SAT / ACT
Hybrid Assessment

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SAT Reading Test

39 Minutes, 31 Questions

DIRECTIONS

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

Questions 1-11 are based on the following passage and supplementary material.

This passage is adapted from Francis J. Flynn and Gabrielle S. Adams, "Money Can't Buy Love: Asymmetric Beliefs about Gift Price and Feelings of Appreciation." ©2008 by Elsevier Inc.

Every day, millions of shoppers hit the stores in full force—both online and on foot—searching frantically for the perfect gift. Last year, Americans spent over $30 billion at retail stores in the month of December alone. Aside from purchasing holiday gifts, most people regularly buy presents for other occasions throughout the year, including weddings, birthdays, anniversaries, graduations, and baby showers. This frequent experience of gift-giving can engender ambivalent feelings in gift-givers. Many relish the opportunity to buy presents because gift-giving offers a powerful means to build stronger bonds with one's closest peers. At the same time, many dread the thought of buying gifts; they worry that their purchases will disappoint rather than delight the intended recipients.

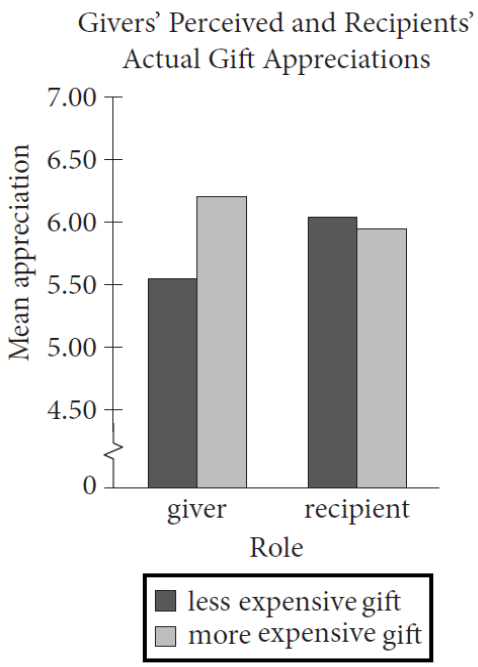
Anthropologists describe gift-giving as a positive social process, serving various political, religious, and psychological functions. Economists, however, offer a less favorable view. According to Waldfogel (1993), gift-giving represents an objective waste of resources. People buy gifts that recipients would not choose to buy on their own, or at least not spend as much money to purchase (a phenomenon referred to as ''the deadweight loss of Christmas"). To wit, givers are likely to spend $100 to purchase a gift that receivers would spend only $80 to buy themselves. This ''deadweight loss" suggests that gift-givers are not very good at predicting what gifts others will appreciate. That in itself is not surprising to social psychologists. Research has found that people often struggle to take account of others' perspectives—their insights are subject to egocentrism, social projection, and multiple attribution errors.

What is surprising is that gift-givers have considerable experience acting as both gift-givers and gift-recipients, but nevertheless tend to overspend each time they set out to purchase a meaningful gift. In the present research, we propose a unique psychological explanation for this overspending problem—i.e., that gift-givers equate how much they spend with how much recipients will appreciate the gift (the more expensive the gift, the stronger a gift-recipient's feelings of appreciation). Although a ink between gift price and feelings of appreciation might seem intuitive to gift-givers, such an assumption may be unfounded. Indeed, we propose that gift-recipients will be less inclined to base their feelings of appreciation on the magnitude of a gift than givers assume.

Why do gift-givers assume that gift price is closely linked to gift-recipients' feelings of appreciation? Perhaps givers believe that bigger (i.e., more expensive) gifts convey stronger signals of thoughtfulness and consideration. According to Camerer (1988) and others, gift-giving represents a symbolic ritual, whereby gift-givers attempt to signal their positive attitudes toward the intended recipient and their willingness to invest resources in a future relationship. In this sense, gift-givers may be motivated to spend more money on a gift in order to send a "stronger signal" to their intended recipient. As for gift-recipients, they may not construe smaller and larger gifts as representing smaller and larger signals of thoughtfulness and consideration.

CONTINUE

The notion of gift-givers and gift-recipients being unable to account for the other party's perspective seems puzzling because people slip in and out of these roles every day, and, in some cases, multiple times in the course of the same day. Yet, despite the extensive experience that people have as both givers and receivers, they often struggle to transfer information gained from one role (e.g., as a giver) and apply it in another, complementary role (e.g., as a receiver). In theoretical terms, people fail to utilize information about their own preferences and experiences in order to produce more efficient outcomes in their exchange relations. In practical terms, people spend hundreds of dollars each year on gifts, but somehow never learn to calibrate their gift expenditures according to personal insight.



1

The authors most likely use the examples in lines 1-9 of the passage ("Every . . . showers") to highlight the

A) regularity with which people shop for gifts.
B) recent increase in the amount of money spent on gifts.
C) anxiety gift shopping causes for consumers.
D) number of special occasions involving gift-giving.

2

In line 10, the word "ambivalent" most nearly means

A) unrealistic.
B) conflicted.
C) apprehensive.
D) supportive.

3

The authors indicate that people value gift-giving because they feel it

A) functions as a form of self-expression.
B) is an inexpensive way to show appreciation.
C) requires the gift-recipient to reciprocate.
D) can serve to strengthen a relationship.

4

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

A) Lines 10-13 ("Many . . . peers")
B) Lines 22-23 ("People . . . own")
C) Lines 31-32 ("Research . . . perspectives")
D) Lines 44-47 ("Although . . . unfounded")

CONTINUE

5

The “social psychologists” mentioned in paragraph 2 (lines 17-34) would likely describe the “deadweight loss” phenomenon as

A) predictable.
B) questionable.
C) disturbing.
D) unprecedented.

6

The passage indicates that the assumption made by gift-givers in lines 41-44 may be

A) insincere.
B) unreasonable.
C) incorrect.
D) substantiated.

7

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

A) Lines 53-55 (“Perhaps . . . consideration”)
B) Lines 55-60 (“According . . . relationship”)
C) Lines 63-65 (“As . . . consideration”)
D) Lines 75-78 (“In . . . relations”)

8

As it is used in line 54, “convey” most nearly means

A) transport.
B) counteract.
C) exchange.
D) communicate.

9

The authors refer to work by Camerer and others (line 56) in order to

A) offer an explanation.
B) introduce an argument.
C) question a motive.
D) support a conclusion.

10

The graph following the passage offers evidence that gift-givers base their predictions of how much a gift will be appreciated on

A) the appreciation level of the gift-recipients.
B) the monetary value of the gift.
C) their own desires for the gifts they purchase.
D) their relationship with the gift-recipients

11

The authors would likely attribute the differences in gift-giver and recipient mean appreciation as represented in the graph to

A) an inability to shift perspective.
B) an increasingly materialistic culture.
C) a growing opposition to gift-giving.
D) a misunderstanding of intentions.

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

This passage is adapted from J. D. Watson and F. H. C. Crick, "Genetical Implications of the Structure of Deoxyribonucleic Acid." ©1953 by Nature Publishing Group. Watson and Crick deduced the structure of DNA using evidence from Rosalind Franklin and R. G. Gosling's X-ray crystallography diagrams of DNA and from Erwin Chargaff's data on the base composition of DNA.

The chemical formula of deoxyribonucleic acid (DNA) is now well established. The molecule is a very long chain, the backbone of which consists of a regular alternation of sugar and phosphate groups. To each sugar is attached a nitrogenous base, which can be of four different types. Two of the possible bases—adenine and guanine—are purines, and the other two—thymine and cytosine—are pyrimidines. So far as is known, the sequence of bases along the chain is irregular. The monomer unit, consisting of phosphate, sugar and base, is known as a nucleotide.

The first feature of our structure which is of biological interest is that it consists not of one chain, but of two. These two chains are both coiled around a common fiber axis. It has often been assumed that since there was only one chain in the chemical formula there would only be one in the structural unit. However, the density, taken with the X-ray evidence, suggests very strongly that there are two.

The other biologically important feature is the manner in which the two chains are held together. This is done by hydrogen bonds between the bases. The bases are joined together in pairs, a single base from one chain being hydrogen-bonded to a single base from the other. The important point is that only certain pairs of bases will fit into the structure. One member of a pair must be a purine and the other a pyrimidine in order to bridge between the two chains. If a pair consisted of two purines, for example, there would not be room for it.

We believe that the bases will be present almost entirely in their most probable forms. If this is true, the conditions for forming hydrogen bonds are more restrictive, and the only pairs of bases possible are: adenine with thymine, and guanine with cytosine. Adenine, for example, can occur on either chain; but when it does, its partner on the other chain must always be thymine.

The phosphate-sugar backbone of our model is completely regular, but any sequence of the pairs of bases can fit into the structure. It follows that in a long molecule many different permutations are possible, and it therefore seems likely that the precise sequence of bases is the code which carries the genetical information. If the actual order of the bases on one of the pair of chains were given, one could write down the exact order of the bases on the other one, because of the specific pairing. Thus one chain is, as it were, the complement of the other, and it is this feature which suggests how the deoxyribonucleic acid molecule might duplicate itself.

The table shows, for various organisms, the percentage of each of the four types of nitrogenous bases in that organism's DNA.

Base Composition of DNA

Organism	Percentage of base in organism's DNA			
	adenine (%)	guanine (%)	cytosine (%)	thymine (%)
Maize	26.8	22.8	23.2	27.2
Octopus	33.2	17.6	17.6	31.6
Chicken	28.0	22.0	21.6	28.4
Rat	28.6	21.4	20.5	28.4
Human	29.3	20.7	20.0	30.0
Grasshopper	29.3	20.5	20.7	29.3
Sea urchin	32.8	17.7	17.3	32.1
Wheat	27.3	22.7	22.8	27.1
Yeast	31.3	18.7	17.1	32.9
E. coli	24.7	26.0	25.7	23.6

Adapted from Manju Bansal, "DNA Structure: Revisiting the Watson-Crick Double Helix." ©2003 by Current Science Association, Bangalore.

CONTINUE

12

The authors use the word “backbone” in lines 3 and 39 to indicate that

A) only very long chains of DNA can be taken from an organism with a spinal column.

B) the main structure of a chain in a DNA molecule is composed of repeating units.

C) a chain in a DNA molecule consists entirely of phosphate groups or of sugars.

D) nitrogenous bases form the main structural unit of DNA.

13

A student claims that nitrogenous bases pair randomly with one another. Which of the following statements in the passage contradicts the student’s claim?

A) Lines 5-6 (“To each . . . types”)

B) Lines 9-10 (“So far . . . irregular”)

C) Lines 23-25 (“The bases . . . other”)

D) Lines 27-29 (“One member . . . chains”)

14

In the second paragraph (lines 12-19), what do the authors claim to be a feature of biological interest?

A) The chemical formula of DNA

B) The common fiber axis

C) The X-ray evidence

D) DNA consisting of two chains

15

The authors’ main purpose of including the information about X-ray evidence and density is to

A) establish that DNA is the molecule that carries the genetic information.

B) present an alternate hypothesis about the composition of a nucleotide.

C) provide support for the authors’ claim about the number of chains in a molecule of DNA.

D) confirm the relationship between the density of DNA and the known chemical formula of DNA.

16

Based on the passage, the authors’ statement “If a pair consisted of two purines, for example, there would not be room for it” (lines 29-30) implies that a pair

A) of purines would be larger than the space between a sugar and a phosphate group.

B) of purines would be larger than a pair consisting of a purine and a pyrimidine.

C) of pyrimidines would be larger than a pair of purines.

D) consisting of a purine and a pyrimidine would be larger than a pair of pyrimidines.

17

The authors’ use of the words “exact,” “specific,” and “complement” in lines 47-49 in the final paragraph functions mainly to

A) confirm that the nucleotide sequences are known for most molecules of DNA.

B) counter the claim that the sequences of bases along a chain can occur in any order.

C) support the claim that the phosphate-sugar backbone of the authors’ model is completely regular.

D) emphasize how one chain of DNA may serve as a template to be copied during DNA replication.

18

Based on the table and passage, which choice gives the correct percentages of the purines in yeast DNA?

A) 17.1% and 18.7%
B) 17.1% and 32.9%
C) 18.7% and 31.3%
D) 31.3% and 32.9%

19

Do the data in the table support the authors' proposed pairing of bases in DNA?

A) Yes, because for each given organism, the percentage of adenine is closest to the percentage of thymine, and the percentage of guanine is closest to the percentage of cytosine.
B) Yes, because for each given organism, the percentage of adenine is closest to the percentage of guanine, and the percentage of cytosine is closest to the percentage of thymine.
C) No, because for each given organism, the percentage of adenine is closest to the percentage of thymine, and the percentage of guanine is closest to the percentage of cytosine.
D) No, because for each given organism, the percentage of adenine is closest to the percentage of guanine, and the percentage of cytosine is closest to the percentage of thymine.

20

According to the table, which of the following pairs of base percentages in sea urchin DNA provides evidence in support of the answer to the previous question?

A) 17.3% and 17.7%
B) 17.3% and 32.1%
C) 17.3% and 32.8%
D) 17.7% and 32.8%

21

Based on the table, is the percentage of adenine in each organism's DNA the same or does it vary, and which statement made by the authors is most consistent with that data?

A) The same; "Two of . . . pyrimidines" (lines 6-8)
B) The same; "The important . . . structure" (lines 25-26)
C) It varies; "Adenine . . . thymine" (lines 36-38)
D) It varies; "It follows . . . information" (lines 41-45)

Questions 32-41 are based on the following passage.

This passage is adapted from Virginia Woolf, Three Guineas. ©1938 by Harcourt, Inc. Here, Woolf considers the situation of women in English society.

Close at hand is a bridge over the River Thames, an admirable vantage ground for us to make a survey. The river flows beneath; barges pass, laden with timber, bursting with corn; there on one side are the domes and spires of the city; on the other, Westminster and the Houses of Parliament. It is a place to stand on by the hour, dreaming. But not now. Now we are pressed for time. Now we are here to consider facts; now we must fix our eyes upon the procession—the procession of the sons of educated men.

There they go, our brothers who have been educated at public schools and universities, mounting those steps, passing in and out of those doors, ascending those pulpits, preaching, teaching, administering justice, practising medicine, transacting business, making money. It is a solemn sight always—a procession, like a caravanserai crossing a desert. . . . But now, for the past twenty years or so, it is no longer a sight merely, a photograph, or fresco scrawled upon the walls of time, at which we can look with merely an esthetic appreciation. For there, trapesing along at the tail end of the procession, we go ourselves. And that makes a difference. We who have looked so long at the pageant in books, or from a curtained window watched educated men leaving the house at about nine-thirty to go to an office, returning to the house at about six-thirty from an office, need look passively no longer. We too can leave the house, can mount those steps, pass in and out of those doors, . . . make money, administer justice. . . . We who now agitate these humble pens may in another century or two speak from a pulpit. Nobody will dare contradict us then; we shall be the mouthpieces of the divine spirit—a solemn thought, is it not? Who can say whether, as time goes on, we may not dress in military uniform, with gold lace on our breasts, swords at our sides, and something like the old family coal-scuttle on our heads, save that that venerable object was never decorated with plumes of white horsehair. You laugh—indeed the shadow of the private house still makes those dresses look a little queer. We have worn private clothes so long. . . . But we have not come here to laugh, or to talk of fashions—men's and women's. We are here, on the bridge, to ask ourselves certain questions. And they are very important questions; and we have very little time in which to answer them. The questions that we have to ask and to answer about that procession during this moment of transition are so important that they may well change the lives of all men and women for ever. For we have to ask ourselves, here and now, do we wish to join that procession, or don't we? On what terms shall we join that procession? Above all, where is it leading us, the procession of educated men? The moment is short; it may last five years; ten years, or perhaps only a matter of a few months longer. . . . But, you will object, you have no time to think; you have your battles to fight, your rent to pay, your bazaars to organize. That excuse shall not serve you, Madam. As you know from your own experience, and there are facts that prove it, the daughters of educated men have always done their thinking from hand to mouth; not under green lamps at study tables in the cloisters of secluded colleges. They have thought while they stirred the pot, while they rocked the cradle. It was thus that they won us the right to our brand-new sixpence. It falls to us now to go on thinking; how are we to spend that sixpence? Think we must. Let us think in offices; in omnibuses; while we are standing in the crowd watching Coronations and Lord Mayor's Shows; let us think . . . in the gallery of the House of Commons; in the Law Courts; let us think at baptisms and marriages and funerals. Let us never cease from thinking—what is this "civilization" in which we find ourselves? What are these ceremonies and why should we take part in them? What are these professions and why should we make money out of them? Where in short is it leading us, the procession of the sons of educated men?

22

The main purpose of the passage is to

A) emphasize the value of a tradition.
B) stress the urgency of an issue.
C) highlight the severity of social divisions.
D) question the feasibility of an undertaking.

CONTINUE

23

The central claim of the passage is that

A) educated women face a decision about how to engage with existing institutions.

B) women can have positions of influence in English society only if they give up some of their traditional roles.

C) the male monopoly on power in English society has had grave and continuing effects.

D) the entry of educated women into positions of power traditionally held by men will transform those positions.

24

Woolf uses the word “we” throughout the passage mainly to

A) reflect the growing friendliness among a group of people.

B) advance the need for candor among a group of people.

C) establish a sense of solidarity among a group of people.

D) reinforce the need for respect among a group of people.

25

According to the passage, Woolf chooses the setting of the bridge because it

A) is conducive to a mood of fanciful reflection.

B) provides a good view of the procession of the sons of educated men.

C) is within sight of historic episodes to which she alludes.

D) is symbolic of the legacy of past and present sons of educated men.

26

Woolf indicates that the procession she describes in the passage

A) has come to have more practical influence in recent years.

B) has become a celebrated feature of English public life.

C) includes all of the richest and most powerful men in England.

D) has become less exclusionary in its membership in recent years.

27

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

A) Lines 12-17 (“There . . . money”)

B) Lines 17-19 (“It . . . desert”)

C) Lines 23-24 (“For . . . ourselves”)

D) Lines 30-34 (“We . . . pulpit”)

28

Woolf characterizes the questions in lines 53-57 (“For we . . . men”) as both

A) controversial and threatening.
B) weighty and unanswerable.
C) momentous and pressing.
D) provocative and mysterious.

29

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

A) Lines 46-47 (“We . . . questions”)
B) Lines 48-49 (“And . . . them”)
C) Line 57 (“The moment . . . short”)
D) Line 62 (“That . . . Madam”)

30

Which choice most closely captures the meaning of the figurative “sixpence” referred to in lines 70 and 71?

A) Tolerance
B) Knowledge
C) Opportunity
D) Perspective

31

The range of places and occasions listed in lines 72-76 (“Let us . . . funerals”) mainly serves to emphasize how

A) novel the challenge faced by women is.
B) pervasive the need for critical reflection is.
C) complex the political and social issues of the day are.
D) enjoyable the career possibilities for women are.

STOP

If you finish before time is called, you may check your work on this section only. Do not turn to any other section.

ACT English Test

27 Minutes, 45 Questions

DIRECTIONS

In the three passages that follow, certain words and phrases are underlined and numbered. In the right-hand column, you will find alternatives for the underlined part. In most cases, you are to choose the one 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. If you think the original version is best, choose "NO CHANGE." In some cases, you will find in the right-hand column a question about the underlined part. You are to choose the best answer to the question. You will also find questions about a section of the passage, or about the passage as a whole. These questions do not refer to an underlined portion of the passage, but rather are identified by a number or numbers in a box. For each question, choose the alternative you consider best and fill in the corresponding oval on your answer document. Read each passage through once before you begin to answer the questions that accompany it. For many of the questions, you must read several sentences beyond the question to determine the answer. Be sure that you have read far enough ahead each time you choose an alternative.

PASSAGE I

Mystery Paper Sculptor

Between March and November of 2011, an anonymous donor left intricately[1] crafted paper sculptures at various cultural institutions in Edinburgh, Scotland.

1. Which choice most effectively emphasizes the complexity of the paper sculptures?

A. NO CHANGE
B. impressively
C. terrifically
D. superbly

Delighted, each sculpture was left secretly and was later discovered by staff[2]. The delicate sculptures—streetscapes, plants, and animals—were carved exclusively from the pages and bindings of books. The tiny details in the pieces are awe-inspiring.

2. **F.** NO CHANGE
G. Each sculpture was left secretly and later discovered by delighted staff.
H. Left secretly and later discovered by staff, each sculpture was delighted.
J. Secretly delighted, each sculpture was discovered by staff.

The first sculpture discovered—at the Scottish Poetry Library—was a tiny tree formed from a book of verse. Library staff dubbed[3] it the "poetree." The tree sits atop a book. Beneath the tree are the halves of a golden paper egg, each half filled with words clipped from the poem "A Trace of Wings" by Edwin Morgan.

3. **A.** NO CHANGE
B. specified
C. adorned
D. honored

At Edinburgh's Filmhouse Cinema, a three-dimensional sculpted scene (3) (4) shows patrons sitting in a movie theater as horse leaps (5) out of the screen. At the Scottish Storytelling Centre, a dragon crafted from the pages (6) of a mystery novel was found nesting in a window. At the National Museum of Scotland, a paper tail was spotted emerging from the spine of Sir Arthur Conan Doyle's book The Lost World. Inside, a dinosaur charges through shredded pages of the open book. More creations appeared at more than a few additional places where literature and artifacts are related to (7) (7) books and writing.

Therefore, (8) a total of ten sculptures were bestowed on special institutions, whose staff are thrilled by their luck.

The creator of these sculptures are (9) not known because no one has claimed responsibility. So far, that is. The last gift came with a note in which the mystery artist reveals her gender. Whatever: whoever (10) created the art, your (11) intention is clear. Each gift came with a

4. **F.** NO CHANGE
G. Cinema, a three-dimensional sculpted, scene
H. Cinema a three-dimensional sculpted scene,
J. Cinema a three-dimensional, sculpted, scene

5. **A.** NO CHANGE
B. movie theaters as horse's leaps
C. a movie theater as horses leap
D. movie theater's as horse leap

6. **F.** NO CHANGE
G. dragon—crafted from the pages
H. dragon, crafted from the pages,
J. dragon crafted from the pages,

7. **A.** NO CHANGE
B. a number of additional cultural institutions supporting intellectual endeavors dedicated to promoting
C. quite a lot of other cultural institutions characterized by loyalty and dedication to
D. several libraries and museums devoted to

8. **F**. NO CHANGE
G. Eventually,
H. Of course,
J. However,

9. **A.** NO CHANGE
B. creators of this sculptures are
C. creator of these sculptures is
D. creators of this sculptures is

10. **F.** NO CHANGE
G. Disregarding the unknown identity of the person who
H. Without consideration of or concern about whoever
J. Regardless of who

11. **A.** NO CHANGE
B. whose
C. her
D. our

note expressing special gratitude (12) for "libraries, books, words, ideas." [13]

Ironically, the creator of these exquisite sculptures who destroyed books—(14) cutting them up with (15) refashioning them into elaborate works of art—as "a tiny gesture in support of the special places." The mystery artist celebrated the magic of those places and, at the same time, made some magic.

12. F. NO CHANGE
G. note of gratitude expressing special gratefulness and thanks
H. thank-you note on each one expressing special thanks
J. thankful note expressing special thanks

13. If the writer were to delete the preceding sentence, the paragraph would primarily lose a statement that:
A. suggests the essay writer knows the identity of the artist.
B. explains why the artist created the sculptures.
C. proves the artist is a woman.
D. indicates the artist is a librarian.

14. F. NO CHANGE
G. for whom books were destroyed—
H. as she destroyed books—
J. destroyed books—

15. A. NO CHANGE
B. and
C. nor
D. so

PASSAGE II

Lightning in the Sand

As my friend Anna and I walked the sand dunes of southeastern New Mexico, she told me that she hoped we'd find a fulgurite, one as translucent white as the southeastern New Mexico sands around us. (16) A fulgurite—whose name stems from the Latin word fulgur, which means "thunderbolt"—is a hollow silica glass tube formed when lightning strikes sand. A fulgurite is created in one explosive second by fusion and pressure as sand heated by a lightning blast melts, (17) and becomes glass. Commonly called "petrified lightning," a fulgurite places (18) the shape of a miniature lightning bolt into the earth, often branching deep into the ground.

16. F. NO CHANGE
G. and nearly transparent to the eye almost as the white sands of these dunes.
H. as these sands.
J. DELETE the underlined portion and end the sentence with a period.

17. A. NO CHANGE
B. sand heated (by a lightning blast) melts
C. sand, heated by a lightning blast melts,
D. sand heated by a lightning blast melts

18. Which choice best builds on the preceding sentence by emphasizing the dramatic nature of the mark a fulgurite leaves on the earth?
F. NO CHANGE
G. sketches
H. burns
J. sends

Anna told me that I had possibly seen a small fragment of a fulgurite before, without realizing I had, on a beach. She explained though that even experts (19) are rarely able to locate a fully intact fulgurite.

The thin, brittle glass tubes break easily. (20) Occasionally, after strong, sustained winds have shifted desert sands, while (21) an unbroken, previously buried fulgurite will be revealed, showing as a tube protruding from the ground.

[22] I scanned the area, hopeful that I'd see a tube newly uncovered. (23) Anna made clear that we'd be lucky to come upon a small piece of fulgurite, just a few inches long.

Anna had shown me fulgurites she had found on other trips. Their colors ranged from black to brown to green, corresponding to the color of the sand in which she had discovered them. I wasn't surprised that I'd never recognized fulgurites on any beach: no one had ever told me what to look for. (24)

19. A. NO CHANGE
B. explained, though, that even experts
C. explained though that, even experts,
D. explained, though that even experts

20. Given that all the statements are true, which one provides the most relevant information at this point in the essay?
F. NO CHANGE
G. Human-made fulgurites are not any easier to excavate than naturally occurring fulgurites.
H. A fulgurite is not a geode (a crystal-lined stone), though the two are often confused.
J. Still, pieces of fulgurite can be worked into jewelry.

21. A. NO CHANGE
B. however
C. so
D. DELETE the underlined portion.

22. Which of the following sentences, if added here, best connects the preceding sentence to the information that follows in the paragraph?
F. Anna told me that there had been a brief rain shower in the area the day before.
G. I could see bright pink sand verbenas blooming in the distance.
H. Swift winds were moving the white sands that day.
J. Dig carefully.

23. A. NO CHANGE
B. uncovered, I focused my gaze on the sands in the distance.
C. uncovered, I looked closely.
D. had it been uncovered.

24. Which choice most effectively concludes this sentence and leads into the information that follows in the paragraph?
F. NO CHANGE
G. I focus on looking for seashells, sand dollars, and smooth rocks when I'm walking the sands.
H. usually, I'm not in the mood for a science project when I'm on vacation.
J. on their surface, they look like pieces of tree branches.

Their interiors, though, are smooth, clear glass stained (25)

with tiny bubbles trapped formed by air and moisture (26)
during the rapid cooling of the melted sand after the lightning strike.

We continued exploring the dunes.

Anna laughed and said we needed only to stop at the local gift shop to unearth (27)

our treasure. [28] But given

our (29) luck finding fulgurites in

deserts and on beaches, (30) she wanted to keep searching to find our own piece of bright, white lightning in the sand.

25. Which choice makes clearest the light, sporadic arrangement of the bubbles in the glass?

A. NO CHANGE
B. pointed
C. speckled
D. covered

26. The best placement for the underlined portion would be:

F. where it is now.
G. after the word bubbles.
H. after the word during.
J. after the word cooling.

27. **A.** NO CHANGE
B. for having unearthed
C. that would unearth
D. unearthing

28. If the writer deleted the preceding sentence, the essay would primarily lose a:

F. bluntly critical comment that makes clear Anna's frustration with trying to find a white fulgurite in the sand dunes of New Mexico.
G. mildly scolding response by Anna to the narrator's impatience with the time and attention it might take for them to find a white fulgurite.
H. light moment in the form of a good-natured joke by Anna about how easy it could be to find a white fulgurite.
J. moment of excitement when Anna remembers that they could easily find a white fulgurite at the local gift shop.

29. **A.** NO CHANGE
B. her
C. my
D. their

30. Which of the following alternatives to the underlined portion would provide the essay with new information?

F. beaches in Florida, Utah, California, and Nevada,
G. beaches, but so far not this day in the New Mexico sands,
H. beaches, in other words, sandy locales,
J. beaches, even a green fulgurite,

PASSAGE III

The Real McCoy

[1]

"It's the real McCoy." You might have heard this expression before, but who—or what—is a McCoy, real or otherwise? The saying has been used for generations to declare its' (31) the genuine article, the original and best. [A] While its origin is disputed, many people believe the expression was inspired by the inventions of a Canadian American engineer named, (32) Elijah McCoy. McCoy, a railroad worker who, as a teenager, had formally studied mechanical engineering, revolutionized railroad and factory operations, affecting both incredibly (33) with his dozens of patented products.

[2]

While working for the Michigan Central Railroad in the 1870s, then (34) McCoy was assigned to work on the wheel bearings and axles of trains. [35] Trains needed to come to a halt after only a few miles of travel so that the moving parts could be oiled by hand—a tedious, time-consuming process. McCoy invented a device that released oil while a train was in motion, substantially reducing the number (36)

31. A. NO CHANGE
B. its something that's
C. that something is
D. that its

32. F. NO CHANGE
G. American engineer named
H. American, engineer named,
J. American, engineer named

33. A. NO CHANGE
B. operations, changing both of these industries fundamentally
C. operations, so that they would never be the same
D. operations

34. F. NO CHANGE
G. with that company
H. during this time
J. DELETE the underlined portion.

35. In the preceding sentence, the writer is considering revising the phrase "assigned to work on" to "responsible for oiling." Given that the revised phrase is accurate, should the writer make this revision?
A. Yes, because the revision specifically describes the procedures McCoy had to follow as he maintained the wheel bearings and axles of trains.
B. Yes, because the revision provides a clearer connection between McCoy's main task as a railroad worker and his first patented device.
C. No, because the revision doesn't indicate whether McCoy chose to oil the wheel bearings and axles of trains by hand.
D. No, because the revision doesn't make clear whether McCoy had worked on trains for other railroad companies.

36. F. NO CHANGE
G. lessening the frequency of number
H. subtracting the amount
J. lowering the amount

of maintenance stops had the effect of making travel
37
more efficient. [B] This automatic lubricating device became the first of his fifty-seven patents.

[3]

McCoy applied the principles of this invention to other engineering challenges. Factories in the late 1800s, for example, increasingly relied on steam engines to
38

power factory machines. As with trains, therefore
39
many of the machines' parts had to be oiled manually.

McCoy, recognizing the similarities between train
40

wheels and factory machines, designed automated oilers for steam engines. These innovations allowed factories to give machines a certain timelessness,
41

increasing factory productivity and, as a result, profits. 42

37. A. NO CHANGE
B. and making
C. helping to make
D. made

38. F. NO CHANGE
G. subsequently,
H. regardless,
J. however,

39. A. NO CHANGE
B. the problem being
C. in that
D. DELETE the underlined portion.

40. F. NO CHANGE
G. McCoy would recognize
H. McCoy, a recognition
J. McCoy recognized

41. Which choice offers the clearest and most precise information about how the operation of factory machines changed as a result of McCoy's innovations?

A. NO CHANGE
B. rethink operations,
C. run machines continuously,
D. use machines differently,

42. The writer is considering deleting the following phrase from the preceding sentence (ending the sentence with a period):

and, as a result, profits.

Should the writer make this deletion?

F. Yes, because the phrase shifts the focus of the paragraph from the use of McCoy's inventions in factories to factory disputes.
G. Yes, because the phrase suggests that factory owners were more interested in profits than in which of McCoy's devices would best meet their needs.
H. No, because the phrase is relevant to the paragraph's discussion of the positive effects that the use of McCoy's inventions had in factories.
J. No, because the phrase makes clear that the successful use of McCoy's inventions in factories led to higher wages for factory workers.

[4]

McCoy's inventions were an instant success. [C] Not surprisingly, other inventors inundated the market with similar—and usually inferior—devices. [D] Supposedly, factory owners who wanted a product proven to do it (43) would ask if their purchase was "the real McCoy." McCoy's inventions would continue to benefit industries in the United States well into the twentieth century, as his (44) name became synonymous with quality and authenticity. (44)

43. **A.** NO CHANGE
B. lend itself to superiority
C. give off the best result
D. work well

44. Which choice best concludes the essay by reiterating its main idea?
F. NO CHANGE
G. so, not surprisingly, in 2001 McCoy was inducted into the National Inventors Hall of Fame, located in Alexandria, Virginia.
H. even having applications in the booming aluminum manufacturing industry of the 1940s.
J. making this story, for so many reasons, "the genuine article."

Question 45 asks about the preceding passage as a whole

45. The writer is considering adding the following true statement to the essay:

> The imitators expected that the price of their products—often significantly lower than the price of McCoy's devices—would attract buyers, but price didn't seem to matter most.

If the writer were to add this statement, it would most logically be placed at:
A. Point A in Paragraph 1.
B. Point B in Paragraph 2.
C. Point C in Paragraph 4.
D. Point D in Paragraph 4.

END OF ACT ENGLISH TEST
STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.

SAT Writing Test

18 Minutes, 22 Questions

DIRECTIONS

Each passage below is accompanied by a number of questions. For some questions, you will consider how the passage might be revised to improve the expression of ideas. For other questions, you will consider how the passage might be edited to correct errors in sentence structure, usage, or punctuation. A passage or a question may be accompanied by one or more graphics (such as a table or graph) that you will consider as you make revising and editing decisions.

Some questions will direct you to an underlined portion of a passage. Other questions will direct you to a location in a passage or ask you to think about the passage as a whole. After reading each passage, choose the answer to each question that most effectively improves the quality of writing in the passage or that makes the passage conform to the conventions of standard written English. Many questions include a "NO CHANGE" option.

Choose that option if you think the best choice is to leave the relevant portion of the passage as it is.

Questions 1-11 are based on the following passage

Coworking: A Creative Solution

When I left my office job as a website developer at a small company for a position that allowed me to work full-time from home, I thought I had it made: I gleefully traded in my suits and dress shoes for sweatpants and slippers, my frantic early-morning bagged lunch packing for a leisurely midday trip to my refrigerator. The novelty of this comfortable work-from-home life, however, ..1.. soon got worn off quickly. Within a month, I found myself feeling isolated despite having frequent email and instant messaging contact with my colleagues. Having become frustrated trying to solve difficult problems, ..2.. no colleagues were nearby to share ideas. It was during this time that I read an article ..3.. into coworking spaces.

1

A) NO CHANGE
B) was promptly worn
C) promptly wore
D) wore

2

A) NO CHANGE
B) colleagues were important for sharing ideas.
C) ideas couldn't be shared with colleagues.
D) I missed having colleagues nearby to consult.

3

A) NO CHANGE
B) about
C) upon
D) for

CONTINUE

The article, published by Forbes magazine, explained that coworking spaces are designated locations that, for a fee, individuals can use to conduct their work. The spaces are usually stocked with standard office ..4.. equipment, such as photocopiers, printers, and fax machines. ..5.. In these locations, however, the spaces often include small meeting areas and larger rooms for hosting presentations. ..6.. The cost of launching a new coworking business in the United States is estimated to be approximately $58,000.

4

A) NO CHANGE
B) equipment, such as:
C) equipment such as:
D) equipment, such as,

5

A) NO CHANGE
B) In addition to equipment,
C) For these reasons,
D) Likewise,

6

The writer is considering deleting the underlined sentence. Should the sentence be kept or deleted?

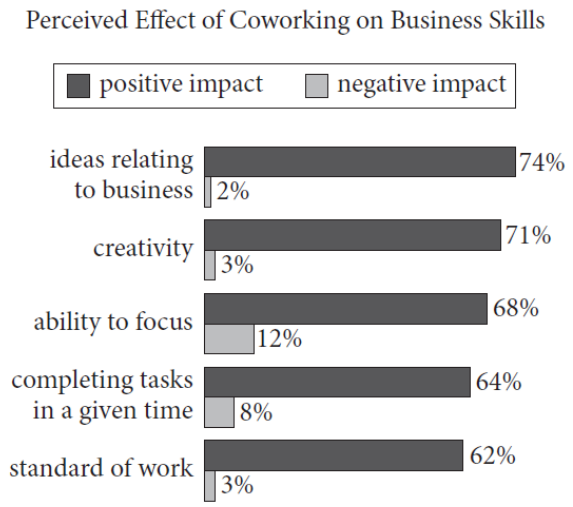
A) Kept, because it provides a detail that supports the main topic of the paragraph.
B) Kept, because it sets up the main topic of the paragraph that follows.
C) Deleted, because it blurs the paragraph's main focus with a loosely related detail.
D) Deleted, because it repeats information that has been provided in an earlier paragraph.

CONTINUE

What most caught my interest, though, was a quotation from someone who described coworking spaces as "melting pots of creativity." The article refers to a 2012 survey in which 7 64 percent of respondents noted that coworking spaces prevented them from completing tasks in a given time. The article goes on to suggest that the most valuable resources provided by coworking spaces are actually the people 8 whom use them.

7

At this point, the writer wants to add specific information that supports the main topic of the paragraph.



Adapted from "The 3rd Global Coworking Survey." ©2013 by Deskmag.

Which choice most effectively completes the sentence with relevant and accurate information based on the graph above?

A) NO CHANGE
B) 71 percent of respondents indicated that using a coworking space increased their creativity.
C) respondents credited coworking spaces with giving them 74 percent of their ideas relating to business.
D) respondents revealed that their ability to focus on their work improved by 12 percent in a coworking space.

8

A) NO CHANGE
B) whom uses
C) who uses
D) who use

CONTINUE

[1] Thus, even though I already had all the equipment I needed in my home office, I decided to try using a coworking space in my city. [2] Because I was specifically interested in coworking's reported benefits related to creativity, I chose a facility that offered a bright, open work area where I wouldn't be isolated.
[3] Throughout the morning, more people appeared.
[4] Periods of quiet, during which everyone worked independently, were broken up occasionally with lively conversation. .9..

I liked the experience so much that I now go to the coworking space a few times a week. Over time, I've gotten to know several of my coworking .10.. colleagues: another website developer, a graphic designer, a freelance writer, and several mobile app coders. Even those of us who work in disparate fields are able to .11.. share advice and help each other brainstorm. In fact, it's the diversity of their talents and experiences that makes my coworking colleagues so valuable.

9

The writer wants to add the following sentence to the paragraph.

> After filling out a simple registration form and taking a quick tour of the facility, I took a seat at a table and got right to work on my laptop.

The best placement for the sentence is immediately

A) before sentence 1.
B) after sentence 1.
C) after sentence 2.
D) after sentence 3.

10

A) NO CHANGE
B) colleagues;
C) colleagues,
D) colleagues

11

A) NO CHANGE
B) give some wisdom
C) proclaim our opinions
D) opine

CONTINUE

Questions 12-22 are based on the following passage and supplementary material.

Dark Snow

Most of Greenland's interior is covered by a thick layer of ice and compressed snow known as the Greenland Ice Sheet. The size of the ice sheet fluctuates seasonally: in summer, average daily high temperatures in Greenland can rise to slightly above 50 degrees Fahrenheit, partially melting the ice; in the winter, the sheet thickens as additional snow falls, and average daily low temperatures can drop 12 to as low as 20 degrees.

12

Which choice most accurately and effectively represents the information in the graph?

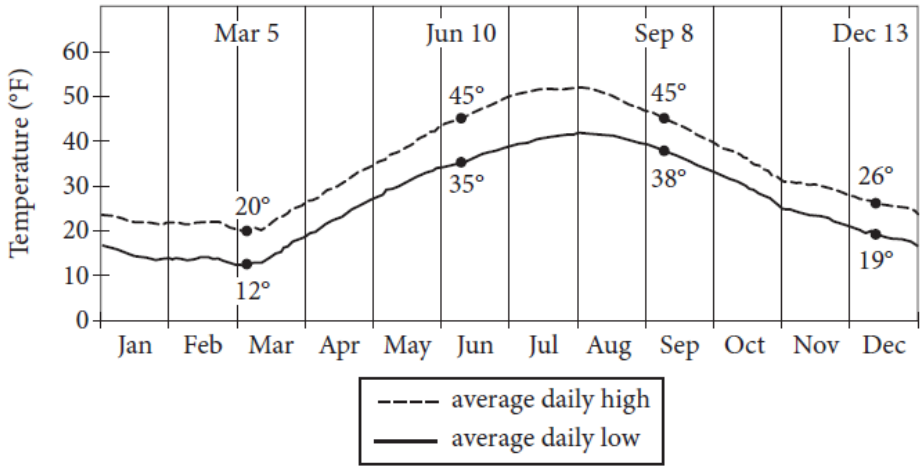
A) NO CHANGE

B) to 12 degrees Fahrenheit.

C) to their lowest point on December 13.

D) to 10 degrees Fahrenheit and stay there for months.

Average Daily High and Low Temperatures Recorded at Nuuk Weather Station, Greenland (1961—1990)



Adapted from WMO. ©2014 by World Meteorological Organization.

CONTINUE

Typically, the ice sheet begins to show evidence of thawing in late .13.. summer. This follows several weeks of higher temperatures. .14.. For example, in the summer of 2012, virtually the entire Greenland Ice Sheet underwent thawing at or near its surface by mid-July, the earliest date on record. Most scientists looking for the causes of the Great Melt of 2012 have focused exclusively on rising temperatures. The summer of 2012 was the warmest in 170 years, records show. But Jason .15.. Box, an associate professor of geology at Ohio State believes that another factor added to the early .16.. thaw; the "dark snow" problem.

13

Which choice most effectively combines the two sentences at the underlined portion?

A) summer, following
B) summer, and this thawing follows
C) summer, and such thawing follows
D) summer and this evidence follows

14

A) NO CHANGE
B) However,
C) As such,
D) Moreover,

15

A) NO CHANGE
B) Box an associate professor of geology at Ohio State,
C) Box, an associate professor of geology at Ohio State,
D) Box, an associate professor of geology, at Ohio State

16

A) NO CHANGE
B) thaw; and it was
C) thaw:
D) thaw: being

CONTINUE

According to Box, a leading Greenland expert, tundra fires in 2012 from as far away as North America produced great amounts of soot, some ..17.. of it drifted over Greenland in giant plumes of smoke and then ..18.. fell as particles onto the ice sheet. Scientists have long known that soot particles facilitate melting by darkening snow and ice, limiting ..19.. it's ability to reflect the Sun's rays. As Box explains, "Soot is an extremely powerful light absorber. It settles over the ice and captures the Sun's heat." The result is a self-reinforcing cycle. As the ice melts, the land and water under the ice become exposed, and since land and water are darker than snow, the surface absorbs even more heat, which ..20.. is related to the rising temperatures.

17

A) NO CHANGE
B) soot
C) of which
D) DELETE the underlined portion.

18

A) NO CHANGE
B) falls
C) will fall
D) had fallen

19

A) NO CHANGE
B) its
C) there
D) their

20

Which choice best completes the description of a self-reinforcing cycle?

A) NO CHANGE
B) raises the surface temperature.
C) begins to cool at a certain point.
D) leads to additional melting.

[1] Box's research is important because the fires of 2012 may not be a one-time phenomenon. [2] According to scientists, rising Arctic temperatures are making northern latitudes greener and thus more fire prone. [3] The pattern Box observed in 2012 may repeat 21 itself again, with harmful effects on the Arctic ecosystem. [4] Box is currently organizing an expedition to gather this crucial information. [5] The next step for Box and his team is to travel to Greenland to perform direct sampling of the ice in order to determine just how much the soot is contributing to the melting of the ice sheet. [6] Members of the public will be able to track his team's progress—and even help fund the expedition—through a website Box has created. 22

21

A) NO CHANGE
B) itself,
C) itself, with damage and
D) itself possibly,

22

To make this paragraph most logical, sentence 4 should be placed

A) where it is now.
B) after sentence 1.
C) after sentence 2.
D) after sentence 5.

STOP

If you finish before time is called, you may check your work on this section only. Do not turn to any other section.

ACT Math Test

30 Minutes, 30 Questions

DIRECTIONS

Solve each problem, choose the correct answer, and then fill in the corresponding oval on your answer document.

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

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

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

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

1. For what value of *x* is the equation $2^{2x+7} = 2^{15}$ true?

A. 2
B. 4
C. 11
D. 16
E. 44

2. A wallet containing 5 five-dollar bills, 7 ten-dollar bills, and 8 twenty-dollar bills is found and returned to its owner. The wallet's owner will reward the finder with 1 bill drawn randomly from the wallet. What is the probability that the bill drawn will be a twenty dollar bill?

F. $\frac{1}{20}$

G. $\frac{4}{51}$

H. $\frac{1}{8}$

J. $\frac{2}{5}$

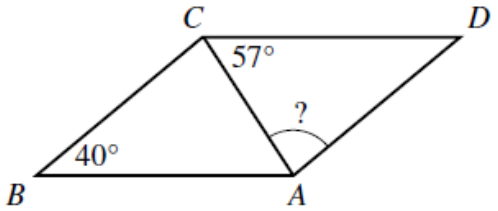
K. $\frac{2}{3}$

3. The ABC Book Club charges a \$40 monthly fee, plus \$2 per book read in that month. The Easy Book Club charges a \$35 monthly fee, plus \$3 per book read in that month. For each club, how many books must be read in 1 month for the total charges from each club to be equal?

A. 1
B. 4
C. 5
D. 6
E. 75

4. In parallelogram ABCD below, $\overline{AC}$ is a diagonal, the measure of ∠ABC is 40°, and the measure of ∠ACD is 57°. What is the measure of ∠CAD ?

F. 40°
G. 57°
H. 77°
J. 83°
K. 97°



5. In the standard (x,y) coordinate plane, what is the midpoint of the line segment that has endpoints (3,8) and (1,−4) ?

A. (−2, −12)

B. (−1, −6)

C. $(\frac{11}{2}, -\frac{3}{2})$

D. (2, 2)

E. (4, −12)

6. What is the slope of the line through (−2, 1) and (2, −5) in the standard (x,y) coordinate plane?

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

G. 1

H. −1

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

K. −4

7. The average of 5 distinct scores has the same value as the median of the 5 scores. The sum of the 5 scores is 420. What is the sum of the 4 scores that are NOT the median?

A. 315
B. 320
C. 336
D. 350
E. 360

8. Which of the following expressions is equivalent to $x^{\frac{2}{3}}$?

F. $\frac{x^2}{3}$

G. $\frac{x(2)}{3}$

H. $\sqrt{x^3}$

J. $\sqrt[3]{x}$

K. $\sqrt[3]{x^2}$

9. In the standard (x,y) coordinate plane, what is the slope of the line given by the equation $4x = 7y + 5$?

A. $-\frac{4}{7}$

B. $\frac{4}{7}$

C. $\frac{7}{4}$

D. 4

E. 7

10. For which of the following conditions will the sum of integers m and n always be an odd integer?
F. m is an odd integer.
G. n is an odd integer.
H. m and n are both odd integers.
J. m and n are both even integers.
K. m is an odd integer and n is an even integer.

11. $\frac{4.8 \times 10^{-7}}{1.6 \times 10^{-11}}$ = ?

A. 3.0×10^4
B. 3.0×10^{-4}
C. 3.0×10^{-18}
D. 3.2×10^{18}
E. 3.2×10^4

12. A circle in the standard (x,y) coordinate plane has center C (−1, 2) and passes through A (2, 6). Line segment $\overline{AB}$ is a diameter of this circle. What are the coordinates of point B ?

F. (−6, −2)
G. (−5, −1)
H. (−4, −2)
J. (4, 2)
K. (5, 10)

13. Which of the following expressions is a factor of $x^3 - 64$?

A. $x - 4$

B. $x + 4$

C. $x + 64$

D. $x^3 + 16$

E. $x^3 - 4x + 16$

14. The average of a list of 4 numbers is 90.0. A new list of 4 numbers has the same first 3 numbers as the original list, but the fourth number in the original list is 80, and the fourth number in the new list is 96. What is the average of this new list of numbers?

F. 90.0
G. 91.5
H. 94.0
J. 94.5
K. 94.8

15. Maria ordered a pizza. She ate only $\frac{2}{9}$ of it and gave the remaining pizza to her 3 brothers. What fraction of the whole pizza will each of Maria's brothers receive, if they share the remaining pizza equally?

A. $\frac{7}{9}$

B. $\frac{3}{7}$

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

D. $\frac{7}{27}$

E. $\frac{2}{27}$

16. Which of the following expressions, when evaluated, equals an irrational number?

F. $\frac{\sqrt{2}}{\sqrt{8}}$

G. $\frac{\sqrt{8}}{\sqrt{2}}$

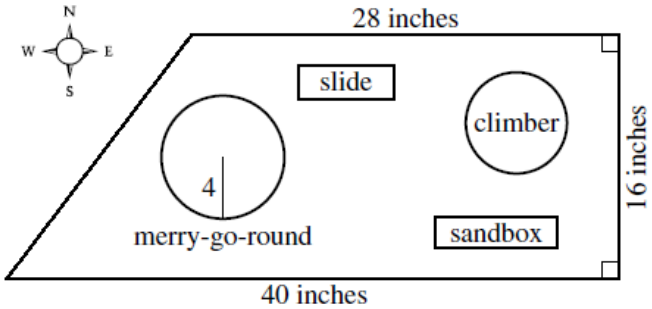
H. $(\sqrt{8})^2$

J. $\sqrt{2} \times \sqrt{8}$

K. $\sqrt{2} + \sqrt{8}$

Use the following information to answer questions 17-19.

Mikea, an intern with the Parks and Recreation Department, is developing a proposal for the new trapezoidal Springdale Park. The figure below shows her scale drawing of the proposed park with 3 side lengths and the radius of the merry-go-round given in inches. In Mikea's scale drawing, 1 inch represents 1.5 feet.



17. What is the area, in square inches, of the scale drawing of the park?

A. 448
B. 544
C. 640
D. 672
E. 1,088

18. Mikea's proposal includes installing a fence on the perimeter of the park. What is the perimeter, in *feet*, of the park?

F. 84
G. 88
H. 104
J. 126
K. 156

19. The length of the south side of the park is what percent of the length of the north side?

A. 112 %

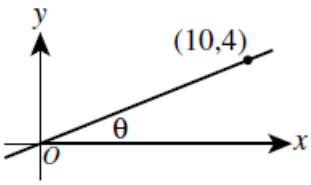
B. 124 %

C. $142\frac{6}{7}$ %

D. 175 %

E. 250 %

20. A line through the origin and (10,4) is shown in the standard (*x*,*y*) coordinate plane below. The acute angle between the line and the positive x-axis has measure θ. What is the value of tan,θ ?



F. $\frac{\sqrt{29}}{2}$

G. $\frac{2}{\sqrt{29}}$

H. $\frac{5}{\sqrt{29}}$

J. $\frac{2}{5}$

K. $\frac{5}{2}$

21. The frequency chart below shows the cumulative number of Ms. Hernandez's science students whose test scores fell within certain score ranges. All test scores are whole numbers.

Score Range	Cumulative number of students
65−70	12
65−80	13
65−90	19
65−100	21

How many students have a test score in the interval 71−80 ?

A. 1
B. 6
C. 8
D. 12
E. 13

22. Toby wants to find the volume of a solid toy soldier. He fills a rectangular container 8 cm long, 6 cm wide, and 10 cm high with water to a depth of 4 cm. Toby totally submerges the toy soldier in the water. The height of the water with the submerged toy soldier is 6.6 cm. Which of the following is closest to the volume, in cubic centimeters, of the toy soldier?

F. 125
G. 156
H. 192
J. 208
K. 317

23. Mario plays basketball on a town league team. The table below gives Mario's scoring statistics for last season. How many points did Mario score playing basketball last season?

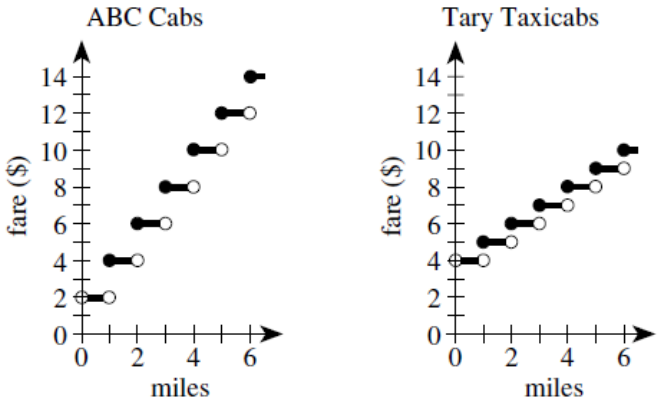
Type of shot	Number attempted	Percent Successful
1-point free throw	80	75%
2-point free throw	60	90%
3-point free throw	60	25%

A. 129
B. 190
C. 213
D. 330
E. 380

24. A room has a rectangular floor that is 15 feet by 21 feet. What is the area of the floor in square yards ?

F. 24
G. 35
H. 36
J. 105
K. 144

25. ABC Cabs and Tary Taxicabs both have an initial fare of a whole number of dollars for 1 passenger. The fare increases a whole number of dollars at each whole number of miles traveled. The graphs below show the 1-passenger fares, in dollars, for both cab companies for trips up to 6 miles. When the fares of the 2 cab companies are compared, what is the cheaper fare for a 5-mile trip?



A. $ 8
B. $ 9
C. $10
D. $11
E. $12

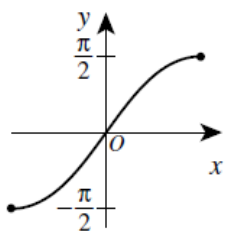
GO ON TO THE NEXT PAGE.

26. The 3rd and 4th terms of an arithmetic sequence are 13 and 18, respectively. What is the 50th term of the sequence?

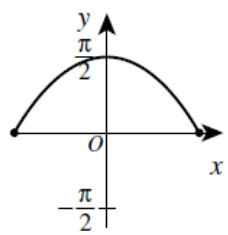
F. 248
G. 250
H. 253
J. 258
K. 263

27. One of the following graphs in the standard (x,y) coordinate plane is the graph of $y = \sin^2 x + \cos^2 x$ over the domain $-\frac{\pi}{2} \le x \le \frac{\pi}{2}$. Which one?

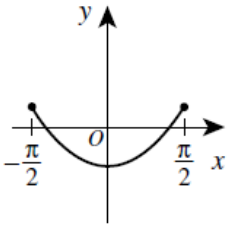
A



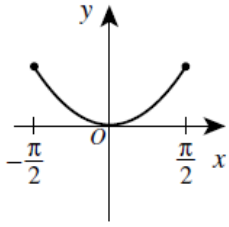
D.



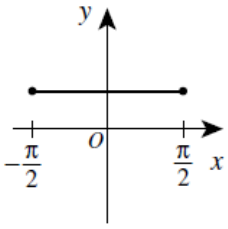
B.



E.



C.



28. At the school carnival, Mike will play a game in which he will toss a penny, a nickel, and a dime at the same time. He will be awarded 3 points for each coin that lands with heads faceup. Let the random variable x represent the total number of points awarded on any toss of the coins. What is the expected value of x ?

F. 1

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

H. $\frac{9}{2}$

J. 6

K. 9

29. For $-\frac{\pi}{2} \le \theta \le \frac{\pi}{2}$, $|\sin\theta| \ge 1$ is true for all and only the values of θ in which of the following sets?

A. $\left\{-\frac{\pi}{2}, \frac{\pi}{2}\right\}$

B. $\left\{\frac{\pi}{2}\right\}$

C. $\left\{\theta \mid -\frac{\pi}{2} \le \theta \le \frac{\pi}{2}\right\}$

D. $\{\theta \mid -\pi \le \theta \le \pi\}$

E. The empty set

30. Ray $\overrightarrow{PK}$ bisects $\angle LPM$, the measure of $\angle LPM$ is $11x°$, and the measure of $\angle LPK$ is $(4x + 18)°$. What is the measure of $\angle KPM$?

F. 12°

G. $28\frac{2}{7}°$

H. 42°

J. $61\frac{1}{5}°$

K. 66°

END OF ACT MATH TEST
STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.

ACT Reading Test

18 Minutes, 20 Questions

DIRECTIONS

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

PASSAGE I

LITERARY NARRATIVE: This passage is adapted from the essay "Rough Water" by David McGlynn (©2008 by David McGlynn).

One of my best races could hardly be called a race at all. I was a senior in high school, gunning to qualify for the USA Junior Nationals. The previous summer I had missed the cut by less than a second in the mile, and just the day before, at my high school regional meet, I had come within three-tenths of a second in the 500-yard freestyle. The qualification time was 4:39.69; I swam a 4:39.95. The next day, Sunday, I drove with my mother to the far side of Houston where a time trial was being held—an informal, unadvertised event thrown together at the last minute. The only races swum were those the swimmers requested to swim. Most were short, flapping sprints in which swimmers attempted to shave off a few one-hundredths of a second. I didn't have the courage to face the mile, and since I'd struck out in the 500 the day before, I decided to swim the 1,000-yard freestyle. Forty lengths of the pool. It was a race I'd swum fast enough to believe that given the right confluence of circumstances—cold water, an aggressive heat, an energetic meet—I could make the cut. I had fifteen seconds to drop to qualify.

By the time I stood up on the blocks, I was not only the only one in the race, I was practically the only one in the natatorium. The horn sounded and I dove in. I was angry and disheartened at having missed the cut the day before and I had little belief that I could go any faster today.

About six hundred yards in, my coach started to pace. I stayed steady on, not in a hurry, not about to get my hopes up. In my mind, I had already missed the time. Then a boy from a rival high school, whom I hardly knew, unfolded his legs and climbed down from the bleachers and started to cheer. He squatted low to the water and pointed his finger toward the end of the pool, as if to say, *That's where you're going, now hurry up*. I thought, *If he's cheering, maybe I'm close*.

Sometimes a moment comes along when the world slows down, and though everything else moves around us at the same frenetic speed, we're afforded the opportunity to reflect in real-time rather than in retrospect. It is as though we slip into a worm-hole in the fabric of time and space, travel into the past and then back again to the present in the same instant. That morning, swimming, I remembered a day in late September the year before, the last day my swim team had use of an outdoor pool. All summer long my teammates and I swam under an open sky. After this day we would spend the rest of the season in a dank and moldy indoor pool.

The triangular backstroke flags were strung across the lanes and the adjacent diving well. My teammates liked to run down the long cement deck, jump out over the diving well, and try to grab hold of the line. Many of them could jump far enough to make it. I could not, though I tried every day. I tried that day, and missed. Since I would not have another shot until May, I decided to try again. I squared up and ran, my feet wet against the pavement, and just as my foot hit the water's edge, one of my teammates called out "Jump!" I bent my knees and pushed off hard and got my hand around the flag line. I pulled the whole thing into the water. Autumn was coming and I wondered if there was a metaphor in what I had just done; a fortune folded inside a cookie: my greatest effort would come when I was down to my last opportunity.

Now it was March and I was down to my last opportunity, thinking about that day and hearing the word "Jump!" as my eyes followed the finger of the boy pointing me onward. What I understood—not later, but right then, in the water—was how little this swim added up to in the world. I had spent more than a year training for this one swim, and when it was finished the world would be no different than before it began. If no one else cared, then the swim was mine alone. It mattered because it was the task before me *now*, the thing I wanted *now*. Swimming, I had long understood, is a constant choice between the now and the later: exhaustion now for the sake of fitness later, all those Friday nights spent in the pool in pursuit of an end that seemed always one step farther on. I was out of laters, this was the end, and I made my choice. I cashed in the energy I set aside for climbing out of the pool and unfolding my towel and tying my shoes. I've never sprinted harder in my life, not before and not since. I hit the wall. I knew by instinct, by the spasm of my tendons and the ache in my bones, before I ever turned toward the clock or heard my coach scream, that I had made it.

1. The narrator of the passage can best be described as a swimmer who primarily:

A. recalls the swim of his life and the factors that motivated him during that swim.
B. remembers the events that inspired him to participate in a time trial at the Junior Nationals.
C. contrasts the joy of winning competitions early in the season with his later struggles to succeed.
D. chronicles his swimming career, from childhood through high school.

2. Which of the following events mentioned in the passage happened first chronologically?

F. The narrator stood on the blocks at the Sunday time trial his senior year.
G. The narrator leapt out over the diving well in late September.
H. The narrator swam the 500-yard freestyle in the high school regional meet as a senior.
J. The narrator heard a boy from a rival school cheering.

3. The narrator describes the natatorium as being nearly empty of spectators the day of his race in order to:

A. illustrate that the perfect racing conditions the narrator had hoped for weren't likely to occur.
B. demonstrate that, contrary to the narrator's expectations, the meet was energetic.
C. explain why the narrator's coach paced at the sound of the horn.
D. identify why the narrator felt a rush of energy before the race.

4. The narrator indicates that when he swam the 1,000-yard freestyle in the time trials, the world, for a moment, seemed to:

F. speed up, blurring past and present events.
G. rush past, forcing him to reflect in retrospect.
H. move in slow motion, as did everything around him.
J. slow down, allowing him to reflect in real time.

5. The passage indicates that during the narrator's swim at the time trial, he understood for the first time that:

A. his goals would always be one step farther on.
B. he had trained for this swim for over a year.
C. the swim was an event that was important to him alone.
D. swimming is a choice between the now and the later.

6. Based on the passage, the "end" the narrator mentions in line 82 most likely refers to his:

F. final pursuit of fitness.
G. last chance to qualify for Junior Nationals.
H. memory of his final Friday night practice.
J. ultimate realization that he had defeated the other competitors in the race.

7. The narrator of the passage characterizes the time trial in Houston as:

A. one long sprint in which swimmers attempted to improve their times.
B. a meet advertised as a way to qualify for the Junior Nationals.
C. a regional meet that featured only the 500-yard freestyle and 1,000-yard freestyle.
D. an informal swimming event put together at the last minute.

8. The statement "That's where you're going, now hurry up" (lines 36–37) can most directly be attributed to the:

F. cheering boy, as he verbally criticizes the narrator's efforts.
G. cheering boy, as he shouts encouragement to the narrator.
H. narrator, as he speculates about what the cheering boy meant when the boy pointed at the pool.
J. narrator, as he angrily contemplates his response to the cheering boy.

9. For the narrator, compared to practicing in the outdoor pool, practicing in the indoor pool is:

A. more productive.
B. more liberating.
C. less appealing.
D. less competitive.

10. When the narrator heard "Jump!" in his mind while swimming (line 69), he was most likely remembering:

F. his teammate's command the day the narrator caught the flag line.
G. his own shout as he leapt off the outdoor pool's deck that fall.
H. the cheers of the boy from the rival school.
J. the abrupt start of his race that Sunday.

Passage II

SOCIAL SCIENCE: Passage A is adapted from the book Apple: A Global History by Erika Janik (©2011 by Erika Janik). Passage B is adapted from the article "The Fatherland of Apples" by Gary Nabhan (©2008 by The Orion Society).

Passage A by Erika Janik

In early September of 1929, Nikolai Vavilov, famed Russian plant explorer and botanist, arrived in the central Asian crossroads of Alma-Ata, Kazakhstan. Climbing up the Zailijskei Alatau slopes of the Tian Shan mountains separating Kazakhstan from China, Vavilov found thickets of wild apples stretching in every direction, an extensive forest of fruit coloured russet red, creamy yellow, and vibrant pink. Nowhere else in the world do apples grow thickly as a forest or with such incredible diversity. Amazed by what he saw, Vavilov wrote: 'I could see with my own eyes that I had stumbled upon the centre of origin for the apple.'

With extraordinary prescience and few facts, Vavilov suggested that the wild apples he had seen growing in the Tian Shan were in fact the ancestors of the modern apple. He tracked the whole process of domestication to the mountains near Alma-Ata, where the wild apples looked awfully similar to the apples found at the local grocery. Unfortunately, Vavilov's theory would remain mostly unknown for decades.

Exactly where the apple came from had long been a matter of contention and discussion among people who study plant origins. Vavilov, imprisoned by Joseph Stalin in 1940 for work in plant genetics that challenged Stalin's beliefs, died in a Leningrad prison in 1943. Only after the fall of communism in Russia did Vavilov's theory, made more than half a century earlier, become widely recognized.

As Vavilov predicted, it's now believed that all of the apples known today are direct descendents of the wild apples that evolved in Kazakhstan. Apples do not comprise all of Kazakhstan's plant bounty, however. At least 157 other plant species found in Kazakhstan are either direct precursors or close wild relatives of domesticated crops, including 90 per cent of all cultivated temperate fruits. The name of Kazakhstan's largest city, Alma-Ata, or Almaty as it is known today, even translates as 'Father of Apples' or, according to some, 'where the apples are'. So this news about the apple's origins was probably no surprise to residents, particularly in towns where apple seedlings are known to grow up through the cracks in the pavements. The apple has been evolving in Central Asia for upwards of 4.5 million years.

Passage B by Gary Nabhan

Nikolai Vavilov is widely regarded as the world's greatest plant explorer, for he made over 250,000 seed, fruit, and tuber collections on five continents. Kazakh conservationist Tatiana Salova credits him with first recognizing that Kazakhstan was the center of origin and diversity for apples. "It is not surprising," she concedes, "that when Vavilov first came to Kazakhstan to look at plants he was so amazed. Nowhere else in the world do apples grow as a forest. That is one reason why he stated that this is probably where the apple was born, this was its birthing grounds."

Discerning where a crop originated and where the greatest portion of its genetic diversity remains extant may seem esoteric to the uninitiated. But knowing where exactly our food comes from—geographically, culturally, and genetically—is of paramount importance to the rather small portion of our own species that regularly concerns itself with the issue of food security. The variety of foods that we keep in our fields, orchards, and, secondarily, in our seed banks is critically important in protecting our food supply from plagues, crop diseases, catastrophic weather, and political upheavals. Vavilov himself was personally motivated to become an agricultural scientist by witnessing several famines during the czarist era of Russia. He hoped that by combining a more diverse seed portfolio with knowledge from both traditional farmers and collaborating scientists, the number of Russian families suffering from hunger might be reduced.

In a very real sense, the forests of wild foragers and the orchards of traditional farmers in such centers of crop diversity are the wellsprings of diversity that plant breeders, pathologists, and entomologists return to every time our society whittles the resilience in our fields and orchards down to its breaking point.

And whittle away we have done. Here in North America, according to apple historian Dan Bussey, some 16,000 apple varieties have been named and nurtured over the last four centuries. By 1904, however, the identities and sources of only 7,098 of those varieties could be discerned by USDA scientist W. H. Ragan. Since then, some 6,121 apple varieties—86.2 percent of Ragan's 1904 inventory—have been lost from nursery catalogs, farmers' markets, and from the American table.

11. The author's use of the words and phrases "thickets," "stretching in every direction," and "extensive forest" (lines 6–7) in Passage A most nearly serves to emphasize which of the following points?

A. The Tian Shan mountains are a challenge to navigate.
B. The apple varieties of Kazakhstan would be difficult for a botanist to catalog.
C. The diversity of plant species in Kazakhstan is crucially important.
D. The magnitude of wild apples in Kazakhstan is stunning.

12. The author of Passage A most likely states that the wild apples growing in the Tian Shan looked like apples found at the local grocery store to support the point that:

F. many of the apples stocked in grocery stores are harvested in the Tian Shan.
G. in the Tian Shan, Vavilov had likely found the wild ancestors of the domesticated apple.
H. the wild apples growing in the Tian Shan are among the most popular varieties with consumers.
J. in the Tian Shan, Vavilov had found new apple varieties to introduce to food producers.

13. Passage A makes which of the following claims about plant species that are found in Kazakhstan?

A. Approximately 157 species of cultivated temperate fruits originated in Kazakhstan.
B. Ninety percent of all domesticated crops are either direct precursors or close wild relatives of plant species found in Kazakhstan.
C. Of the plant species found in Kazakhstan, ninety percent are species of apples.
D. Aside from apples, at least 157 plant species found in Kazakhstan are either direct precursors or close wild relatives of domesticated crops.

14. Passage B most strongly suggests that Vavilov was motivated to become an agricultural scientist primarily because he:

F. wanted to have one of his findings published.
G. aimed to work with a famous botanist.
H. wished to remedy a personal financial crisis.
J. hoped to help feed others.

15. The author of Passage B uses the phrase "whittle away" (line 81) to refer to the way that apple varieties have been:

A. gradually lost from nursery catalogs, farmers' markets, and the American table.
B. modified by plant breeders, entomologists, and pathologists to meet specialized needs.
C. weeded out by scientists until only the few thousand most resilient varieties remained.
D. pared down in 1904 to the few varieties that nursery catalogs wanted to feature.

16. As it is used in lines 83–84, the phrase named and nurtured most nearly means:

F. nominated and encouraged.
G. identified and cultivated.
H. pointed to and groomed.
J. cited and fed.

17. In Passage B, it can most reasonably be inferred from the third paragraph (lines 75–80) that "centers of crop diversity" become crucially important when:

A. plant breeders would like to learn more about the plant species of central Asia.
B. problems with a cultivated crop require experts to research a new variety of the crop.
C. consumers would like more variety in grocery produce departments.
D. disputes among plant breeders, pathologists, and entomologists lead to a reduction in crop variety.

18. Which of the following statements best describes the difference in the tone of the two passages?

F. Passage A is defensive, whereas Passage B is dispassionate.
G. Passage A is solemn, whereas Passage B is optimistic.
H. Passage A is celebratory, whereas Passage B is cautionary.
J. Passage A is accusatory, whereas Passage B is sentimental.

19. Compared to the author of Passage A, the author of Passage B provides more information about the:

A. reduction in the number of apple varieties in North America over the past four centuries.
B. methods Vavilov used to prove to other scientists that the apples growing in the Tian Shan are the ancestors of the modern apple.
C. number of apple varieties that are thriving in Kazakhstan today.
D. techniques used by researchers to determine the regions with the greatest genetic diversity in plants.

20. Passage A quotes Vavilov as saying "'I could see with my own eyes that I had stumbled upon the centre of origin for the apple'" (lines 11–12). In Passage B this quote is directly:

F. invoked by the passage author as he imagines what Kazakhstan looked like centuries ago.
G. used to support an argument by USDA scientists.
H. paraphrased by Salova.
J. refuted by Bussey.

END OF ACT READING TEST
STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.

SAT Math Test - No Calculator

13 Minutes, 10 Questions

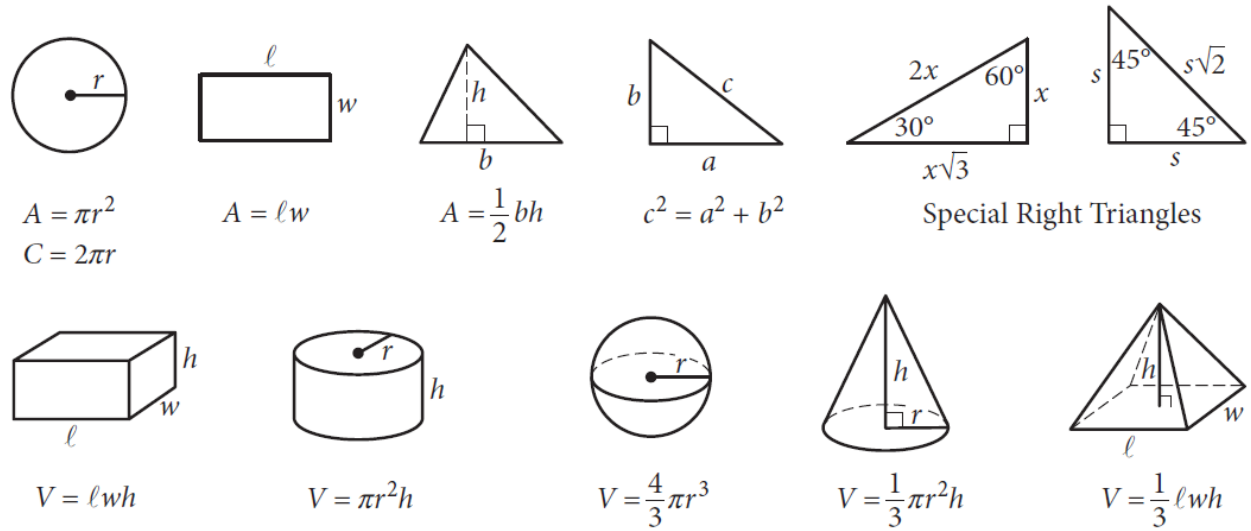
DIRECTIONS

For questions **1-7**, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions **8-10**, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 8 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

NOTES

1. The use of a calculator is **not permitted**.
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated, the domain of a given function *f* is the set of all real numbers *x* for which *f*(*x*) is a real number.

REFERENCE



$A = \pi r^2$
$C = 2\pi r$

$A = \ell w$

$A = \frac{1}{2}bh$

$c^2 = a^2 + b^2$

Special Right Triangles

$V = \ell wh$

$V = \pi r^2 h$

$V = \frac{4}{3}\pi r^3$

$V = \frac{1}{3}\pi r^2 h$

$V = \frac{1}{3}\ell wh$

The number of degrees of arc in a circle is 360.
The number of radians of arc in a circle is 2*p*.
The sum of the measures in degrees of the angles of a triangle is 180.

CONTINUE

1

If $\frac{x-1}{3} = k$ and $k = 3$, what is the value of x ?

A) 2

B) 4

C) 9

D) 10

2

Kathy is a repair technician for a phone company. Each week, she receives a batch of phones that need repairs. The number of phones that she has left to fix at the end of each day can be estimated with the equation $P = 108 - 23d$, where P is the number of phones left and d is the number of days she has worked that week. What is the meaning of the value 108 in this equation?

A) Kathy will complete the repairs within 108 days.

B) Kathy starts each week with 108 phones to fix.

C) Kathy repairs phones at a rate of 108 per hour.

D) Kathy repairs phones at a rate of 108 per day.

3

$$h = 3a + 28.6$$

A pediatrician uses the model above to estimate the height h of a boy, in inches, in terms of the boy's age a, in years, between the ages of 2 and 5. Based on the model, what is the estimated increase, in inches, of a boy's height each year?

A) 3

B) 5.7

C) 9.5

D) 14.3

4

If $\frac{a}{b} = 2$, what is the value of $\frac{4b}{a}$?

A) 0

B) 1

C) 2

D) 4

CONTINUE

5

$$b = 2.35 + 0.25x$$

$$c = 1.75 + 0.40x$$

In the equations above, b and c represent the price per pound, in dollars, of beef and chicken, respectively, x weeks after July 1 during last summer. What was the price per pound of beef when it was equal to the price per pound of chicken?

A) $2.60

B) $2.85

C) $2.95

D) $3.35

6

If 3x − y = 12, what is the value of $\frac{8^x}{2^y}$?

A) 2^{12}

B) 4^4

C) 8^2

D) The value cannot be determined from the information given.

7

If $(ax + 2)(bx + 7) = 15x^2 + cx + 14$ for all values of x, and $a + b = 8$, what are the two possible values for c ?

A) 3 and 5

B) 6 and 35

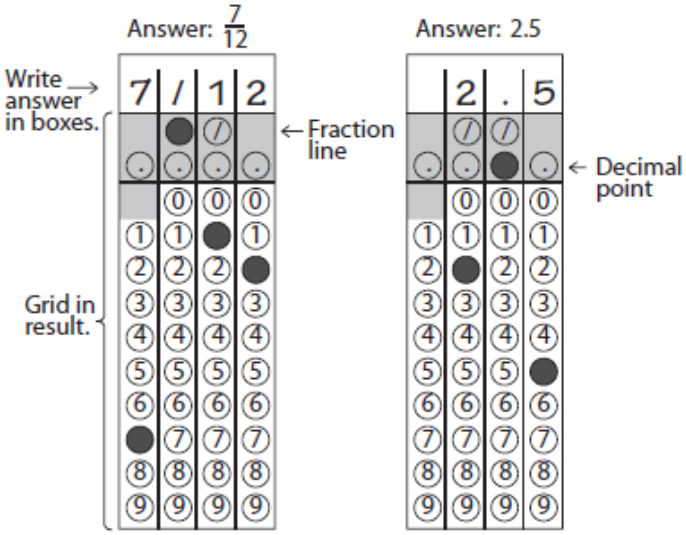
C) 10 and 21

D) 31 and 41

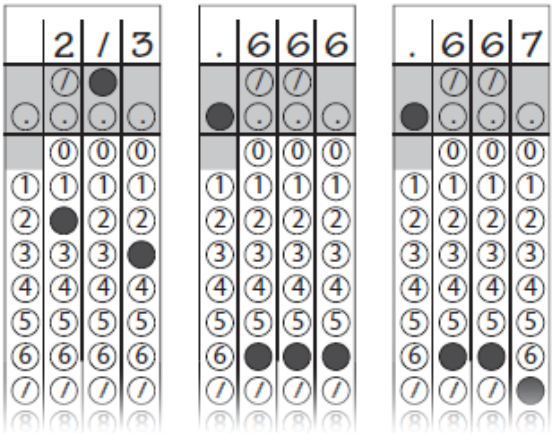
DIRECTIONS

For questions 16–20, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

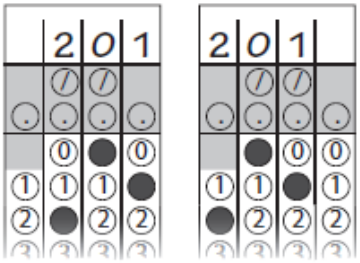
1. Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
2. Mark no more than one circle in any column.
3. No question has a negative answer.
4. Some problems may have more than one correct answer. In such cases, grid only one answer.
5. **Mixed numbers** $3\frac{1}{2}$ must be gridded as 3.5 or 7/2. (If  is entered into the grid, it will be interpreted as $\frac{31}{2}$, not $3\frac{1}{2}$.)
6. **Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.



Acceptable ways to grid $\frac{2}{3}$ are:



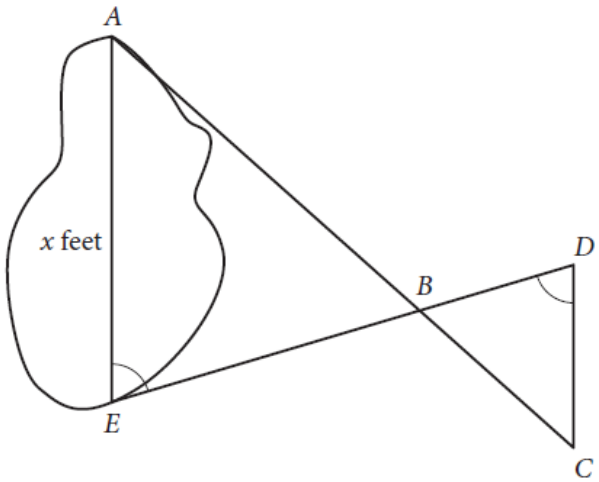
Answer: 201 – either position is correct



NOTE: You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.

CONTINUE

8



A summer camp counselor wants to find a length, x, in feet, across a lake as represented in the sketch above. The lengths represented by AB, EB, BD, and CD on the sketch were determined to be 1800 feet, 1400 feet, 700 feet, and 800 feet, respectively. Segments AC and DE intersect at B, and $\angle AEB$ and $\angle CDB$ have the same measure. What is the value of x ?

9

$$x + y = -9$$
$$x + 2y = -25$$

According to the system of equations above, what is the value of x ?

10

If $a = 5\sqrt{2}$ and $2a = \sqrt{2x}$, what is the value of x ?

STOP

If you finish before time is called, you may check your work on this section only. Do not turn to any other section.

SAT Math Test - Calculator

28 Minutes, 19 Questions

DIRECTIONS

For questions **1-15**, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions **16-19**, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 16 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

NOTES

1. The use of a calculator is **permitted**.
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated, the domain of a given function *f* is the set of all real numbers *x* for which *f*(*x*) is a real number.

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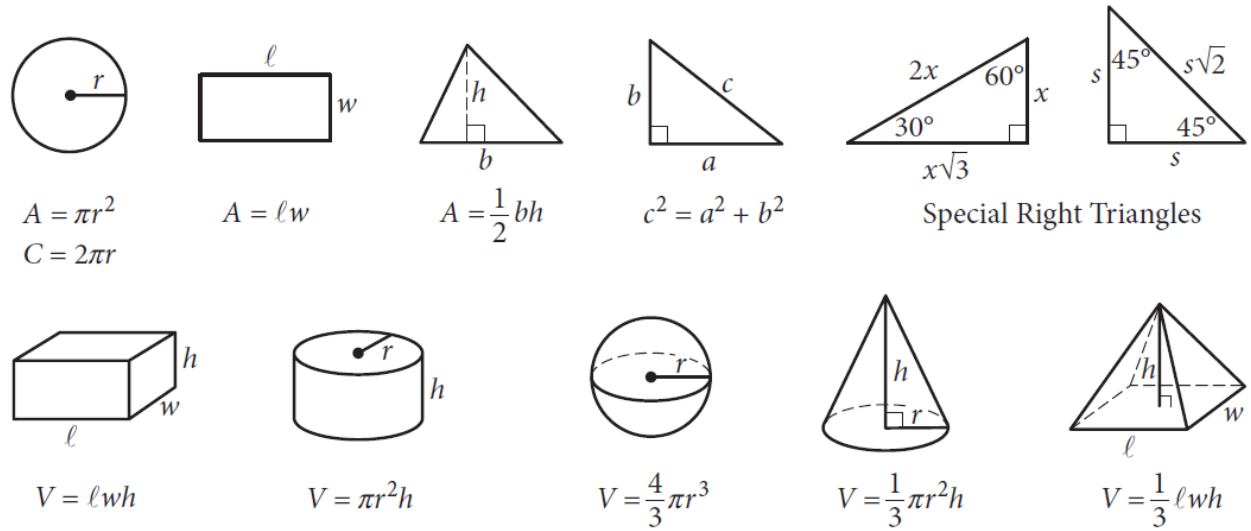

$A = \pi r^2$
$C = 2\pi r$

$A = \ell w$

$A = \frac{1}{2}bh$

$c^2 = a^2 + b^2$

Special Right Triangles

$V = \ell wh$

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$V = \frac{4}{3}\pi r^3$

$V = \frac{1}{3}\pi r^2 h$

$V = \frac{1}{3}\ell wh$

The number of degrees of arc in a circle is 360.
The number of radians of arc in a circle is 2*p*.
The sum of the measures in degrees of the angles of a triangle is 180.

1

If $y = kx$, where k is a constant, and $y = 24$ when $x = 6$, what is the value of y when $x = 5$?

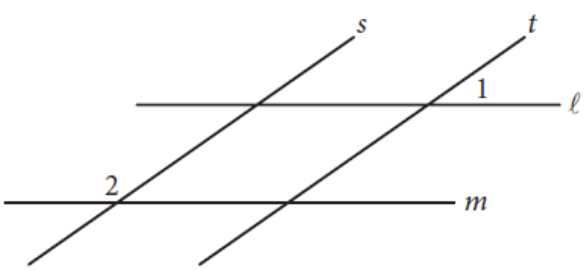
A) 6

B) 15

C) 20

D) 23

2



In the figure above, lines ℓ and m are parallel and lines s and t are parallel. If the measure of $\angle 1$ is 35°, what is the measure of $\angle 2$?

A) 35°

B) 55°

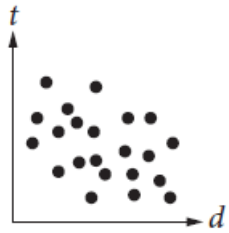
C) 70°

D) 145°

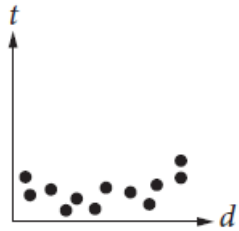
3

Which of the following graphs best shows a strong negative association between d and t ?

A)



B)



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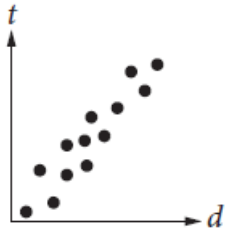
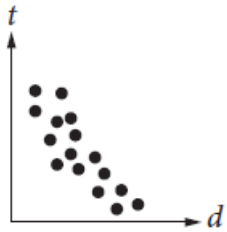


D)



CONTINUE

4

1 decagram = 10 grams
1,000 milligrams = 1 gram

A hospital stores one type of medicine in 2-decagram containers. Based on the information given in the box above, how many 1-milligram doses are there in one 2-decagram container?

A) 0.002

B) 200

C) 2,000

D) 20,000

5

Which of the following numbers is NOT a solution of the inequality $3x - 5 \geq 4x - 3$?

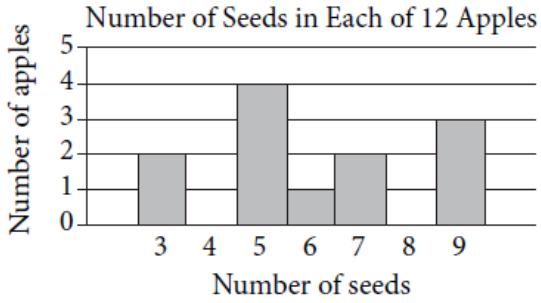
A) −1

B) −2

C) −3

D) −5

6



Based on the histogram above, of the following, which is closest to the average (arithmetic mean) number of seeds per apple?

A) 4

B) 5

C) 6

D) 7

CONTINUE

7

		Course			
		Algebra I	Geometry	Algebra II	Total
Gender	Female	35	53	62	150
	Male	44	59	57	160
	Total	79	112	119	310

A group of tenth-grade students responded to a survey that asked which math course they were currently enrolled in. The survey data were broken down as shown in the table above. Which of the following categories accounts for approximately 19 percent of all the survey respondents?

A) Females taking Geometry

B) Females taking Algebra II

C) Males taking Geometry

D) Males taking Algebra I

8

Lengths of Fish (in inches)						
8	9	9	9	10	10	11
11	12	12	12	12	13	13
13	14	14	15	15	16	24

The table above lists the lengths, to the nearest inch, of a random sample of 21 brown bullhead fish. The outlier measurement of 24 inches is an error. Of the mean, median, and range of the values listed, which will change the most if the 24-inch measurement is removed from the data?

A) Mean

B) Median

C) Range

D) They will all change by the same amount.

9

A food truck sells salads for $6.50 each and drinks for $2.00 each. The food truck's revenue from selling a total of 209 salads and drinks in one day was $836.50. How many salads were sold that day?

A) 77

B) 93

C) 99

D) 105

CONTINUE

10

Alma bought a laptop computer at a store that gave a 20 percent discount off its original price. The total amount she paid to the cashier was p dollars, including an 8 percent sales tax on the discounted price. Which of the following represents the original price of the computer in terms of p ?

A) $0.88p$

B) $\frac{p}{0.88}$

C) $(0.8)(1.08)p$

D) $\frac{p}{(0.8)(1.08)}$

11

Dreams Recalled during One Week

	None	1 to 4	5 or more	Total
Group X	15	28	57	100
Group Y	21	11	68	100
Total	36	39	125	200

The data in the table above were produced by a sleep researcher studying the number of dreams people recall when asked to record their dreams for one week. Group X consisted of 100 people who observed early bedtimes, and Group Y consisted of 100 people who observed later bedtimes. If a person is chosen at random from those who recalled at least 1 dream, what is the probability that the person belonged to Group Y ?

A) $\frac{68}{100}$

B) $\frac{79}{100}$

C) $\frac{79}{164}$

D) $\frac{164}{200}$

12

Which of the following is an equation of a circle in the xy-plane with center (0, 4) and a radius with endpoint ($\frac{4}{3}$, 5) ?

A) $x^2 + (y - 4)^2 = \frac{25}{9}$

B) $x^2 + (y + 4)^2 = \frac{25}{9}$

C) $x^2 + (y - 4)^2 = \frac{5}{3}$

D) $x^2 + (y + 4)^2 = \frac{5}{3}$

13

Katarina is a botanist studying the production of pears by two types of pear trees. She noticed that Type A trees produced 20 percent more pears than Type B trees did. Based on Katarina's observation, if the Type A trees produced 144 pears, how many pears did the Type B trees produce?

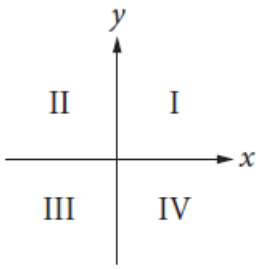
A) 115

B) 120

C) 124

D) 173

14



If the system of inequalities $y \geq 2x + 1$ and $y > \frac{1}{2}x - 1$ is graphed in the xy-plane above, which quadrant contains no solutions to the system?

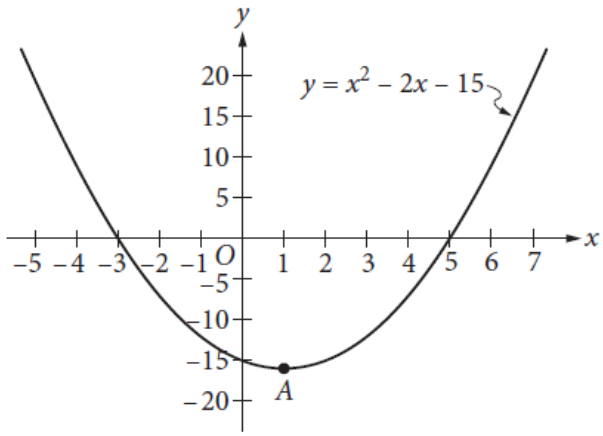
A) Quadrant II

B) Quadrant III

C) Quadrant IV

D) There are solutions in all four quadrants.

15



Which of the following is an equivalent form of the equation of the graph shown in the xy-plane above, from which the coordinates of vertex A can be identified as constants in the equation?

A) $y = (x + 3)(x - 5)$

B) $y = (x - 3)(x + 5)$

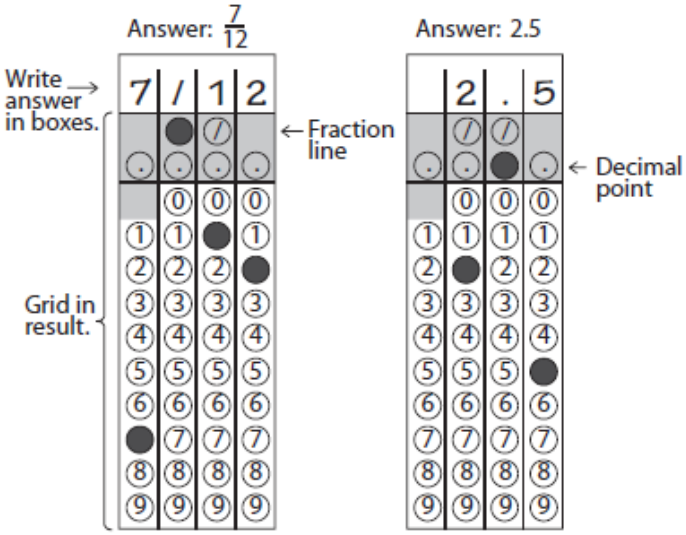
C) $y = x(x - 2) - 15$

D) $y = (x - 1)^2 - 16$

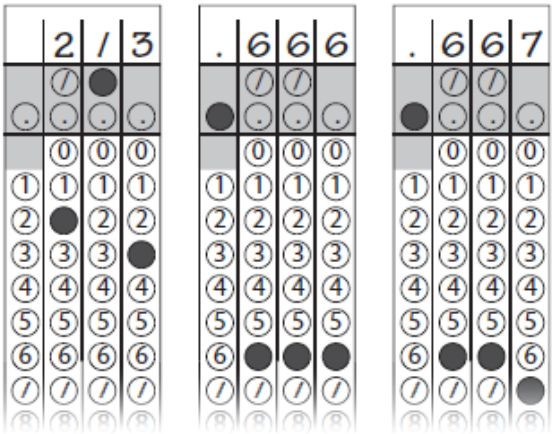
DIRECTIONS

For questions 16–20, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

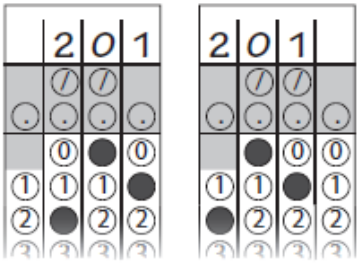
1. Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
2. Mark no more than one circle in any column.
3. No question has a negative answer.
4. Some problems may have more than one correct answer. In such cases, grid only one answer.
5. **Mixed numbers** $3\frac{1}{2}$ must be gridded as 3.5 or 7/2. (If  is entered into the grid, it will be interpreted as $\frac{31}{2}$, not $3\frac{1}{2}$.)
6. **Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.



Acceptable ways to grid $\frac{2}{3}$ are:



Answer: 201 – either position is correct



NOTE: You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.

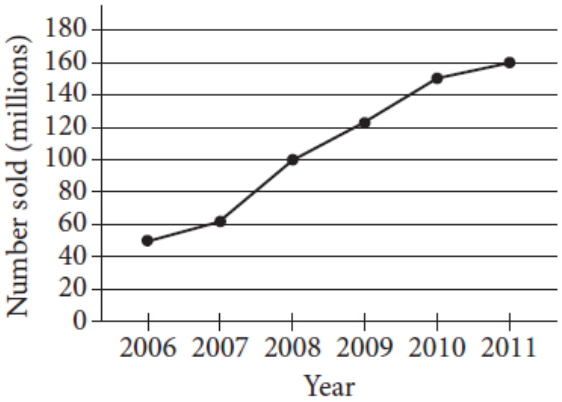
CONTINUE

16

Wyatt can husk at least 12 dozen ears of corn per hour and at most 18 dozen ears of corn per hour. Based on this information, what is a possible amount of time, in hours, that it could take Wyatt to husk 72 dozen ears of corn?

17

Number of Portable Media Players
Sold Worldwide Each Year from 2006 to 2011



According to the line graph above, the number of portable media players sold in 2008 is what fraction of the number sold in 2011 ?

Questions 37 and 38 refer to the following information.

Jessica opened a bank account that earns 2 percent interest compounded annually. Her initial deposit was \$100, and she uses the expression $\$100(x)^t$ to find the value of the account after t years.

18

What is the value of x in the expression?

19

Jessica's friend Tyshaun found an account that earns 2.5 percent interest compounded annually. Tyshaun made an initial deposit of \$100 into this account at the same time Jessica made a deposit of \$100 into her account. After 10 years, how much more money will Tyshaun's initial deposit have earned than Jessica's initial deposit? (Round your answer to the nearest cent and ignore the dollar sign when gridding your response.)

STOP

If you finish before time is called, you may check your work on this section only. Do not turn to any other section.

ACT Science Test

18 Minutes, 20 Questions

DIRECTIONS

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

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

Passage I

A study was conducted to examine whether female *Blattella germanica* (a species of cockroach) prefer to eat cat food, cheese, ham, or peanuts. First, 200 mg of each of the 4 foods was separately placed into a single box. Then, adult female *B. germanica* were added to the box. Figure 1 shows how the mass, in mg, of each food in the box changed over time after the addition of the *B. germanica*. Table 1 shows the percent by mass of carbohydrates, lipids, proteins, and water, respectively, present in each of the 4 foods tested in the study.

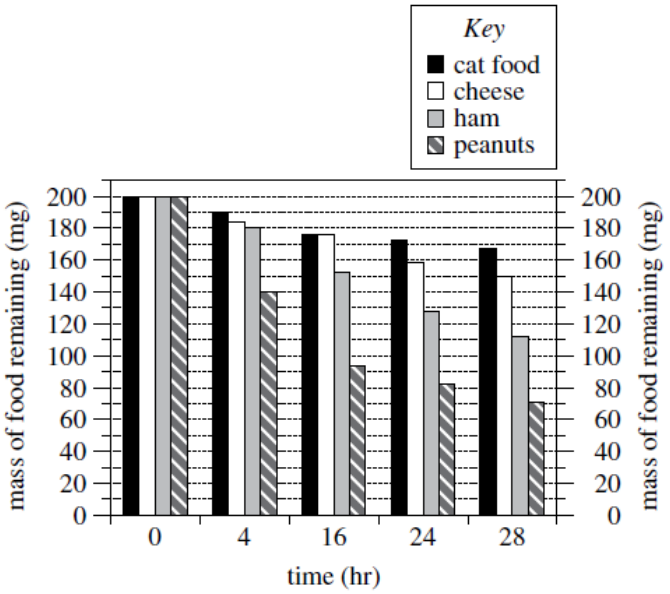


Figure 1

Figure adapted from Prachumporn Lauprasert et al., "Food Preference and Feeding Behavior of the German Cockroach, *Blattella germanica* (Linnaeus)." ©2006 by the Faculty of Science, Chulalongkorn University.

Table 1

Food	Percent by mass			
	carbohydrates	lipids	proteins	water
Cat food	1.2	6.0	16.9	66.2
Cheese	0.5	27.7	20.8	48.4
Ham	0.0	18.2	23.6	57.1
Peanuts	15.8	49.6	26.2	6.4

Table adapted from U.S. Department of Agriculture, *USDA National Nutrient Database for Standard Reference, Release 24*. 2011.

1. According to Figure 1, the mass of cheese remaining at 4 hr was closest to which of the following values?

A. 140 mg
B. 176 mg
C. 185 mg
D. 190 mg

2. Suppose a company wants to use food as bait in a trap designed to capture female *B. germanica*. Based on Figure 1, which of the 4 foods should the company place in the trap to maximize the chance of capturing female *B. germanica* ?

F. Cat food
G. Cheese
H. Ham
J. Peanuts

3. Consider the 4 foods in order of the percent by mass of proteins, from lowest to highest. From food to food, as the percent by mass of proteins increased, the mass of food remaining at 28 hr:

A. increased only.
B. decreased only.
C. increased and then decreased.
D. decreased and then increased.

4. Consider the statement "The *B. germanica* ate the food between 0 hr and 4 hr, between 4 hr and 16 hr, between 16 hr and 24 hr, and between 24 hr and 28 hr." This statement is consistent with the data in Figure 1 for how many of the 4 foods?

F. 1
G. 2
H. 3
J. 4

5. A student predicted that the *B. germanica* would eat less cat food than ham by the end of the study. Do the data in Figure 1 support this prediction?

A. Yes; at 28 hr, the mass of cat food remaining was about 55 mg greater than the mass of ham remaining.
B. Yes; at 28 hr, the mass of cat food remaining was about 95 mg greater than the mass of ham remaining.
C. No; at 28 hr, the mass of cat food remaining was about 55 mg less than the mass of ham remaining.
D. No; at 28 hr, the mass of cat food remaining was about 95 mg less than the mass of ham remaining.

6. Based on Table 1, when 200 mg of each of the 4 foods was placed in the box, water accounted for more than 100 mg of the mass of which food(s)?

F. Peanuts only
G. Cat food and ham only
H. Cheese and peanuts only
J. Cat food, cheese, and ham only

Passage II

A teacher provided the table below to the students in a science class. The table gives 5 properties for each of Samples A–H. The students were told to assume that each sample is a completely solid cube composed of a single hypothetical pure substance.

Sample	Mass (g)	Volume (cm^3)	Density (g/cm^3)	Melting point (°C)	Boiling point (°C)
A	8.0	4.0	2.0	126	747
B	8.0	4.0	2.0	342	959
C	6.0	3.0	2.0	237	885
D	6.0	3.0	2.0	237	885
E	8.0	2.0	4.0	126	747
F	8.0	2.0	4.0	126	747
G	4.0	1.0	4.0	126	747
H	4.0	1.0	4.0	342	959

Note: Assume that mass, volume, and density were determined at 20°C and that all 5 properties were determined at 1 atmosphere (atm) of pressure.

The teacher asked each of 4 students to explain how these data could be used to predict which samples are composed of the same substance.

Student 1

If 2 samples have the same values for all 5 properties, they are composed of the same substance. If 2 samples have different values for any of the 5 properties, they are composed of different substances.

Student 2

If 2 samples have the same values for any 3 or more of the 5 properties, they are composed of the same substance. If 2 samples have the same values for fewer than 3 of the 5 properties, they are composed of different substances.

Student 3

If 2 samples have the same mass, volume, and density, they are composed of the same substance. If 2 samples have different values for any of these 3 properties, they are composed of different substances. Neither melting point nor boiling point, by itself, can distinguish between substances
.

Student 4

If 2 samples have the same density, melting point, and boiling point, they are composed of the same substance. If 2 samples have different values for any of these 3 properties, they are composed of different substances. Neither mass nor volume, by itself, can distinguish between substances.

7. Based on Student 1's explanation, the same substance composes both of the samples in which of the following pairs?

A. Samples A and B
B. Samples B and C
C. Samples C and D
D. Samples D and E

8. Based on Student 3's explanation, the same substance composes both of the samples in which of the following pairs?

F. Samples A and C
G. Samples B and E
H. Samples F and G
J. Samples G and H

9. Suppose that the temperature of Sample A is increased to 250°C at 1 atm of pressure. At 250°C, would Sample A be a solid or a liquid?

A. Solid, because the melting point of Sample A is 126°C.
B. Solid, because the melting point of Sample A is 747°C.
C. Liquid, because the melting point of Sample A is 126°C.
D. Liquid, because the melting point of Sample A is 747°C.

10. Consider the claim that 2 samples having the same density will always be composed of the same substance, regardless of the values of the other 4 properties. Which of the students, if any, would be likely to agree with this claim?

F. Students 1 and 2 only
G. Students 2, 3, and 4 only
H. All of the students
J. None of the students

11. Which of Students 2, 3, and 4 would be likely to agree that Sample A and Sample B are composed of the same substance?

A. Students 2 and 3 only
B. Students 2 and 4 only
C. Students 3 and 4 only
D. Students 2, 3, and 4

12. Consider the statement "Two samples that have the same mass, volume, density, and boiling point are composed of the same substance, even if the two samples have different melting points." Which of Students 2 and 4, if either, would be likely to agree with this statement?

F. Student 2 only
G. Student 4 only
H. Both Student 2 and Student 4
J. Neither Student 2 nor Student 4

13. Suppose that the temperature of Sample D is increased to 890°C at 1 atm of pressure. Will the sample's density be lower than or higher than it was at 20°C and 1 atm ?

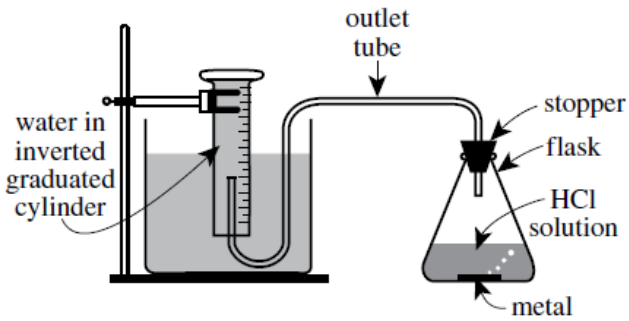
A. Lower; Sample D will be a gas, and gases generally have lower densities than do solids.
B. Lower; Sample D will be a liquid, and liquids generally have lower densities than do solids.
C. Higher; Sample D will be a gas, and gases generally have higher densities than do solids.
D. Higher; Sample D will be a liquid, and liquids generally have higher densities than do solids.

Passage III

When a solid metal (M) such as iron (Fe), nickel (Ni), or zinc (Zn) is placed in an aqueous hydrochloric acid (HCl) solution, a reaction that produces H2 gas occurs:

$$M + 2HCl \rightarrow MCl2 + H2$$

Two experiments were conducted to study the production of H2 in this reaction. The apparatus shown in the diagram below was used to collect the H2 gas produced in each trial.



diagram

As H2 was produced in the stoppered flask, it exited the flask through the outlet tube and displaced the water that had been trapped in the inverted graduated cylinder. (This displacement occurred because the H2 did not dissolve in the water.) The volume of water displaced equaled the volume of gas (H2 and water vapor) collected.

In each trial of the experiments, Steps 1−3 were performed:

1. The apparatus was assembled, and 25 mL of a 4 moles/L HCl solution was poured into the empty flask.

2. A selected mass of Fe, Ni, or Zn was added to the flask, and the stopper was quickly reinserted into the flask.

3. When H2 production ceased, the volume of water that was displaced from the graduated cylinder was recorded.

The apparatus and its contents were kept at a selected temperature throughout Steps 2 and 3. The atmospheric pressure was 758 mm Hg throughout all 3 steps.

Experiment 1

In each trial, a selected mass of Fe, Ni, or Zn was tested at 30°C (see Figure

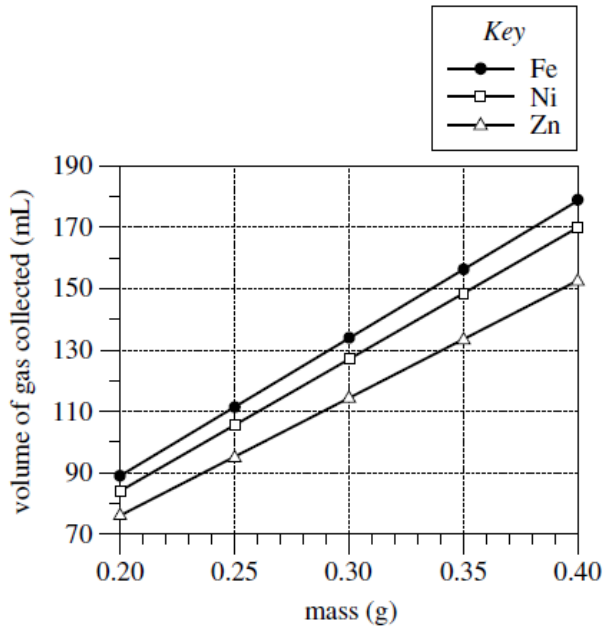


Figure 1

Experiment 2

In each trial, 0.30 g of Fe, Ni, or Zn was tested at a selected temperature (see Figure 2).

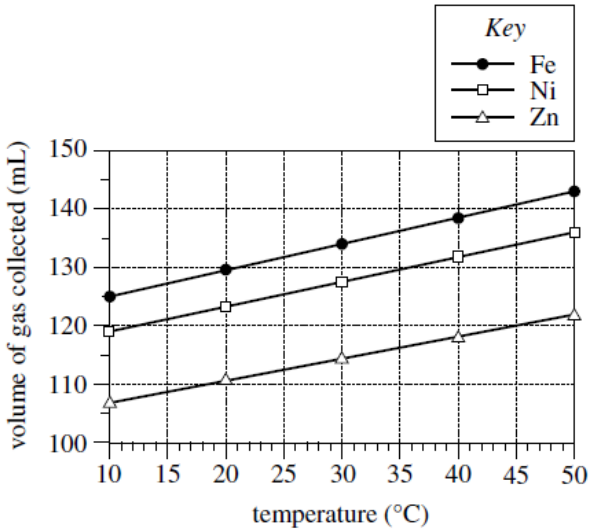


Figure 2

14. Consider the volume of gas collected in the trial in Experiment 2 for Ni at 30°C. The same approximate volume of gas was collected in the trial in Experiment 1 for what mass of Ni ?

F. 0.20 g
G. 0.25 g
H. 0.30 g
J. 0.35 g

15. How many temperatures were tested in Experiment 1, and how many temperatures were tested in Experiment 2 ?

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

16. Which of the following statements describes a difference between Experiments 1 and 2 ? In Experiment 1:

F. only Fe was tested, but in Experiment 2, Fe, Ni, and Zn were tested.
G. Fe, Ni, and Zn were tested, but in Experiment 2, only Fe was tested.
H. the same mass value of each metal was tested, but in Experiment 2, multiple mass values of each metal were tested.
J. multiple mass values of each metal were tested, but in Experiment 2, the same mass value of each metal was tested.

17. Which of the following variables remained constant throughout both experiments?

A. Atmospheric pressure
B. Mass of metal
C. Temperature
D. Volume of gas collected

18. If a temperature of 5°C had been tested in Experiment 2, would the volume of gas collected for Zn more likely have been greater than 107 mL or less than 107 mL ?

F. Greater than 107 mL, because for a given metal, the volume of collected gas increased as the temperature decreased.
G. Greater than 107 mL, because for a given metal, the volume of collected gas increased as the temperature increased.
H. Less than 107 mL, because for a given metal, the volume of collected gas decreased as the temperature decreased.
J. Less than 107 mL, because for a given metal, the volume of collected gas decreased as the temperature increased.

19. Consider the balanced chemical equation in the passage. Based on this equation, if 10 moles of HCl are consumed, how many moles of H2 are produced?

A. 5
B. 10
C. 15
D. 20

20. Suppose that the trial in Experiment 1 with 0.25 g of Zn is repeated, except that the inverted graduated cylinder is replaced by inverted test tubes, each completely filled with 60 mL of water. Based on Figure 1, how many test tubes will be needed to collect all the gas?

F. 1
G. 2
H. 3
J. 4

END OF ACT SCIENCE TEST
STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.