$ liters

   D. $3\frac{1}{2}$ liters

6. A 153-ounce batch of liquid laundry detergent is used to create travel-sized bottles. Each travel-sized bottle consists of 2.8 ounces of detergent. This batch of detergent can make, at most, how many travel-sized bottles?

   F. 51
   G. 54
   H. 55
   J. 425

7. Which of the following matrices is equal to $\begin{bmatrix} -7 & 3 \\ 9 & -4 \end{bmatrix} + \begin{bmatrix} 8 & 5 \\ 1 & -3 \end{bmatrix}$?

   A. $\begin{bmatrix} -1 & 8 \\ 10 & -1 \end{bmatrix}$

   B. $\begin{bmatrix} 1 & 8 \\ 10 & -7 \end{bmatrix}$

   C. $\begin{bmatrix} -15 & -2 \\ 8 & -1 \end{bmatrix}$

   D. $\begin{bmatrix} -53 & -44 \\ 68 & 57 \end{bmatrix}$

8. In the standard (x,y) coordinate plane, what is the slope of the line through $(7, -3)$ and $(5, -6)$?

DO YOUR FIGURING HERE

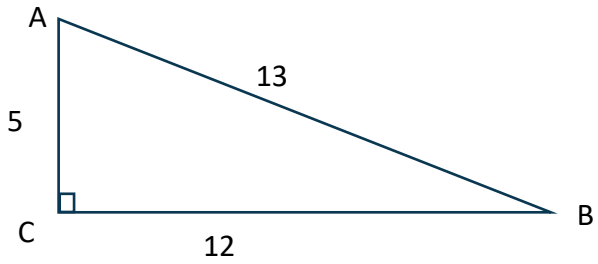
F. $-\frac{3}{2}$

G. $-\frac{2}{3}$

H. $\frac{2}{3}$

J. $\frac{3}{2}$

9. The lengths of the 3 sides of right triangle ΔABC shown are given in centimeters. What is $\cos A$?



A. $\frac{5}{12}$

B. $\frac{5}{13}$

C. $\frac{12}{13}$

D. $\frac{13}{5}$

10. What is the sum of the 2 solutions of the equation $x^2 - x - 42 = 0$

F. -6

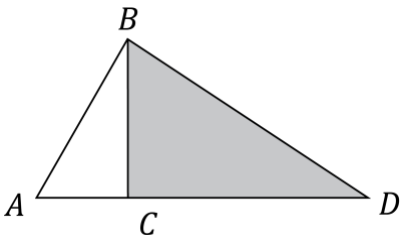
G. -1

H. 1

J. 7

DO YOUR FIGURING HERE

11. In the figure shown, C is on the segment with endpoints A and D. The distance between A and B is 2,000 km, between A and C is 1,600 km, between A and D is 2,500 km, and between B and C is 1,200 km. What is the distance, in kilometers, between B and D?

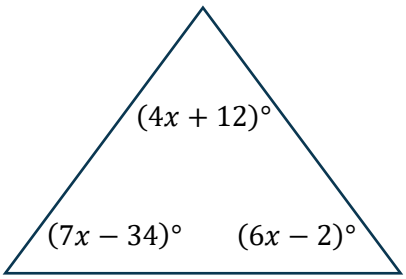


A. 900
B. 1200
C. 1500
D. $1500\sqrt{3}$

12. The lengths of the corresponding sides of two similar right triangles are in the ratio 3:4. The hypotenuse of the smaller triangle is 12 centimeters long. How many centimeters long is the hypotenuse of the larger triangle?

F. 12
G. 16
H. 36
J. 48

13. The degree measures of the three angles of the triangle shown are expressed in terms of x. What is the value of x?



A. 12°
B. 17°
C. 24°
D. 204°

14. In an arithmetic sequence, the 8th term (a_8) is 28, and the common difference is 3. What is the 1st term (a_1)?

F. 4
G. 7
H. 20
J. 25

DO YOUR FIGURING HERE

15. The equation $P = I^2R$ gives P, in terms of I and R. Which of the following expressions gives I in terms of P and R?

    A. $\frac{P}{R}$

    B. $\frac{R}{P}$

    C. $\sqrt{\frac{P}{R}}$

    D. $\sqrt{\frac{R}{P}}$

16. The area of a certain square is 1600 square centimeters. What is the perimeter of this square in centimeters?

    F. 40
    G. 80
    H. 120
    J. 160

17. Biologists are estimating the turtle population in Blue Lake. Earlier this spring, they captured, tagged, and released 168 turtles back into the lake. Last week, they captured a sample of 60 turtles and found 27 of them had tags from the earlier capture. The biologists estimate the lake's turtle population using the proportion shown. What is the biologists' estimate of the turtle population in the lake?

    $$\frac{Turtles\ tagged\ in\ capture\ 1}{Turtle\ population} = \frac{Turtles\ tagged\ in\ capture\ 2}{Turtles\ in\ capture\ 2}$$

    A. 270
    B. 336
    C. 373
    D. 420

18. The equation $\sqrt{x^2} \neq x$ is true for real numbers when

    F. x is negative
    G. x is positive
    H. x is irrational
    J. x is rational

19. For the mean of 12 numbers to decrease by 5, by how much would the sum of the 12 numbers have to decrease?

    A. 5
    B. 12
    C. 17
    D. 60

20. What value of x makes the equation $-\frac{1}{64} = -4^x$ true?

F. -3

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

H. $\frac{1}{3}$

J. 3

DO YOUR FIGURING HERE

21. A total of 31 students took a U.S. history test. All test scores were reported as integer values and each student received a score that differed from the others (i.e. no two students earned the same test score). The median test score was 76 points. How many students earned a test score that was greater than 76 points?

A. 15
B. 17
C. 23
D. 24

22. A pedometer is a device that counts the number of steps a person takes. If a pedometer records 4,963 steps taken by a person who covers a distance of 2.3 feet per step, how much distance did the person cover? Round your answer to the nearest 0.1 of a mile. (Note: 1 mile = 5,280 feet)

F. 0.4
G. 0.9
H. 2.2
J. 2.6

23. Among a group of 30 high school students, 18 play a sport, 13 are involved in performing arts (drama, band, choir, etc.), and 11 are involved in both. How many of the 30 students are not involved in sports or performing arts?

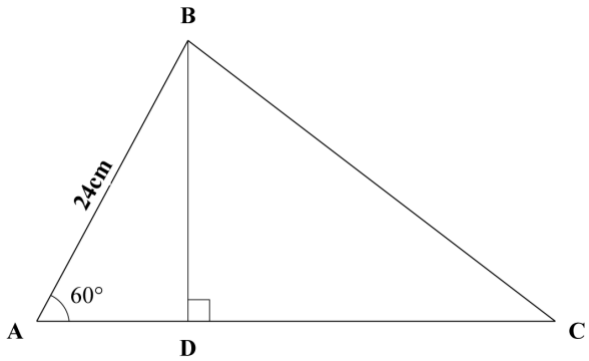
A. 1
B. 10
C. 12
D. 20

DO YOUR FIGURING HERE

24. Jordan buys her team coffee and donuts every Friday. Two Fridays ago, Jordan purchased 5 donuts and 2 coffees. The total cost was $18.20. Last Friday, she purchased only 9 donuts and the total was $16.20. Today, she has only $15 in cash to spend. Given that none of the prices have changed over the last 3 weeks, what is the maximum number of coffees she can purchase today? (Note: Assume no sales tax is charged.)

    F. 3
    G. 4
    H. 8
    J. 15

25. In ΔABC, shown in the figure, $\overline{BD}$ is an altitude, $\angle ABC$ is a right angle, $BA = 24$ centimeters, and the measure of $\angle BAC$ is 60°. What is the length of DC in centimeters?



    A. $12\sqrt{3}$
    B. 36
    C. $24\sqrt{3}$
    D. $36\sqrt{3}$

26. Which of the following is an equation of the circle in the standard (x, y) coordinate plane whose center is at $(-8, 7)$ and has a radius length of 4 coordinate units?

    F. $(x-7)^2 + (y+8)^2 = 16$
    G. $(x-8)^2 + (y+7)^2 = 16$
    H. $(x+8)^2 + (y-7)^2 = 4$
    J. $(x+8)^2 + (y-7)^2 = 16$

27. For the polynomial functions f and g, where $f(x) = x^2 + 5x + 7$ and $g(x) = x^2 - 7x + 2$. Let $h(x) = f(x) - g(x)$. What is $h(4)$?

    A. -3
    B. 33
    C. 53
    D. 56

28. Given the functions $f(x) = x^2 - 2$ and $g(x) = x - 5$, which of the following expressions is $f(g(x))$?

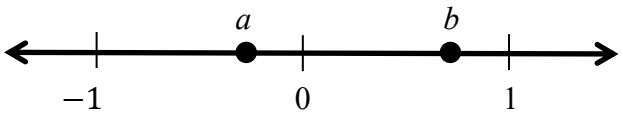
DO YOUR FIGURING HERE

F. $x^2 - 7$
G. $x^2 - 10x + 23$
H. $x^2 + x - 7$
J. $x^3 - 5x^2 - 2x + 10$

29. Given that the equation $\frac{3x-2y}{5x-3y} = \frac{3}{7}$ is true, what is the value of $\frac{x}{y}$?

A. $\frac{-23}{36}$
B. $\frac{3}{7}$
C. $\frac{1}{2}$
D. $\frac{5}{6}$

30. A number line graph includes the points at real numbers a and b, as shown. Which of the following inequalities is valid?



F. $ab < -1$
G. $b < a$
H. $ab < 0$
J. $0 < ab$

31. For real numbers x and y such that $0 \leq x \leq 7$ and $y \geq 4$, the expression $\frac{x+y}{y}$ can have which of the following values?

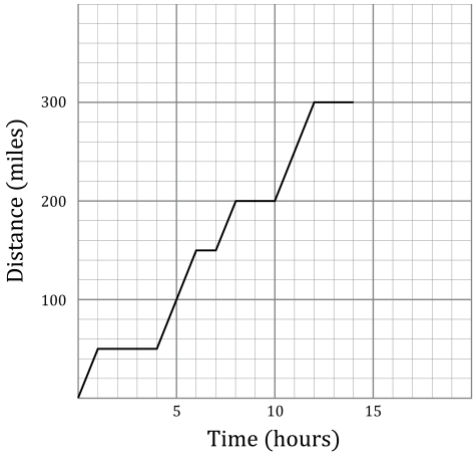
A. 0
B. $\frac{3}{4}$
C. $\frac{9}{4}$
D. $\frac{13}{4}$

32. What is the amplitude of the function $y = 4\cos(2x - 1)$?

F. $-\frac{1}{3}$
G. -1
H. 2
J. 4

33. Charlie traveled to 4 locations during a workday. Charlie remained at each location a whole number of hours. The graph shows the relationship between the time in hours in his workday and total distance in miles traveled. Which of the following values is closest to the average speed in miles per hour when Charlie was traveling?

DO YOUR FIGURING HERE



A. 25
B. 50
C. 60
D. 300

34. For all nonzero values of x, which of the following expressions is equivalent to $\frac{7}{x} + \frac{4}{x^2}$?

F. $\frac{11}{x+x^2}$

G. $\frac{7x+4}{x^2}$

H. $\frac{9}{x}$

J. $\frac{11x}{x^2}$

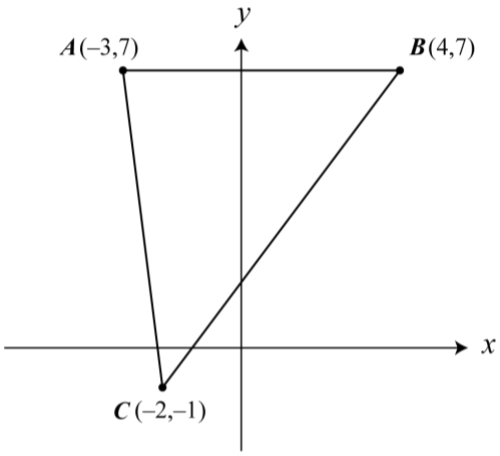
35. Jennifer's course grade in her Intro to Statistics class is based on three tests and one final exam. Each of the three test scores is worth 20% of the course grade, and the final exam score is worth 40% of the course grade. Her three test scores are 82%, 71%, and 81%. What is the minimum score that she will have to earn on the final exam to receive a course grade of at least 80%?

A. 72%
B. 80%
C. 83%
D. 86%

DO YOUR FIGURING HERE

36. The triangle shown has vertices $A(-3, 7)$, $B(4, 7)$ and $C(-2, -1)$. What is the area?

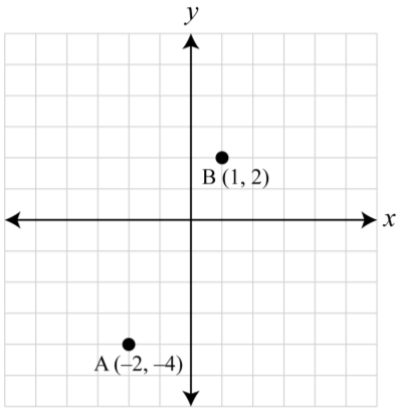
F. 24.5
G. 28
H. 49
J. 56



37. One car's turn signal flashes every 6 seconds, and another car's turn signal flashes every 16 seconds. At a certain point, the two car's turn signals flash at the same time. How many seconds elapse until the two signals next flash at the same time?

A. 3
B. 7
C. 48
D. 96

38. In the standard (x, y) coordinate plane two points are shown, $A(-2, -4)$, and $B(1, 2)$. The segment $\overline{AB}$ divides $\overline{AC}$ so that the ratio $AB:BC$ is 1:2 . What are the coordinates of point C?



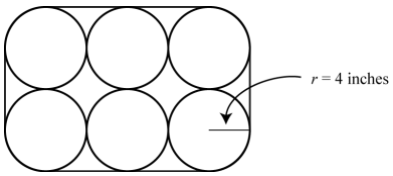
F. (7, 14)
G. (4, 8)
H. (13, 8)
J. (7, 5)

K20 LEARN ACT CHALLENGE
Next Page

DO YOUR FIGURING HERE

39. A plumber uses a metal strap to bundle 6 identical pipes together in a 2 x 3 rectangle as shown below. Each pipe has a radius of 4 inches. What is the length, to the nearest inch, of the shortest strap that will wrap around the 6 pipes without overlap?

    A. 48
    B. 73
    C. 89
    D. 105



40. Given that b is rational and $i = \sqrt{-1}$, the product of the expression $(5 - bi)$ and which of the following expressions must be a rational number?

    F. bi
    G. $5bi$
    H. $5 + bi$
    J. $5 - bi$

41. For positive integers x and y where $x < 25$, and $\log_x 25 = y$. Which of these is a possible value of y?

    A. 1
    B. 2
    C. 3
    D. 5

42. For all positive integers x, which of the following expressions is equivalent to $(x^{\frac{1}{3}})(x^{\frac{3}{4}})$?

    F. $\sqrt[12]{x^3}$
    G. $\sqrt[7]{x^4}$
    H. $\sqrt[12]{x^{13}}$
    J. $\sqrt[13]{x^{12}}$

43. The sides of an acute triangle measure 14 cm, 16 cm, and 19 cm. The measure of the smallest angle of the triangle is a solution for A to which of the following equations?

    A. $14^2 = 16^2 + 19^2 - 2(16)(19)\cos A$
    B. $14^2 = 16^2 + 19^2 - 2(16)(19)\sin A$
    C. $16^2 = 14^2 + 19^2 - 2(14)(19)\cos A$
    D. $16^2 = 14^2 + 19^2 - 2(14)(16)\sin A$

44. Set Q and set R each consists of 9 distinct numbers. The 2 sets contain identical numbers with the exception of the number with the greatest value in each set. The number with the greatest value in set R is less than the number with the greatest value in set Q. The value(s) of which of the following measures must be greater for set Q than for set R?

F. Just the mean
G. Just the median
H. Just the range
J. The mean and the range

DO YOUR FIGURING HERE

45. Of the 14 cars on a rental-car lot, 5 are Teslas, 6 are Mercedes, and 3 are Jaguars. Sharon will rent 3 of these cars chosen at random for business associates. What is the probability that Sharon will rent 1 of each of the 3 types of cars?

A. $\frac{1}{3}$
B. $\frac{45}{182}$
C. $\frac{45}{364}$
D. $\frac{15}{364}$

You have reached the end of the Math section. Pause your work now. If time is still available, check your answers for this section only.



READING TEST

40 minutes – 36 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. You may refer to the passages as often as necessary.

Passage I

LITERARY NARRATIVE: This passage is adapted from the novel *Frankenstein; or, The Modern Prometheus* by Mary Shelley (© 1818 Mary Shelley).

It was on a dreary night of November that I beheld the accomplishment of my toils. With an anxiety that almost amounted to agony, I collected the instruments of life around me, that I might infuse a spark of being into the lifeless thing that lay at my feet. It was already one in the morning; the rain pattered dismally against the panes, and my candle was nearly burnt out, when, by the glimmer of the half-extinguished light, I saw the dull yellow eye of the creature open; it breathed hard, and a convulsive motion agitated its limbs.

How can I describe my emotions at this catastrophe, or how delineate the wretch whom with such infinite pains and care I had endeavored to form? His limbs were in proportion, and I had selected his features as beautiful. Beautiful! Great God! His yellow skin scarcely covered the work of muscles and arteries beneath; his hair was of a lustrous black, and flowing; his teeth of a pearly whiteness; but these luxuriances only formed a more horrid contrast with his watery eyes, that seemed almost of the same color as the dun-white sockets in which they were set, his shriveled complexion and straight black lips.

The different accidents of life are not so changeable as the feelings of human nature. I had worked hard for nearly two years, for the sole purpose of infusing life into an inanimate body. For this I had deprived myself of rest and health. I had desired it with an ardor that far exceeded moderation; but now that I had finished, the beauty of the dream vanished, and breathless horror and disgust filled my heart.

Unable to endure the aspect of the being I had created, I rushed out of the room and continued a long time traversing my bedchamber, unable to compose my mind to sleep. At length I threw myself on the bed in my clothes, endeavoring to seek a few moments of forgetfulness. But it was in vain; I slept, indeed, but I was disturbed by the wildest dreams. I thought I saw Elizabeth, in the bloom of health, walking in the streets of Ingolstadt. Delighted and surprised, I embraced her, but as I imprinted the first kiss on her lips, they became livid with the hue of death; her features appeared to change, and I thought that I held the corpse of my dead mother in my arms.

I started from my sleep with horror; a cold dew covered my forehead, my teeth chattered, and every limb became convulsed; when, by the dim and yellow light of the moon, as it forced its way through the window shutters, I beheld the wretch—the miserable monster whom I had created. He held up the curtain of the bed; and his eyes, if eyes they may be called, were fixed on me. His jaws opened, and he muttered some inarticulate sounds, while a grin wrinkled his cheeks. He might have spoken, but I did not hear; one hand was stretched out.

I escaped, and rushed downstairs. I took refuge in the courtyard, belonging to the house which I inhabited; where I remained during the rest of the night, walking up and down in the greatest agitation, listening attentively, catching and fearing each sound as if it were to announce

the approach of the demoniacal corpse to which I had so miserably given life.

I remained for several days in a state of utter exhaustion and fever. At length, a gentle voice soothed me—I turned, and saw Henry Clerval. He had come to the university to begin his studies and, finding me in this condition, nursed me with the greatest kindness.

"My dear Frankenstein," he said, "how glad I am to see you recover! You have been ill for weeks. Do you not remember me?"

I grasped his hand. "Have I indeed been so long unconscious? You have restored me to life, Henry."

He smiled. "You will soon be well again. You must not speak of what you have suffered until you are strong. I will not ask you to explain anything now."

As I began to recover, Henry endeavored to divert my mind from the dark impressions I could not explain. He brought books, spoke of home, and described the new professors he had met. Still, every time he mentioned scientific studies, I shuddered involuntarily. The name of chemistry or natural philosophy filled me with dread.

"I see you are not yet yourself," he said gently. "Let us not speak of science. You will be well again soon."

His words brought me momentary relief. Yet in the stillness of night, I would often wake in terror, my imagination conjuring the monster's face—his yellow eye, his twisted lips. I dared not confess what I had done.

Shelley , M. (1818). Frankenstein; or, the Modern Prometheus. Frankenstein | Project Gutenberg. https://www.gutenberg.org/files/84/84-h/84-h.htm#chap09

1. Which statement best expresses the central idea of the passage?

   A. Frankenstein's ambition leads to unexpected emotional turmoil.
   B. Frankenstein's success brings lasting satisfaction and pride.
   C. Frankenstein's exhaustion prevents him from appreciating his achievement.
   D. Frankenstein's work fulfills his dream without consequence.

2. In lines 16-26, the narrator's tone in describing the creature's appearance is best described as:

   F. admiring and awe-struck.
   G. curious and observant.
   H. conflicted and repulsed.
   J. disgusted but impressed.

3. As used in the passage, the phrase "the beauty of the dream vanished" (line 34) most nearly means:

   A. the dream ended abruptly when Frankenstein fell asleep.
   B. Frankenstein's original motivation had changed.
   C. the hope and ambition behind the project disappeared.
   D. the creature turned out ugly.

4. In the description of Frankenstein's dream (lines 43-50), the transformation of Elizabeth into his dead mother serves to:

   F. reveal Frankenstein's longing for family approval.
   G. foreshadow the creature's violent future.
   H. emphasize the scientific success of the experiment.
   J. suggest Frankenstein's guilt and emotional confusion.

5. Why does the author include the detailed physical description of the creature ("His yellow skin scarcely covered… straight black lips") in the third paragraph (lines 13-26)?

   A. To emphasize Frankenstein's emotional shift from admiration to horror.
   B. To highlight the scientific precision Frankenstein used when constructing the creature.
   C. To explain why the creature would later be rejected by society.
   D. To suggest that the creature's beauty is misunderstood by others.

6. What does the line "You have restored me to life, Henry" (lines 81-82) most likely suggest about Frankenstein's emotional state?

   F. He is physically revived but mentally unchanged.
   G. He feels genuine joy at seeing the creature again.
   H. He no longer wishes to continue his education.
   J. He views Henry's arrival as a kind of salvation.

7. As used in the passage, the word "delineate" (line 14) most nearly means:

   A. erase or remove completely.
   B. describe or portray precisely.
   C. criticize harshly.
   D. indicate the exact position of.

8. Which statement best describes how the passage develops a theme about ambition?

   F. Frankenstein's ambition isolates him from others and leads to regret.
   G. Frankenstein's ambition earns him admiration and lasting success.
   H. Frankenstein's ambition strengthens his friendships and sense of purpose.
   J. Frankenstein's ambition results in scientific progress without personal cost.

9. Given what we have read so far in the passage, what does the author suggest about human nature through Frankenstein's abandonment of the creature?

   A. Individuals are responsible for their own isolation.
   B. People instinctively fear what they do not understand.
   C. Human beings are naturally drawn to physical beauty.
   D. Society values scientific achievement over emotional connection.

Passage II

INFORMATIONAL: This passage is adapted from the article *What is a haboob? The science behind the dust blob that swallowed Phoenix* by Domonique Tolliver, published on August 26, 2025, for National Geographic.

On a hot summer afternoon in Phoenix, Arizona, the sky can change in an instant. What begins as a distant cloud on the horizon can quickly transform into a towering wall of dust—what meteorologists call a *haboob*. One such storm swept through the city in August of 2025, plunging neighborhoods into near-total darkness, cutting power for more than 60,000 people, and diverting planes to airports outside the area.

But what exactly is a haboob? A haboob is a formidable meteorological phenomenon characterized by immense walls of dust generated by the collapse of intense thunderstorms. When rain-cooled air plunges rapidly toward the surface, the resulting gust strikes the ground with tremendous force, dispersing outward in all directions propelling loose sediment and particulate matter into the air. These dust-laden storms can extend across dozens of miles and rise thousands of feet into the atmosphere, forming a dense, shifting barrier that dramatically reduces visibility. Depending on terrain, they may travel hundreds of miles before dissipating.

"A haboob is a dust storm, but not all dust storms are categorized as haboobs," explains Sean Benedict, lead meteorologist at the National Weather Service in Phoenix. Most dust storms in the American Southwest qualify as haboobs, he says, due to their distinct mechanisms of formation, their dramatic visual characteristics, and their tendency to persist for extended periods of time. The word itself comes from the Arabic word *hab*, meaning "to blow," and has been formally adopted within the meteorological community for nearly a century.

The American Southwest is particularly susceptible to haboobs because of the North American monsoon, a seasonal reconfiguration of regional atmospheric circulation. During the summer months, high temperatures shift wind patterns, drawing substantial moisture from the Pacific Ocean and the Gulf of California into the interior. This influx of humidity increases the frequency and intensity of convective activity, resulting in more thunderstorms and subsequent rainfall across Arizona and New Mexico.

When thunderstorms develop, they generate powerful vertical air currents known as *updrafts*. These rising columns of air can be strong enough to suspend substantial volumes of water. Sometimes, the internal air mass cools abruptly, weakening the updraft. When the upward motion weakens, the storm can no longer hold all the moisture and the precipitation descends rapidly toward the surface. When this falling air intensifies and descends with exceptional force before striking the ground and spreading out, the phenomenon is classified as a *downburst*.

Downbursts can produce wind velocities ranging from 50 to 80 miles per hour, and in some instances, large convective storm complexes release successive bursts of this kind. These powerful downdrafts spread laterally with considerable force. In arid regions where soil is loose and desiccated, the winds lift not only fine *particulates* but small rocks and sediment, dislodging all materials with a cascading effect. The cyclical process of particle uplift and rebound is called *saltation*. Saltation serves as the fundamental mechanism by which the towering dust walls characteristic of haboobs are formed.

Some areas, such as the I-10 pathway between Phoenix and Tuscon, are highly susceptible to dust accumulation, making it a common area for haboobs.

Haboobs are not only scary in appearance, they pose serious health concerns, such as increasing the risk of respiratory infections. The strong winds can stir up spores of Coccidioides, the fungus that causes Valley Fever. People who inhale the spores may become sick and experience pneumonia-like symptoms, such as fatigue, cough, fever, and shortness of breath. Around 20,000 cases of Valley Fever are reported annually in the U.S., typically in Arizona and California. Not everyone who breathes in the spores falls ill; however, people with weakened immune systems are especially vulnerable. Rates of Valley Fever are highest among people 60 years and older and account for 15-30% of community-acquired pneumonia in Phoenix and Tucson metropolitan areas.

Dust generated by haboobs can also contain hazardous contaminants. Abandoned or legacy mines scattered across the American Southwest often harbor residual heavy metals such as lead and arsenic, which can be stirred up by a haboob. When precipitation follows a haboob, rainfall will clear out the contaminated particles from the air, reducing exposure. However, if raindrops evaporate before reaching the surface, particles may remain suspended for extended periods, where inhalation over time can contribute to respiratory or cardiovascular health risks.

To mitigate danger during such events, people should adhere to recommendations during dust advisory or warnings in their area. Avoid travel during conditions conducive to haboob formation. If you are caught on the roadway, exit, but follow a path that leaves shoulders or emergency passages open. Remain in your vehicle with your seat belt fastened and wait until visibility improves and the storm has dissipated.

For individuals sheltering indoors, high-efficiency particulate air (HEPA) filtration systems can help reduce exposure to fine dust and other airborne contaminants stirred up by a haboob. For those who must venture outdoors during, or just after a storm, the use of well-fitted protective masks provide a layer of protection against inhalation of hazardous matter. Prolonged exposure to airborne pollutants can exacerbate existing health concerns. Adopting protective measures can reduce the risks posed by one of the desert's most dramatic natural phenomena.

Tolliver, D. (2025, August 26). *What is a haboob? The science behind the dust blob that swallowed Phoenix*. National Geographic. https://www.nationalgeographic.com/environment/article/haboob-dust-storm

10. The main purpose of the passage is to:

F. describe the formation process and health effects of haboobs.
G. summarize only the effects of changes in weather patterns.
H. argue for the importance of meteorology to public health and safety.
J. explain why haboobs only form in one region of the U.S.

11. Why is the American Southwest particularly vulnerable to haboobs?

    A. The area is prone to intense storms and high-velocity downbursts.
    B. There is a regional shift in atmospheric circulation during the summer months.
    C. Lack of rain causes the soil to be very dry, loose, and full of fine particulates.
    D. Storms here often hold dust and particles for extended periods.

12. As it is used in line 11, the term "formidable" most nearly means:

    F. intimidating and awe-inspiring
    G. impressive and threatening
    H. strong and powerful
    J. dynamic and persistent

13. As it is described in the passage, rainfall after a haboob results in:

    A. an increase of fungal spores in the air
    B. reduced exposure to contaminated particles in the air
    C. decreased intensity of thunderstorms
    D. increased risk for flooding

14. Based on the information in lines 65-73, which conditions are necessary for a haboob to form?

    F. Successive wind bursts.
    G. Shifting wind patterns.
    H. Loose soil and fine particulates.
    J. Substantial volumes of water.

15. Which of the following best captures the shift in tone from the first paragraph to the second?

    A. The tone shifts from emotional to factual.
    B. The tone shifts from persuasive to explanatory.
    C. The tone shifts from informational to analytical.
    D. The tone shifts from sensory to scientific.

16. Which of the following details best supports the author's claim in line 31 that a haboob is a "dramatic" phenomenon?

    F. Contaminated dust in haboobs can pose serious health concerns.
    G. Strong thunderstorms are needed to produce a haboob.
    H. The dust in a haboob is made up of loose and desiccated soil.
    J. The quick transformation of the horizon can change into a towering wall of dust.

17. The main purpose of paragraph 5 (lines 48-59) is to:

    A. present the relationship between updrafts and downbursts.
    B. introduce the role of precipitation in haboobs.
    C. emphasize the importance of vertical air currents during thunderstorms.
    D. explain why haboobs are rare.

18. How does the passage contrast the reduction in visibility with other dangers caused by haboobs?

F. Loss of visibility is dangerous, but health risks only affect those with pre-existing conditions.
G. Loss of visibility ends after the storm passes, but health risks only disappear after precipitation.
H. Loss of visibility is immediate, but health risks may develop slowly due to repeated exposure.
J. Loss of visibility is temporary, but health risks are permanent and irreversible.

Passage III

INFORMATIONAL: Passage A is adapted from the book *Psychology and Industrial Efficiency* (by Hugo Münsterberg). Passage B is adapted from the article "An attention economic perspective on the future of the information age" (by Hendriks Vettehen).

Passage A by Hugo Münsterberg

One of the most significant discoveries in psychology is the power of attention and suggestion. These forces shape not only individual behavior but also influence society as a whole.

Attention is the process by which the mind focuses on certain objects or ideas while ignoring others. In everyday life, attention determines what we notice, remember, and act upon. For example, a student in a classroom may hear many sounds—the ticking of a clock, the shuffling of papers, the teacher's voice—but only the teacher's words are attended to, while the rest fade into the background. This selective focus allows people to function effectively in complex environments.

The power of suggestion is closely related to attention. Suggestion refers to the process by which an idea is introduced into the mind and, by being attended to, influences thought or action. This can happen in many ways, both consciously and unconsciously. For instance, an advertisement may suggest that a product is superior, and through repetition, the person may come to believe it without critical examination.

Psychologists have also studied the effects of suggestion in groups. When people are part of a crowd, they are often more susceptible to suggestions from others. This is because attention is directed toward the actions and emotions of the group, which can override individual judgment. For example, in a theater, if one person starts to applaud, others may quickly join in, even if they were not initially inclined to do so. The suggestion to applaud becomes more powerful as more people participate.

Attention and suggestion also play a role in education. Teachers are aware that students learn best when their attention is fully engaged. Techniques such as storytelling, questioning, and the use of visual aids are all designed to capture and hold students' attention. Suggestions from teachers—such as encouragement or the expectation of success—can shape students' attitudes and achievements.

In summary, attention and suggestion are powerful forces in human life. They influence how people perceive the world, interact with others, and make decisions. By studying these processes, psychology helps individuals and society understand the hidden currents that guide behavior. With this knowledge, people can strive to direct their attention wisely and be mindful of the suggestions they accept.

Passage B by Hendricks Vettehen et al.

A development that is intrinsically related to the information age concerns the rise of what became known in the late 1990s as the "attention economy," in which a person's attention is the most valuable limited resource that advertisers compete to capture and sell, as opposed to previous eras, when information itself was a scarce resource that companies sought to control and distribute. One mechanism that can help us understand a wide variety of current and future trends in our societies is a

spiral of attention scarcity in which attention-grabbing efforts induce attention scarcity, which in turn induces more attention-grabbing efforts, and so on.

Central to the concept of the attention economy are two basic insights about our human nature: humans are both natural-born attention seekers and natural-born attention givers. Our ability to pay attention to stimuli is limited by our biological design. The existence of these natural limits complicates the exchange of attention that takes place in communication processes. The demand for attention may theoretically be increased almost limitlessly. However, the supply of attention is constrained by our biological givens—we cannot expand our brain capacity. When the demand for attention by attention seekers exceeds the supply of attention available from attention givers, an attention economy arises, where attention becomes the principal scarce resource being competed for.

This competition for attention has transformed our media environment in predictable ways. Although humans may intentionally direct their attention to particular stimuli, attention is more often automatically triggered by certain characteristics of the information environment. Communicators exploit these automatic responses by designing content that targets our innate attention triggers, such as novelty, emotional intensity, and social relevance. As a result, media messages have become more tailored to personal interests, more emotionally provocative, faster-paced, and more intrusive.

The result is an information landscape that grows progressively harder to ignore.

These patterns of media consumption create serious problems for how we process information and acquire knowledge. In many areas of life, possessing relevant knowledge is crucial, particularly for citizens in a democracy. However, deriving knowledge from information requires sustained attention, especially when processing complex material. Unfortunately, both the trend toward attention-grabbing content and inattentive media use compromise our ability to think deeply about information.

Research demonstrates that fast-paced, emotionally arousing content becomes more difficult to process accurately. Similarly, inattentive media consumption—such as multitasking or rapid scrolling—creates an illusion of learning while actually reducing comprehension and memory. Studies show that people who consume media inattentively believe they have learned significantly more than they actually have.

Following psychological models that distinguish between careful, analytical thinking and quick, intuitive responses, we can predict broader consequences. When attention becomes scarce, people rely more heavily on mental shortcuts and first impressions rather than careful analysis. This shift promotes errors in reasoning, increases susceptibility to misinformation, and leads to systematic misperceptions about the world.

The attention economy thus creates a troubling cycle: as information producers compete more intensely for our limited attention, they design content that is increasingly difficult to ignore but also increasingly difficult to process thoughtfully. Meanwhile, overwhelmed by information, we develop consumption habits that feel efficient but actually undermine our

ability to understand and remember what we encounter.

Münsterberg, H. (1913). *Psychology and Industrial Efficiency*. Project Gutenberg. https://www.gutenberg.org/ebooks/15154

Vettehen, P. H., & Schaap, G. (2023). An attention economic perspective on the future of the information age. *Futures*, *153*, 103243.

19. According to Passage A, attention is best described as:

    A. a biological function that operates independently of conscious control.
    B. the ability to process multiple sources of information simultaneously.
    C. a learned behavior that develops through repeated exposure to stimuli.
    D. the process by which the mind focuses on certain objects while ignoring others.

20. Passage A indicates that suggestion differs from simple attention in that suggestion:

    F. requires more cognitive effort to process information effectively.
    G. only occurs in educational settings where teachers guide student learning.
    H. introduces ideas into the mind that can influence actions without critical examination.
    J. depends entirely on the willingness of individuals to accept new information.

21. The main purpose of Passage A is to:

    A. critique the limitations of early psychological research methods.
    B. explain how attention and suggestion function as psychological forces in human life.
    C. compare the effectiveness of different teaching strategies in classrooms.
    D. argue that group dynamics always override individual decision-making.

22. Passage A suggests that when people are part of a crowd in a theater, the power of suggestion becomes more potent because:

    F. individual judgment becomes less dominant as group emotions and actions take over.
    G. people in theaters are more intellectually engaged than in other settings.
    H. the physical darkness of the theater enhances cognitive processing.
    J. theatrical performances provide more accurate information than other media.

23. As it is used in Passage B (line 101), the word "innate" most nearly means:

    A. learned through experience.
    B. natural or inborn.
    C. consciously controlled.
    D. recently developed.

24. Based on Passage B, attention economics in the digital age primarily concerns:
    F. the historical development of psychological theories.
    G. how modern technology and media are designed to capture and hold human attention.
    H. the economic impact of declining literacy rates among students.
    J. the benefits of traditional classroom instruction over digital learning.

25. According to Passage B, how do communicators take advantage of automatic attention responses?
    A. They rely on humans to intentionally seek novelty and emotional intensity.
    B. They design content that activates automatic attention triggers.
    C. They reduce the amount of automatic attention triggers to encourage focus.
    D. They replace automatic attention responses with intentional ones.

26. Both passages are primarily concerned with:
    F. explaining how attention functions and can be influenced.
    G. criticizing the negative effects of group behavior on individuals.
    H. advocating for traditional educational methods over modern approaches.
    J. documenting the history of psychological research.

27. Based on both passages, the authors would most likely agree that:
    A. people can be led to accept ideas without carefully evaluating them.
    B. people in crowds are more easily influenced than people acting alone.
    C. people who consume media inattentively tend to overestimate how much they have learned.
    D. people generally recognize when their attention is being manipulated.

Passage IV

INFORMATIONAL: This passage is based on information from the article *Julius Caesar* by Joshua J. Mark, published on April 28, 2011, for World History Encyclopedia.

Born in 100 BCE, Julius Caesar would become one of Rome's most powerful—and controversial—leaders of his time. Known for his ambition, political skill, and military success, Caesar rose steadily through Roman society. Though remembered for his dramatic fall, his early life reveals how deeply Rome's political instability shaped his rise to power.

When Caesar was born, Rome was already under great strain. The Roman Republic, once governed by shared authority and tradition, was increasingly divided by class conflict and military ambition. Caesar belonged to the patrician class—Rome's ruling elite. Patricians held political offices and social privileges, while plebeians—free citizens who made up the majority of the population—had little access to power. This division influenced nearly every aspect of Roman public life.

In 90 BCE, when Caesar was still a child, unrest spread across Italy. Rome's former allies revolted in what became known as the Social War (91–88 BCE). These allies had fought in Roman armies for generations but had been repeatedly denied Roman citizenship. Without the rights of citizens, they had no legal protection or political voice. Eventually, the socii rose up against the ruling patricians. Rome responded by sending legions to suppress the rebellion, but the cost of the conflict forced the Republic to grant citizenship to many Italian communities. Although the war ended, the Republic remained unstable.

Soon after the war ended, Rome faced another crisis as two generals, Gaius Marius and Lucius Cornelius Sulla, competed for control. Marius, a popular leader, drew support from the plebeians and newly enfranchised citizens. His reforms allowed landless men to serve in the army, binding soldiers' loyalty to commanders rather than the Senate. Sulla, representing the traditional aristocracy, opposed these changes. Their rivalry escalated into violence when Sulla led his army into Rome—an unprecedented act that shattered long-standing political norms.

Caesar's own family reflected both privilege and decline. Though patrician, the family had lost much of its wealth and influence. His father, Gaius Julius Caesar the Elder, served as a praetor, a senior magistrate who oversaw the courts, but he died suddenly when Caesar was young. Left to raise their children alone, Caesar's mother, Aurelia, played a central role in his upbringing. Well educated and politically aware, she ensured her son received instruction in rhetoric, literature, and civic life—skills essential for success in Roman politics.

In 84 BCE, Caesar married Cornelia, the daughter of Lucius Cinna, a powerful political figure allied with Marius. The marriage strengthened Caesar's political connections, but it also placed him in danger when Sulla seized control of Rome. Sulla ordered Caesar to divorce Cornelia. Caesar refused, defying the dictator and risking his life. Forced to flee Rome, he lived in hiding until Sulla eventually relented and allowed his return. The experience taught Caesar the consequences of political power and personal loyalty.

As time passed, Caesar carefully rebuilt his position through military service and public office. In 60 BCE, he formed the First Triumvirate with Pompey and Crassus, an

informal alliance that dominated the Roman government. Caesar's military campaigns expanded Roman territory and earned him widespread support among soldiers and citizens alike. As his power and popularity increased, tensions grew between Caesar, the Senate, and Pompey.

When ordered by the Senate to surrender his command, Caesar refused and led his army into Rome, echoing Sulla's earlier actions. This decision marked the effective end of the Roman Republic. Returning triumphantly to Rome, the champion of the armies he had led, in 44 BCE, Caesar was named dictator for life. This appointment affirmed everything that the Romans detested. Rome had steadfastly spoken against the concept of a "king," and this lifetime appointment seemed to contradict this belief. Fearing the loss of republican government, a group of senators plotted to assassinate him. On March 15, the Ides of March, a group of about 40 senators, called the Liberators, led by Marcus Brutus and Cassius Longinus, attacked Caesar in the Senate, stabbing him 23 times. When he died, he supposedly spoke the famous last words, "Et tu, Brute?" This phrase ("You too, Brutus?") illustrated his absolute shock that his former friend and devoted follower, Brutus, had perpetrated one of the most famous betrayals of all time.

Although Caesar enacted reforms that benefited ordinary citizens and weakened entrenched inequality, his concentration of power had destabilized the Republic. His life demonstrates how ambition, talent, and political instability combined to transform Rome—and how the Republic's weaknesses enabled individual power to rise above shared rule.

Mark, J.J. (2011, April 28). *Julius Caesar*. World History Encyclopedia. https://www.worldhistory.org/Julius_Caesar/

28. The primary purpose of the passage is to:

F. argue that Julius Caesar was responsible for the collapse of Roman democracy.
G. describe how Rome's social class divisions created permanent instability.
H. explain how Julius Caesar's early life was shaped by Rome's political unrest.
J. compare Julius Caesar's leadership style with that of Marius and Sulla.

29. According to the passage, the Social War began primarily because Rome's allies:

A. wanted to overthrow patrician rule.
B. demanded land and grain subsidies.
C. were denied Roman citizenship despite military service.
D. were recruited into the Roman army without pay.

30. As used in the passage (line 44), the word *"unprecedented"* most nearly means:

F. violent.
G. Unexpected.
H. previously unknown.
J. never done before.

31. It can reasonably be inferred from the passage that Aurelia, Caesar's mother, believed that education should:

    A. prepare a person primarily for military success.
    B. emphasize loyalty to family over political ambition.
    C. include an understanding of political realities.
    D. discourage involvement in public life.

32. Which of the following events happened first?

    F. Caesar formed the First Triumvirate.
    G. Sulla marched his army into Rome.
    H. Caesar refused to divorce Cornelia.
    J. Caesar was named dictator for life.

33. The paragraph describing Marius and Sulla (lines 34-45) primarily serves to:

    A. explain why Caesar admired Marius.
    B. introduce military tactics used by Rome.
    C. illustrate the breakdown of political norms.
    D. summarize the success of populist reforms.

34. According to the passage, one effect of Marius's military reforms was that:

    F. soldiers became more loyal to generals than the Senate.
    G. plebeians gained immediate political equality.
    H. Rome's allies were granted citizenship.
    J. aristocratic families reclaimed lost power.

35. The author's attitude toward Julius Caesar is best described as:

    A. admiring but uncritical.
    B. balanced and historically neutral.
    C. openly hostile.
    D. dismissive of his achievements.

36. When the passage states that Caesar's family reflected "both privilege and decline," (lines 46-48) it most nearly means that

    F. they had power but lacked education.
    G. they were wealthy but politically ignored.
    H. they retained status but had lost influence.
    J. they rejected aristocratic values.

You have reached the end of the Reading section. Pause your work now. If time is still available, check your answers for this section only.



SCIENCE TEST

40 minutes—40 Questions

Directions: There are seven passages in this test. Each passage is accompanied by several questions. After reading a passage, chose the best answer to each question. You may refer to the passages as often as necessary. You are NOT allowed to use a calculator on this test.

Passage I

Scientists examined several ingredients commonly used as active agents in sunscreen. The goal of the study was to determine which ingredients are most effective at blocking harmful UV rays.

Scientists used PABA, oxybenzone, octyl salicylate, and a broad-spectrum commercial sunscreen (SPF 45). The samples were exposed to sunlight with wavelengths ranging from 240 to 440 nm. The percent transmittance of UV rays at each wavelength was recorded. The data was collected manually using a spectrophotometer. The results, in 20 nm increments, are shown in Table 1.

Table 1

nm	PABA	oxybenzone	octyl salicylate	commercial sunscreen
240	38.2	15.7	12.7	15.2
260	2.9	19.2	83.5	24.5
280	1.7	3.2	33.1	4.2
300	9	4.2	3	1.5
320	82.9	6	10.8	2.5
340	99.2	9.7	93.5	25.5
360	100	45.3	100	67.6
380	100	92.6	100	96.8
400	100	100	100	99.8
420	100	100	100	100
440	100	100	100	100

Figure 1 displays the intensity of sunlight across the spectrum.

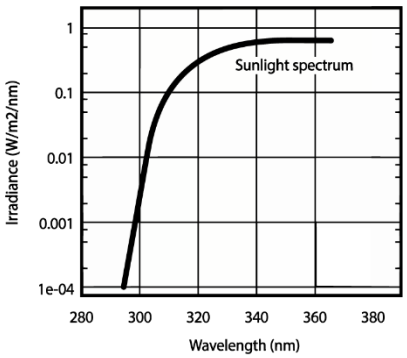


Figure 1

Table 2

Skin Type	Color	Reaction to UVA	Reaction to Sun
Type I	Very fair skin tone	Very Sensitive	Always burns easily, never tans
Type II	Fair skin tone	Very Sensitive	Usually burns easily, tans with difficulty
Type III	Fair to medium skin tone	Sensitive	Burns moderately, tans gradually
Type IV	Medium skin tone	Moderately Sensitive	Rarely burns, always tans well
Type V	Olive or dark skin tone	Minimally Sensitive	Very rarely burns, tans very easily
Type VI	Very dark skin tone	Least Sensitive	Never burns, deeply pigmented

In 1975, Thomas B. Fitzpatrick, MD, PhD, of Harvard Medical School, developed a classification system for skin type. This system was based on a person's complexion and responses to sun exposure. Table 2 lists the skin types and their characteristics.

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1. According to Table 1, which substance had the highest percent transmittance of UV rays for sunlight with a wavelength of 260 nm?

   A. Octyl salicylate
   B. PABA
   C. Oxybenzone
   D. Commercial sunscreen

2. If an individual with type II skin type was exposed to the sun at a wavelength of 320 nm immediately after applying commercial sunscreen SPF 45, how would their skin most likely be affected?

   F. Their skin would burn because Type II skin is sensitive and sunscreen SPF 45 does not block most of the sun's harmful rays at 320 nm wavelength.
   G. Their skin would burn because 320 nm wavelength is very damaging and would burn any skin type.
   H. Their skin would not burn because though they have sensitive skin, sunscreen SPF 45 blocks most of the sun's rays at 320 nm.
   J. Their skin would not burn because Type II skin is not sensitive enough to cause a burn at 320 nm.

3. Based on the information in Figure 1, sunlight is most intense at which of the following wavelengths?

   A. 290 nm
   B. 300 nm
   C. 320 nm
   D. 340 nm

4. A person with fair skin tone, whose skin burns but also tans slowly, likely has which of the following skin types?

   F. Type I
   G. Type II
   H. Type III
   J. Type IV

5. Experts state that anyone whose skin is sensitive or very sensitive to UVA should always wear sunscreen. According to Table 2, people with which skin types should always wear sunscreen?

   A. Types I and II
   B. Types I, II, and III
   C. Types II, III, and IV
   D. Types V and VI

6. In sunlight with an irradiance of 0.01 W/m2/nm, oxybenzone would be expected to have a UV ray percent transmittance of:

   F. 3.8 %
   G. 5 %
   H. 9.7 %
   J. 100 %

Passage II

Crude oil contains many different types of carbons. Different carbon chain lengths have different boiling points, so they can be separated using distillation – the process of boiling and then condensing a liquid in order to separate and purify its components (see Figure 1).

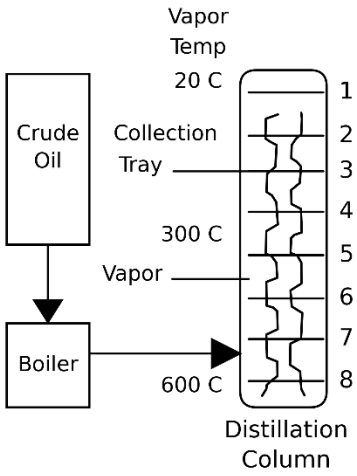

Figure 1

Crude oil is put into a boiler. The boiler is connected to a distillation column filled with collection trays. As the heated oil boils, the vapors released enter the distillation column and rise to the top. When a substance in the vapor reaches a height where the temperature of the column is equal to that substance's boiling point, it will condense to form a liquid. The liquid is gathered on the collection trays.

Experiment 1

Students determined the boiling points of various components of crude oil by recording the temperature of the vapor at various heights in the distillation column, then determining which component was collected in each of the 8 collection trays. See Table 1 and Table 2.

Table 1

Boiling Point	Tray #
20° C	1
40° C	2
120° C	3
200° C	4
350° C	5
400° C	6
500° C	7
600° C	8

Table 2

Crude Oil Component	Tray #
Gas	1
Naphtha	2
Gasoline	3
Kerosene	4
Diesel	5
Lubricating Oil	6
Heavy Gas Oil	7
Residual Oil	8

The students distilled one barrel of crude oil. Figure 2 shows the breakdown of that barrel, in terms of which components were collected.

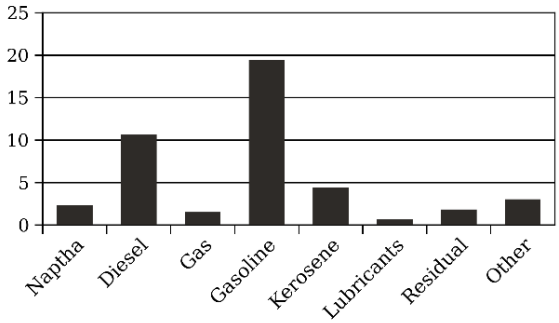

Figure 2

Experiment 2

Students determined the number of carbons in each component of crude oil and recorded the data in Table 3.

Table 3	
Crude Oil Component	# of Carbons
Diesel	12+
Gas	1–4
Gasoline	5–12
Heavy Gas Oil	20–70
Kerosene	10–18
Lubricating Oil	20–50
Naphtha	5–9
Residual Oil	70+

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7. Based on the results of Experiment 1, the boiling temperature of Naptha is:

   A. 20 °
   B. 40 °
   C. 120 °
   D. 200 °

8. A scientist conducting studies on crude oil discovered another substance contained in the oil with a boiling point of 300 degrees. How many carbons would it likely have in its composition?

   F. 12-18
   G. 5-9
   H. 70+
   J. 20-50

9. According to the results of Experiment 1, one barrel of crude oil contains about how many gallons of diesel?

   A. 2
   B. 6
   C. 11
   D. 29

10. One of the students hypothesized that the components of crude oil with the highest boiling points would be collected at the top of the distillation column. Do the results of Experiment 1 support the student's claim?

    F. No; as the vapor rose in the distillation column, the temperature cooled, so the components with the lowest boiling points were collected at the top of the column.
    G. No; there was no correlation between boiling point and location in the distillation column.
    H. Yes; gasoline and diesel had the highest boiling points, and they were collected in the top two trays.
    J. Yes; the lower the collection tray was in the distillation column, the lower the component's boiling point.

11. A scientist claimed that the more carbons a substance has, the higher its boiling point will be. Do the results of Experiment 1 and Experiment 2 support this claim?

    A. No; there is no relationship between the number of carbons and the boiling point.
    B. No; diesel has more carbons than gasoline, yet its boiling point is lower.
    C. Yes; residual oil has the most carbons and the lowest boiling point, while gas has the fewest carbons and the highest boiling point.
    D. Yes; residual oil has the most carbons and the highest boiling point, while gas has the fewest carbons and the lowest boiling point.

12. Which of the following components of crude oil has the highest boiling point?

    F. Naptha
    G. Kerosene
    H. Heavy gas oil
    J. Diesel

Passage III

PFAS (per- and polyfluoroalkyl substances) are long-lasting chemicals that have been found in most environments around the globe. Since these chemicals take an extremely long time to break down, they have also been found in our food, as well as the blood of humans and other animals. Scientists discuss *bioremediation* as a possible method for breaking down PFAS.

Scientist 1

Studies have demonstrated the ability of microbes to breakdown PFAS and rates of breakdown faster than natural degradation. Bioremediation through the use of PFAS-degrading microbes is a promising avenue for the destruction of PFAS in the environment. Many current approaches to the problem emphasize removal of PFAS. While this addresses the immediate problem of pollution, the contamination itself is simply relocated and will still need to be addressed at some point. Meanwhile, PFAS-degrading microbes can be added directly to contaminated soil and groundwater.

A variety of destructive methods do exist, but these chemical and industrial approaches come with high associated costs. The addition of microbes to contaminated systems is an easier and more cost effective approach, because it does not require significant infrastructure or equipment. Some environments already host PFAS-degrading microbes, and the introduction of external microbes can supplement the effectiveness of existing populations. The addition of specific nutrients into these environments can also support the growth of these native microbes.

Scientist 2

Existing destructive approaches have demonstrated effectiveness in contaminated sites. However, most bioremediation research is still restricted to lab studies, and the effectiveness has not been sufficiently evaluated at the scale of the environment. Though studies have demonstrated microbial degradation of PFAS at rates higher than their natural breakdown, this is still an extremely slow process. The time scale is not sufficiently quick for us to rapidly respond to the immediate problems of environmental contamination. Researchers have also identified thousands of PFAS chemical structures, making the identification of effective microbes to address them an unrealistic task.

There are also still too many unknown environmental impacts of introducing external microbes to natural environments. Furthermore, research has demonstrated that microbes sometimes fail to fully break down PFAS, resulting in smaller PFAS products that remain in the environment, often with their own toxic properties.

Sources: Alvarez, Pedro, Metz, Jordan, Javed, Hassan, & Mathieu, Jacques. (2021). Biodegradation of Per- and Polyfluoroalkyl Substances (PFASs) via Superoxide-Hyper-Producing Bacteria. *Semantics Scholar*. Proceedings. https://www.semanticscholar.org/paper/Biodegradation-of-Per-and-Polyfluoroalkyl-(PFASs)-Alvarez-Metz/1cb58d2006f3821e6fe068830fc67b30f56d1e0c

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Rittmann, B. E., Lai, Y.-J. S., Zhou, C., & Friese, D. (2022). *A synergistic platform for defluorination of perfluoroalkyl acids (PFAAs) through catalytic reduction followed by microbial oxidation* (Final Report ER20-C1-1286). Strategic Environmental Research and Development Program (SERDP)

13. According to Scientist 1, do current approaches that emphasize removal of PFAS eliminate contamination or relocate it, and do PFAS-degrading microbes eliminate contamination or relocate it?

    A. Eliminate; Eliminate
    B. Eliminate; Relocate
    C. Relocate; Eliminate
    D. Relocate; Relocate

14. Based on Scientist 2's argument, is microbial degradation of PFAs more likely to occur quickly enough to address urgent contamination, or too slowly, and why?

    F. Quickly enough, because scientists have already identified microbes capable of breaking down all known PFAS structures.
    G. Quickly enough, because microbial degradation occurs faster than natural degradation and completely eliminates PFAS contamination.
    H. Too slowly, because even though microbes can degrade PFAS faster than natural processes, the overall rate is still too slow for urgent contamination problems.
    J. Too slowly, because microbes cannot break down PFAS at rates faster than natural degradation and therefore have no practical use.

15. Which of the scientists, if either, would be likely to agree that physically removing PFAS from a contaminated site, by itself, fully resolves the problem of PFAS contamination?

    A. Scientist 1 only
    B. Scientist 2 only
    C. Scientists 1 and 2
    D. Neither scientist

16. Scientists 1 and 2 agree that PFAS-degrading microbes break down PFAS:

    F. More quickly than PFAS breakdown through natural degradation.
    G. More slowly than PFAS breakdown through natural degradation.
    H. Only when synthetic nutrients are added to a site.
    J. Only in laboratory settings.

17. A region of contaminated soil has no native PFAS-degrading microbial population. Based on Scientist 1's argument, would introducing external PFAS-degrading microbes or adding nutrients alone be more likely to establish microbial degradation there?

    A. Introducing external microbes; because they can directly supplement the environment with PFAS-degrading organisms.
    B. Introducing external microbes; because nutrients prevent PFAS from contaminating soil and groundwater.
    C. Adding nutrients alone; because nutrients can create PFAS-degrading microbes even when none are present.
    D. Adding nutrients alone; because Scientist 1 argues that native microbial populations are unnecessary for PFAS degradation.

18. An observation of which of the following outcomes would support Scientist 2's argument, but weaken Scientist 1's argument?

    F. After PFAS-degrading microbes are added to contaminated soil, PFAS concentrations decrease and no PFAS-related byproducts are detected.

    G. After PFAS-degrading microbes are added to contaminated soil, PFAS compounds are converted into smaller PFAS products that persist in the environment and remain toxic.

    H. After nutrients are added to contaminated groundwater, native PFAS-degrading microbial populations increase in size.

    J. After PFAS-degrading microbes are introduced to a contaminated site, PFAS levels decrease faster than they would through natural degradation alone.

Passage IV

Solubility refers to the ability of a one substance, the solute, to dissolve in another (the *solvent*). The balance of molecules between the solvent and the solute determines the solubility of one substance in another. Factors such as temperature and pressure will alter this balance, thus changing the solubility.

Experiments to determine the solubility of methane and carbon dioxide in polyamide (PA-11) were performed in the temperature range 50 – 90° C, and the pressure range 50-150 atm for methane and 20-40 atm for carbon dioxide. Table 1 displays the solubility (sol) of methane in PA-11. Table 2 shows the solubility (sol) of carbon dioxide in PA-11.

Solubility = (*g* gas/*g* PA-11) x 10^3

Table 1 - Methane					
T = 50° C		T = 70° C		T = 90° C	
Pressure (atm)	Sol	Pressure (atm)	Sol	Pressure (atm)	Sol
51.2	3.18	55.3	2.61	53.1	2.38
107.2	4.51	104.0	4.97	106.5	5.14
156.6	3.45	158.1	5.33	144.4	6.52

Table 2 - Carbon Dioxide					
T = 50° C		T = 70° C		T = 90° C	
Pressure (atm)	Sol	Pressure (atm)	Sol	Pressure (atm)	Sol
22.1	12.8	20.3	11.8	20	6.93
31.1	18.9	26.4	14.3	30.4	12.0
39.8	23.1	37.5	18.7	42.4	14.0

Figure 1 shows the pressurization cycle for methane at 100 atm and 50° C. The mass gain divided by the net polyamide mass determines the solubility of the gas.

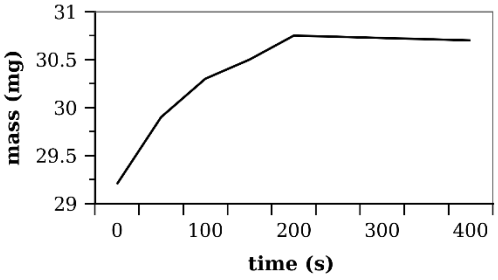

Figure 1

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19. Which of the following substances did NOT become more soluble as pressure increased?

    A. Methane at 70° C
    B. Methane at 50° C
    C. Carbon dioxide at 50° C
    D. Carbon dioxide at 90° C

20. According to Table 2, at which temperature was carbon dioxide the most soluble under pressure of 31.1 atm?

    F. 50° C
    G. 70° C
    H. 90° C
    J. 1000 ° C

21. Figure 1 supports which of the following claims about polyamide mass gain over time?

    A. The polyamide steadily gained mass.
    B. The polyamide lost mass over time.
    C. The polyamide gained mass at first, and then lost mass.
    D. The polyamide quickly gained mass and then leveled off.

22. Scientists wanted to conduct further tests and needed to ensure that experimental conditions were ideal for the solubility of methane. What temperature and pressure would they have to maintain in their experiment?

    F. Temperature 70° C; Pressure 104 atm
    G. Temperature 90° C; Pressure 144.4 atm
    H. Temperature 50° C; Pressure 39.8 atm
    J. Temperature 70° C; Pressure 158.1 atm

23. Based on the results shown in Table 2, which of the following conclusions can be drawn regarding the relationship between pressure and solubility?

    A. Solubility increases with pressure only above 70° C
    B. As pressure increases, solubility decreases.
    C. As pressure increases, so does solubility.
    D. There is no correlation between pressure and solubility.

24. In this experiment, which substance functioned as the *solvent*?

    F. Methane
    G. Carbon dioxide
    H. Mass
    J. Polyamide

Passage V

Sea surface salinity refers to how much salt is dissolved in the water at the ocean's surface. When freshwater is added to the ocean, the salinity level goes down because the salt becomes more diluted. This can happen through processes like rainfall, melting sea ice, or river water flowing into the sea. On the other hand, when seawater evaporates, the salt stays behind, which increases the salinity.

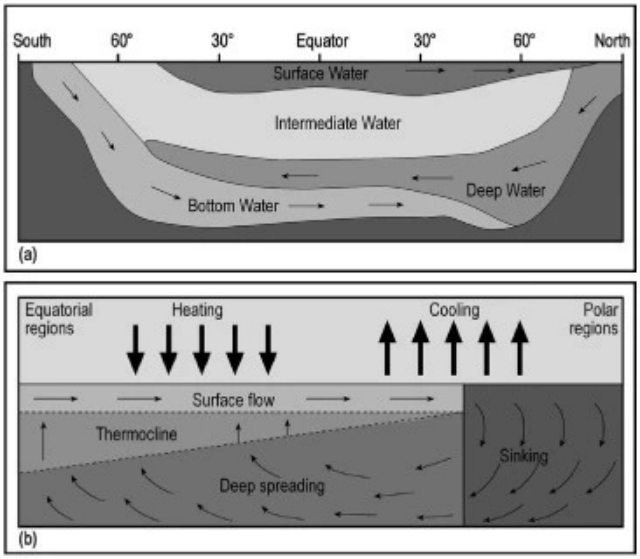
The sun heats the surface of Earth's oceans, and more than half of the solar energy that reaches our planet is absorbed by the ocean's surface. Most of this heat is concentrated near the equator, where sunlight is most direct. Ocean currents help balance the differences in temperature by transporting warm water from the equator toward the poles and carrying cold water from the poles back toward the equator.

Table 1: Sea surface salinity

Latitude (°)	Salinity Range (PSU)
0° (Equator)	33.0 – 34.8
20° N/S	34.6 – 36.2
40° N/S	33.4 – 35.4
60° N/S	31.4 – 34.0
80° N/S	31.0 – 32.8

UNITS: Salinity is measured in practical salinity units (psu). These units are equivalent to grams per kilogram, which in this case is 1 gram of dissolved salt per 1 kg of water.

Figure 1: Thermohaline circulation



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25. Based on Table 1, which two regions have approximately the same salinity?

    A. 20° and 60°
    B. 40° and 80°
    C. 0° and 40°
    D. 20° and 40°

26. Based on Figure 1, in which region does the water sink?

    F. Equatorial regions
    G. Polar regions
    H. Regions in the 60°
    J. Regions in the 30°

27. Which factor does NOT significantly affect ocean currents?

    A. rainfall
    B. temperature
    C. salinity
    D. ocean depth

28. Based on Figure 1, which direction do the major surface and deep currents flow?

    F. On the surface, fresh water flows from the continents toward the middle of the oceans, then sinks and flows back toward the continents.
    G. On the surface, water flows from the polar regions to the equatorial region, then sinks. The deep water then flows from the equatorial region toward the polar regions.
    H. On the surface, fresh water flows from the continents, then sinks and flows toward the middle of the oceans.
    J. On the surface, water flows from the equatorial to polar regions, then sinks. The deep water then flows from the polar regions toward the equatorial region.

29. What relationship can be inferred by Table 1 and Figure 1?

    A. As temperature increases, saline increases.
    B. As temperature decreases, saline increases.
    C. As temperature increases, saline decreases.
    D. As temperature decreases, saline decreases.

Passage VI

Figure 1 shows the average sleep pattern of a child, Figure 2 shows the average sleep pattern of a young adult, and Figure 3 shows the average sleep pattern of an elderly person. At Stage 0, the person is awake. As sleep moves from Stage 1 to Stage 4. It grows progressively deeper. REM sleep, commonly associated with dreaming, is predominant in the final third of a sleep cycle.

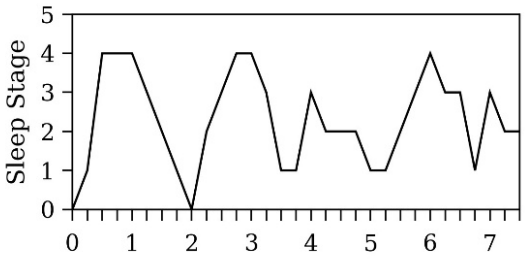

Figure 1

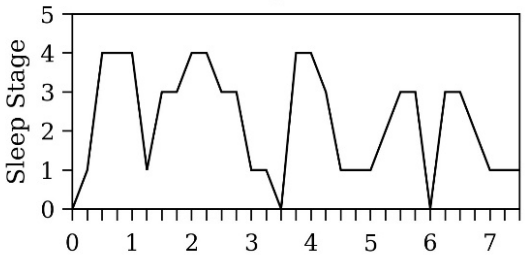

Figure 2

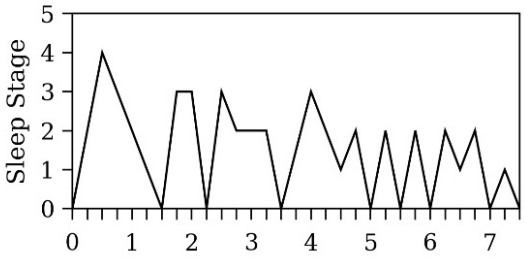

Figure 3

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30. Based on the information in the passage, a child will wake up how many times during a 7-hour stretch of sleep?

    F. 7
    G. 2
    H. 1
    J. 0

31. According to Figure 3, an elderly person can be predicted to be in which sleep stage after 8 hours?

    A. 0
    B. 2
    C. 3
    D. The sleep stage cannot be determined from the data because the sleep pattern is too erratic.

32. Based on the information in the passage and in Figure 2, at which of the following hours into a sleep interval will a young adult be most likely to experience REM sleep?

    F. 0
    G. 1
    H. 2
    J. 7

33. Based on the data presented in Figures 1, 2 and 3, which of the following conclusions can be properly drawn?

    A. As people age, they wake up more frequently during the night.
    B. As people age, they wake up less frequently during the night.
    C. As people age, they spend more time in deep sleep.
    D. As people age, they spend more consecutive time in each sleep stage.

34. A scientist decided to do a comparative study between the sleep cycle of a child and elderly person. From the information given in the figures, which of the following results would he most likely NOT find at the end of the study?

    F. Elderly generally wake up more often during the night.
    G. Elderly and children generally reach stage 4 within the first hour of sleep.
    H. Elderly wake more often than children in the last two hours of sleep.
    J. Elderly and children generally reach stage 4 at least three times during the night.

35. According to Figure 2, a young adult who has been asleep for 5 hours will most likely be in which sleep stage?

    A. Stage 0
    B. Stage 1
    C. Stage 3
    D. Stage 5

Passage VII

Tornado intensity is commonly estimated by analyzing damage to structures and then correlating it with the wind speed required to produce such destruction. This method is essential to assigning tornadoes specific values on the Fujita Scale (F-Scale) of tornado intensity (see Figure 1).

Damage f scale		Little Damage	Minor Damage	Roof Gone	Walls Collapse	Blown Down	Blown Away	
		f0	f1	f2	f3	f4	f5	
Windspeed F scale (17m/s, 40 mph)		F0 (32, 73)	F1 (50, 113)	F2 (70, 158)	F3 (92, 207)	F4 (116, 261)	F5 (142, 319)	
To convert f scale into F scale, add the appropriate number								
Weak Outbuilding	-3	f3	f4	f5	f5	f5	f5	
Strong Outbuilding	-2	f2	f3	f4	f5	f5	f5	
Weak Framehouse	-1	f1	f2	f3	f4	f5	f5	
Strong Framehouse	0	f0	f1	f2	f3	f4	f5	
Brick Structure	+1	-	f0	f1	f2	f3	f4	
Concrete Building	+2	-	-	f0	f1	f2	f3	

Figure 1

A tornado is formed when the following occurs: (1) Warm, moist air rises into cool, dry air; (2) when the barrier is breached, a bulge of warm, moist air expands and condenses to form a cloud; (3) as air moves upward, the resulting instability creates a spiral of air called a mesocyclone; (4) cold air moves downward and rain falls as the cloud becomes a supercell; (5) cool, moist air from rain cycles back into a cloud, forming a spinning wall-cloud; (6) horizontal spiraling wind "tubes" are pushed upward by warm, moist, air, forming a tornado. (See Figure 2).

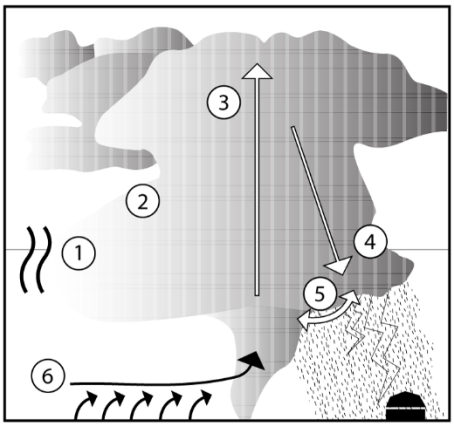

Figure 2

The United States has the most tornadoes of any country, and most of these tornadoes form in an area of the central United States known as "Tornado Alley." Figure 3 displays a geographical (state-by-state) breakdown of the occurrence of tornadoes in the US in 2005.

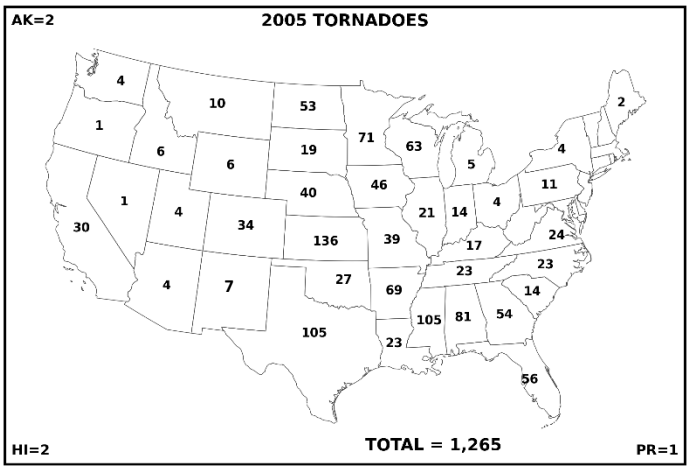

Figure 3

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36. A tornado with an intensity of F4 on the Fujita Scale could have winds of which of the following speeds?

F. 70 mph
G. 155 mph
H. 190 mph
J. 210 mph

37. Which of the following does NOT precede the formation of a mesocyclone?

A. Warm air flowing upward
B. Cool air forming a spinning wall-cloud
C. Cloud formation
D. Moist air condensing

38. Based on the data provided in Figure 3, which of the following states can be inferred to be part of "Tornado Alley?"

F. Texas
G. Florida
H. Michigan
J. Washington

39. If the wind speed of a tornado was unknown, but it was observed that several brick buildings in the area sustained minor damage, what value would the tornado be assigned on the F-Scale?

A. F0
B. F1
C. F2
D. F3

40. In Figure 2, the tornado is labeled with which number?

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

You have reached the end of the Science section. Pause your work now. If time is still available, check your answers for this section only.

