PSAT READING



Directions: Each passage or pair of passages in this exam is accompanied by a series of questions. Read each passage or pair of passages closely, then choose the best answer to each question based on what is stated or implied in the text of the passage and any accompanying graphics, such as graphs or tables.

Questions 1 - 9 are based on the following passage.

This is an excerpt from Mary Wollstonecraft Shelley's novel Frankenstein. The English novel was first published in London in 1818 and is told through the perspective of a boy named Victor.

For a long time, I was their only care. My mother had much desired to have a daughter, but I continued their single offspring. When I was about five years old, while making an excursion beyond the frontiers of Italy, they passed a week

- 5 on the shores of the Lake of Como. Their benevolent disposition often made them enter the cottages of the poor. This, to my mother, was more than a duty; it was a necessity, a passion—remembering what she had suffered, and how she had been relieved—for her to act in her turn the
- 10 guardian angel to the afflicted. During one of their walks, a poor cot in the foldings of a vale attracted their notice as being singularly disconsolate, while the number of halfclothed children gathered about it spoke of penury in its worst shape.
- 15 One day, when my father had gone by himself to Milan, my mother, accompanied by me, visited this abode. She found a peasant and his wife, hard working, bent down by care and labor, distributing a scanty meal to five hungry babes. Among these, there was one which attracted my mother far
- 20 above all the rest. She appeared of a different stock. The four others were dark-eyed, hardy little vagrants; this child was thin and very fair. Her hair was the brightest living gold, and despite the poverty of her clothing, seemed to set a crown of distinction on her head. Her brow was
- 25 clear and ample, her blue eyes cloudless, and her lips and the molding of her face so expressive of sensibility and sweetness that none could behold her without looking on her as of a distinct species, a being heaven-sent, and bearing a celestial stamp in all her features.
- 30 The peasant woman, perceiving that my mother fixed eyes of wonder and admiration on this lovely girl, eagerly communicated her history. She was not her child, but the daughter of a Milanese nobleman. Her mother was a German and had died on giving her birth. The infant had been placed
- 35 with these good people to nurse: they were better off then. They had not been long married, and their eldest child was but just born.

The father of their charge was one of those Italians nursed in the memory of the antique glory of Italy—one among the

- 40 schiavi ognor frementi, who exerted himself to obtain the liberty of his country. He became the victim of its weakness. Whether he had died or still lingered in the dungeons of Austria was not known. His property was confiscated; his child became an orphan and a beggar. She
- 45 continued with her foster parents and bloomed in their rude abode, fairer than a garden rose among dark-leaved brambles. When my father returned from Milan, he found playing with me in the hall of our villa a child fairer than pictured
- cherub—a creature who seemed to shed radiance from her looks 50 and whose form and motions were lighter than the chamois of the hills. The apparition was soon explained. With his permission my mother prevailed on her rustic guardians to yield their charge to her. They were fond of the sweet orphan. Her presence had seemed a blessing to them, but it
- 55 would be unfair to her to keep her in poverty and want when Providence afforded her such powerful protection. They consulted their village priest, and the result was that Elizabeth Lavenza became the inmate of my parents' house—my

- **3.** The author includes the description of the fair child with gold hair (lines 20 29) primarily to
 - (A) \bigcirc suggest that the foster family is not treating her well.
 - (B) \bigcirc distinguish her from the rest of the foster children.
 - (C) \bigcirc foreshadow the disruption to the family unit.
 - (D) \bigcirc offer a sense of how poor the family is.
- 4. Which choice provides the best evidence for the answer to the previous question?
 - (A) 🔘 Lines 15 16 ("One...abode.")
 - (B) 🔘 Lines 16 18 ("She...babes.")
 - (C) 🔘 Line 20 ("She...stock.")
 - (D) O Lines 32 33 ("She...nobleman.")
- 5. What impact does the description about Elizabeth's parents in lines 33 44 ("Her mother... beggar") have on the passage?
 - (A) \bigcirc It minimizes the difficulty of Elizabeth's struggles.
 - (B) \bigcirc It emphasizes the tragedy of Elizabeth's story.
 - (C) 🔘 It foreshadows Elizabeth's tragic fate.
 - (D) 🔘 It educates readers about the dangers of childbirth.
- 6. As it is used in line 51, "apparition" most nearly means
 - (A) O orphan.
 - (B) O child.
 - (C) 🔘 ghost.
 - (D) 🔘 angel.
- 7. As it is used in line 58, "inmate" most nearly means
 - (A) 🔘 guest.
 - (B) O prisoner.
 - (C) 🔘 resident.
 - (D) O renter.
- 8. The author compares Elizabeth's motions to "chamois of the hills" (lines 50 51) to emphasize her
 - (A) 🔘 inner light.
 - (B) 🔘 grace.
 - (C) O playfulness.
 - (D) \bigcirc love of nature.

9. Which choice best summarizes the passage?



more than sister—the beautiful and adored companion of all 60 my occupations and my pleasures.

Everyone loved Elizabeth. The passionate and almost reverential attachment with which all regarded her became, while I shared it, my pride and my delight. On the evening previous to her being brought to my home, my mother had said

- 65 playfully, "I have a pretty present for my Victor—tomorrow he shall have it." And when, on the morrow, she presented Elizabeth to me as her promised gift, I, with childish seriousness, interpreted her words literally and looked upon Elizabeth as mine—mine to protect, love, and cherish. All
- 70 praises bestowed on her I received as made to a possession of my own. We called each other familiarly by the name of cousin. No word, no expression could body forth the kind of relation in which she stood to me—my more than sister, since till death she was to be mine only.

75 (Source)

- 1. According to the text, the mother's benevolence is a result of
 - (A) \bigcirc her natural, kind disposition.
 - (B) \bigcirc her own suffering as a child.
 - (C) \bigcirc a sign from an angel.
 - (D) Oher desire to please providence.
- 2. Which choice provides the best evidence for the answer to the previous question?
 - (A) Lines 5 6 ("Their...poor.")
 - (B) O Lines 7 10 ("This...afflicted.")
 - (C) 🔘 Lines 51 53 ("With...her.")
 - (D) 🔘 Lines 53 56 ("They...protection.")

Questions 10 - 19 are based on the following passage.

This is an excerpt from President Franklin Roosevelt's speech to Congress in 1941 prior to the U.S. entering World War II.

Let us say to the democracies, "We Americans are vitally concerned in your defense of freedom. We are putting forth our energies, our resources, and our organizing powers to give you the strength to regain and maintain a free world.

- 5 We shall send you, in ever-increasing numbers, ships, planes, tanks, guns. This is our purpose and our pledge." In fulfillment of this purpose, we will not be intimidated by the threats of dictators that they will regard as a breach of international law or as an act of war our aid to the
- 10 democracies which dare to resist their aggression. Such aid is not an act of war, even if a dictator should unilaterally proclaim it so to be.

When the dictators are ready to make war upon us, they will not wait for an act of war on our part. They did not wait

- 15 for Norway or Belgium or the Netherlands to commit an act of war. Their only interest is in a new one-way international law, which lacks mutuality in its observance, and, therefore, becomes an instrument of oppression.
- The happiness of future generations of Americans may well 20 depend upon how effective and how immediate we can make our aid felt. No one can tell the exact character of the emergency situations that we may be called upon to meet. The Nation's hands must not be tied when the Nation's life is in danger. We must all prepare to make the sacrifices that the
- 25 emergency-almost as serious as war itself-demands. Whatever

- (A) \bigcirc As a result of his father's great wealth, a character gets a new sister.
- (B) \bigcirc A poor orphan is adopted into a loving family.
- (C) \bigcirc A character resents his new sister.
- (D) \bigcirc A lost child is rescued from a cruel home.

- 12. As used in line 25, "emergency" most nearly means
 - (A) O threatened democratic countries.
 - (B) \bigcirc a sudden act of war.
 - (C) an oppressive dictatorship.
 - (D) \bigcirc a free world without rules.
- 13. In line 35, the main rhetorical effect of Roosevelt's statement about using "the sovereignty of government to save government" is to
 - (A) \bigcirc emphasize the duty of the government.
 - (B) \bigcirc justify the use of force.
 - (C) 🔘 explain governmental protocol.
 - (D) O give patriotic examples.
- 14. The main purpose of this speech is to
 - (A) \bigcirc rally support.
 - (B) O condemn dictators.
 - (C) O solicit funds.
 - (D) \bigcirc encourage conscription.



stands in the way of speed and efficiency in defense preparations must give way to the national need.

A free nation has the right to expect full cooperation from all groups. A free nation has the right to look to the

- *30* leaders of business, of labor, and of agriculture to take the lead in stimulating effort, not among other groups but within their own groups. The best way of dealing with the few slackers or trouble-makers in our midst is, first, to shame them by patriotic example, and, if that fails, to use
- 35 the sovereignty of government to save government. As men do not live by bread alone, they do not fight by armaments alone. Those who man our defenses, and those behind them who build our defenses, must have the stamina and the courage which come from unshakable belief in the
- 40 manner of life which they are defending. The mighty action that we are calling for cannot be based on a disregard of all things worth fighting for.

The Nation takes great satisfaction and much strength from the things that have been done to make its people conscious

- 45 of their individual stake in the preservation of democratic life in America. Those things have toughened the fiber of our people, have renewed their faith, and strengthened their devotion to the institutions we make ready to protect. Certainly this is no time for any of us to stop thinking
- 50 about the social and economic problems that are the root cause of the social revolution which is today a supreme factor in the world.

For there is nothing mysterious about the foundations of a healthy and strong democracy. The basic things expected by

- 55 our people of their political and economic systems are simple. They are equality of opportunity for youth and for others, jobs for those who can work, security for those who need it, the ending of special privilege for the few, the preservation of civil liberties for all, and the enjoyment
- 60 of the fruits of scientific progress in a wider and constantly rising standard of living. These are the simple, basic things that must never be lost sight of in the turmoil and unbelievable complexity of our modern world. The inner and abiding strength of our economic and political systems
- 65 is dependent upon the degree to which the government fulfills these expectations.

(Source)

- **10.** The speaker indicates that in contrast to the United States, dictatorships
 - (A) \bigcirc want to impose a unilateral international law.
 - (B) \bigcirc observe international law.
 - (C) \bigcirc refuse aid during war.
 - (D) \bigcirc refuse to be intimidated by threats.
- 11. Which choice provides the best evidence for the answer to the previous question?
 - (A) 🔘 Lines 1 2 ("We...freedom.")
 - (B) 🔘 Lines 5 6 ("We...pledge.")
 - (C) 🔘 Lines 6 10 ("In...aggression.")
 - (D) 🔘 Lines 16 18 ("Their...oppression.")

- 15. The rights listed in lines 54 61 primarily serve to
 - (A) \bigcirc illustrate the freedoms Americans take for granted.
 - (B) \bigcirc introduce new liberties granted to Americans.
 - (C) \bigcirc remind Americans of the rights for which they are fighting.
 - (D) \bigcirc call attention to the injustices imposed by dictators.
- 16. Which choice best describes the structure of this speech?
 - (A) \bigcirc Historical context is given and earnest advice is offered.
 - (B) \bigcirc A position is stated and possible objections are considered.
 - (C) \bigcirc Conflicting principles are discussed and a consensus is reached.
 - (D) \bigcirc A problem is described and its solutions are outlined.
- **17.** According to the passage, the strength of a democracy is most dependent on
 - (A) \bigcirc the sacrifices its people make both at home and abroad.
 - (B) \bigcirc the equal treatment of all citizens under the law.
 - (C) \bigcirc the government fulfilling its obligations to the people.
 - (D) \bigcirc full political cooperation and support from all groups.
- **18.** Which choice provides the best evidence for the answer to the previous question?
 - (A) 🔘 Lines 28 29 ("A free... groups.")
 - (B) O Lines 43 46 ("The Nation...America.")
 - (C) Lines 54 56 ("The basic...simple.")
 - (D) O Lines 63 66 ("The inner...expectations.")
- 19. What is the speaker's main point about the needs of the nation?
 - (A) \bigcirc They are second to the demands of war.
 - (B) \bigcirc They are to be protected by any means.
 - (C) \bigcirc They are the top priority above all else.
 - (D) O They are worth fighting for.

Questions 20 – 29 are based on the following passage.

This passage is an article titled "Expanding Opportunity for Struggling Families." It discusses the author's opinion on government safety net programs and poverty in the United States.



In the wake of the Great Recession in the early 21st century, millions of families lost their jobs, their homes, and their livelihoods. Many others saw reduced hours, wages, or benefits. The most vulnerable among

- 5 us—children, seniors, those with disabilities, and lowincome families—were particularly hard-hit and have yet to recover. Save for a few financial safety net programs, the gap between the haves and the have-nots has continued to widen.
- 10 Since the recession, moving up the economic ladder—and staying there—has been extremely difficult for far too many Americans. Average real weekly wages in America have been basically stagnant for more than three decades. The trend for those in the bottom 20 percent of wage earners
- 15 is even worse: Wages have actually decreased between 1979 through 2012. On the other hand, the top 10 percent of earners have seen their real wages rise by about a third during the same period.
 - Beyond income and wages, the trends in wealth among low-
- 20 income families are particularly alarming. Median wealth for those in the lowest quintile decreased 63 percent during the past generation from about \$7,500 to only \$2,800, while among those in the top quintile, median wealth increased 27 percent, from about \$500,000 to
- 25 \$630,000.

Racial wealth disparities, a lingering consequence of a long history of segregation and discrimination, are staggering. In 2011, the median wealth of white households (\$110,500) was more than *17 times* that of black

- *30* households (\$6,314) and was over *14 times* that of Hispanic households (\$7,683). This lack of assets makes it particularly difficult for low-income families to move up the economic ladder. It also makes it easier for them to fall into poverty during economic downturns.
- 35 Millions of low-income families work paycheck to paycheck, just trying to make ends meet. Many of these families work at or near the minimum wage of \$7.25 an hour, which is just not enough to live on. Currently, a mother of two children working full-time at minimum wage is living in
- 40 poverty. This situation makes it very difficult for these working families to afford things like groceries, school supplies, and commuting costs, let alone save for education or retirement.

Women, in particular, are bearing the brunt of these

- 45 economic pressures. On average, women make only 77 percent of what men make. Over a typical woman's lifetime, this wage gap amounts to \$464,320 in lost wages. Many women find themselves stuck in or near poverty even as they work one or more low-wage jobs, often while raising children, 50 with little or no sick leave.
- Efforts to keep families out of poverty and provide more economic opportunity are good investments for the nation and have been shown to produce positive long-term results. Research has shown that increasing income for low-income
- 55 families increases earnings for children when they grow up, children who benefit from nutrition assistance have much better outcomes as adults, and families see fewer health costs for their children.

To make sure families have the opportunity to climb the

60 economic ladder, we need to keep our commitment to maintain strong social safety net and support programs for the most vulnerable Americans. In fact, the data clearly show that key safety net programs lift millions of families out of poverty each year.

- 22. As used in line 26, "disparities" most nearly means
 - (A) O differences.
 - (B) O anomalies.
 - (C) O complexities.
 - (D) \bigcirc similarities.
- **23.** The author indicates that in comparison to black and Hispanic families, median white households are more likely to
 - (A) \bigcirc move up the economic ladder.
 - (B) \bigcirc work paycheck to paycheck.
 - (C) \bigcirc fall into poverty during economic downturns.
 - (D) 🔘 earn minimum wage.
- **24.** Which statement best summarizes the information presented in the graph?

(A) \bigcirc The SNAP program is the most successful net program to keep Americans out of poverty.

(B) O The Earned Income Tax Credit (EITC) is the most successful net program to keep Americans out of poverty.

(C) \bigcirc Housing subsidies are the second most effective in keeping Americans out of poverty.

(D) \bigcirc Tax credits almost double in the amount of Americans they keep out of poverty than the SNAP program.

25. The passage is written from the perspective of someone who is

(A) \bigcirc an opponent of social support programs and minimum wages.

- (B) a journalist reporting on new poverty statistics and findings.
 (C) a politician advocating the elimination of racial wealth disparities.
- (D) \bigcirc an advocate for the struggles of low-income families.
- **26.** According to the data presented in the passage, it is reasonable to conclude that the population most likely to struggle economically is
 - (A) \bigcirc white men.
 - (B) \bigcirc black and Hispanic men.
 - (C) \bigcirc black and Hispanic women.
 - (D) \bigcirc white women.
- **27.** Which choice provides the best evidence for the answer to the previous question?
 - (A) Lines 26 28 ("Racial...staggering.")
 - (B) 🔘 Lines 45 46 ("On average...men make.")
 - (C) O Lines 31 33 ("This lack...ladder.")
 - (D) O Lines 35 36 ("Millions...meet.")
- **28.** Based on the passage, what are the author's views on minimum wage?
 - (A) \bigcirc It is not enough to live on.
 - (B) \bigcirc It is not enough to support a family.
 - (C) \bigcirc It should be increased by the government.
 - (D) \bigcirc It is contributing to the racial wealth gap.





Federal safety net programs helped keep millions of Americans out of poverty in 2012, including 9.4 million from the Earned Income Tax Credit (EITC), the Child Tax Credit, and other refundable tax credits, 5.0 million from
70 SNAP, 2.4 million from Unemployment Insurance, 3.3 million from Supplemental Security Income (SSI), and 2.8 million from housing subsidies.

(Passage and image adapted from an article on "Expanding Opportunities for Struggling Families," which was hosted at the following URL: http://www.budget.senate.gov/democratic/public/index.cfm/expandingopportunities-for-struggling-families.)

20. As used in line 13, "stagnant" is closest in meaning to

- (A) \bigcirc decreasing.
- (B) increasing.
- (C) \bigcirc stationary.
- (D) \bigcirc fluctuating.
- **21.** Which situation is most similar to the one described in lines 19 25 ("Beyond income... \$630,000")?

(A) \bigcirc Among a group of students, the males earn higher grades than the females.

(B) \bigcirc In a classroom, the teacher gives more attention to the females over the males.

(D) ○ A school district provides more funding to financially struggling schools.

Questions 30-38 are based on the following passage.

This passage discusses the 2015 discovery of new bacterium GFAJ-1, found in Mono Lake, California.

Deoxyribonucleic acid, or DNA, is known as the molecule of

- **29.** Which choice provides the best evidence for the answer to the previous question?
 - (A) 🔘 Lines 35 36 ("Millions...meet.")
 - (B) 🔘 Lines 38 40 ("Currently...poverty.")
 - (C) O Lines 40 43 ("This situation...retirement.")
 - (D) 🔘 Lines 47 50 ("Many...leave.")



life. In appearance, a DNA molecule is a twisted doublehelix consisting of two strands of nucleic acid bases paired together and connected by a backbone of sugars and

5 phosphates. Every living cell on Earth contains DNA. Therefore, every living cell contains phosphates—or does it?

A 2010 article in *Science Magazine* identified a bacterium, GFAJ-1, that seemed to use arsenate instead of

- 10 phosphate in building its genetic material. The implications of phosphate-free DNA set off a frenzy of speculation that GFAJ-1 was an extraterrestrial life form. NASA, excited by the idea of an extraterrestrial, even held a press conference to announce the discovery. Even
- 15 the location of GFAJ-1, Mono Lake in California, seemed the ideal site for an alien community: Mono Lake's extremely saline and alkaline conditions were practically otherworldly. The site also had the highest concentrations of arsenate in the world.
- 20 While toxic, the chemical compound arsenate (AsO43-) is closely related to phosphate (PO43-) in terms of structure. Researchers jumped at this relationship. They suggested that the bacterial DNA must utilize an arsenate backbone in place of phosphate. Lab experiments showed
- 25 that GFAJ-1could grow and replicate successfully in the absence of phosphate and actually grew more rapidly with increasing amounts of arsenate.

0		
	Phosphate	Arsenate
#P	1	0
#O	4	4
#As	0	1

Chemical compounds phosphate and arsenate and their respective numbers of phosphorous, oxygen, and arsenic molecules. (Source 1), (Source 2)

- 30 The findings shook the scientific community into a crisis. Did DNA actually require phosphate? Or should this onceimportant tenet of biology be irrevocably packed away along with the flat-globe model and the Earth-centric solar system? Scientists were roused to answer the
- 35 question.

One of the first criticisms of the so-called "phosphatefree" bacteria was that it was not, in fact, phosphate free. Despite the high concentrations of arsenate in Mono Lake, researchers proved that there were still enough

40 trace levels of phosphate to support growing and dividing cells. GFAJ-1 may not have been growing without phosphate after all, critics responded.

Another group of researchers attacked the claim that arsenate stimulated growth in GFAJ-1. They countered that

- 45 arsenate instead assisted in degrading ribosomes within the bacteria, freeing up more phosphate that could be incorporated into the bacterium's DNA. More arsenate did not spur growth on its own, they argued; it simply led to more available phosphate. Yet another study used ultra-
- 50 sensitive liquid chromatography and mass spectrometry to search for arsenate in the bacterium's DNA. It failed to identify any arsenate in the bacterium at all. Despite the initial excitement, it would seem that the

mysterious, possibly extraterrestrial DNA molecule was not

55 built upon an arsenate scaffold after all. Ultimately, its structure appeared to be synonymous with the DNA of every other living thing on the planet, and the phosphate model of DNA maintained its integrity.

(Source 1), (Source 2), (Source 3), (Source 4)

30. As used in line 12, "speculation" most nearly means

In paragraphs 4 and 5, the evidence by the group of researchers attacking the arsenate claim serves to

- (A) \bigcirc support the theory of arsenate-based DNA sans phosphate.
- (B) \bigcirc explain the structure behind arsenate-based DNA.

(C) \bigcirc provide a counter to the claim that arsenate stimulated growth in GFAJ-1.

- (D) \bigcirc firmly disprove the arsenate-based DNA theory.
- 33. As used in line 32, "irrevocably" most nearly means
 - (A) O temporarily.
 - (B) O grudgingly.
 - (C) O permanently.
 - (D) O happily.
- **34.** The author uses the comparisons of the acetate discovery to the "flatglobe model" and "Earth-centric solar system" (Lines 33 - 34) in order to emphasize
 - (A) \bigcirc the theory's future place in history and science.

(B) \bigcirc the scale on which this theory might have changed our understanding of the world.

(C) \bigcirc how the theory can change modern science and history.

(D) \bigcirc that this theory has debunked our traditional understanding of DNA.

35. Which choice best describes the structure of the passage?

(A) \bigcirc An accepted scientific theory is presented, challenged, and proven to still hold true.

(B) $\bigcirc\,$ A scientific term is defined, explained with examples, and proven false.

(C) \bigcirc A new scientific discovery is explained and used in field tests.

(D) \bigcirc A hypothesis is presented and proven correct through examples and research.

- 36. Which sentence best summarizes the passage?
 - (A) \bigcirc GFAJ-1 is a new discovery that will change science forever.
 - (B) \bigcirc GFAJ-1 was a useful challenge to the phosphate DNA model.

(C) \bigcirc GFAJ-1 is one of many interesting bacterium in Mono Lake.

(D) \bigcirc GFAJ-1's DNA is the same as all living things on the planet.

- **37.** Which choice provides the best evidence for the answer to the previous question?
 - (A) O Lines 10 12 ("The implications...life form.")
 - (B) 🔘 Lines 14 18 ("Even...otherworldly.")
 - (C) 🔘 Lines 20 22 (While...structure.")
 - (D) O Lines 53 55 ("Despite...all.")
- **38.** Scientists discovered that arsenate did not stimulate growth in GFAJ-1 but instead
 - (A) \bigcirc reduced the amount of phosphate available.
 - (B) \bigcirc degraded ribosomes that then made phosphate available.
 - (C) \bigcirc increased the amount of ribosomes.



- (A) \bigcirc inquiries.
- (B) \bigcirc theories.
- (C) \bigcirc research.
- (D) O concerns.
- **31.** Which statement about phosphate and arsenate is supported by the chart?
 - (A) \bigcirc GFAJ-1 is phosphate-free.
 - (B) \bigcirc The bacterium GFAJ-1 still has trace levels of phosphate.

(C) The chemical compound phosphate contains more arsenic molecules than the chemical compound arsenate.

(D) ○ The chemical compounds of arsenate and phosphate have the same number of oxygen molecules.

Questions 39 - 47 are based on the following passage.

Passage 1 discusses the role of the hormone oxytocin in motherhood. Passage 2 explores the role of oxytocin between humans and canines.

Passage 1

The bond between mother and child is said to be unique and unfathomable. In other words, it's just the type of mystery that scientists like Dr. Robert Froemke love to

5 unravel. As a neurobiologist at New York University School of Medicine, Dr. Froemke studies oxytocin, the "love hormone," and its role in bonding between mother and offspring.

Scientists have already demonstrated the importance of 10 oxytocin in bonding, but Froemke is interested in the specific neural changes that oxytocin causes in the brain. Using mice as his test subjects, Froemke observed the brains of female mice that had no mouse pups before and

- after receiving injections of oxytocin.
 15 Before receiving the oxytocin, the mice showed little interest in retrieving distressed offspring that were not their own. After the injection, however, the mice soon behaved like concerned mothers themselves, seeking to rescue the unfamiliar pups and restore them to the nest.
- 20 As Froemke monitored the changes in the brains of these mice, he found that a typical mother mouse showed a specific set of neural signals when it perceived pups in distress. The mice that had never had pups showed a distinctly different neural display—until they received
- 25 the injection of oxytocin. After the injection, their neural patterns matched those of the typical mother. Dr. Froemke and his team concluded that the neural impulse pattern created by oxytocin allowed the test subjects to more easily distinguish the sound of a calling pup from
- *30* the rest of the background noise, priming mothers to act quickly in an emergency.

(Based on source)

Passage 2

Oxytocin is a peptide hormone best known for its role in *35* childbirth and intimacy. Recent research shows, however, that it may also play a role in the bond between humans and dogs.

In 2015, Dr. Takefumi Kikusui of Azabu University in Japan and his team of researchers examined whether an oxytocin 40 feedback loop existed between humans and dogs. Kikusui **41.** Which choice provides the best evidence for the answer to the previous question?

(D) \bigcirc increased the amount of phosphate and ribosomes.

- (A) 🔘 Lines 12 14 ("Using...oxytocin.")
- (B) 🔘 Lines 17 19 ("After...nest.")
- (C) 🔘 Lines 23 25 ("The mice...oxytocin.")
- (D) 🔘 Lines 25 26 ("After...mother.")
- 42. As used in line 53, "positive" most nearly means
 - (A) 🔘 agreeable.
 - (B) \bigcirc confirmed.
 - (C) 🔘 good.
 - (D) O increasing.
- **43.** Which of the following best describes the relationship between the two passages?

(A) ○ Passage 1 presents research findings, and Passage 2 reports compatible findings.

(B) \bigcirc Passage 1 refutes a commonly held belief, but Passage 2 supports that belief.

(C) O Passage 1 compares multiple species, while Passage 2 focuses on only one type of animal.

(D) $\bigcirc\,$ Passage 1 establishes a theory, and Passage 2 disproves that theory.

- **44.** In lines 43 46 ("The infant's ... intimacy"), what is the most likely reason the author presents this information?
 - (A) \bigcirc To describe the research Kikusui has already completed
 - (B) \bigcirc To provide general background knowledge
 - (C) \bigcirc To present a basis for the human-dog experiment
 - (D) \bigcirc To offer an alternative to the feedback loop phenomenon
- **45.** In Passage 2, Dr. Kikusui's experiments to test the feedback loop led to the unexpected finding that



knew such a feedback loop existed between human mothers and their children. Research had proven that a mother's gaze stimulates an infant's brain to release oxytocin. The infant's gaze in turn signals the mother's brain to

45 release oxytocin also, establishing a feedback loop of increasing intimacy.

To approach the hypothesis, Kikusui gathered dogs and their owners to measure oxytocin levels before and after they played together. The dogs and humans that maintained

- 50 eye contact for longer periods were found to have higher oxytocin levels than those who held eye contact for shorter periods. These results answered Kikusui's first question: A positive oxytocin feedback loop indeed existed between dogs and humans.
- 55 To find out if this reaction was unique to domesticated dogs, Kikusui replicated the experiment with humans and pet wolves, the domesticated dog's ancestors. Results showed no such oxytocin feedback loop in the wolf-human pairs. Kikusui concluded that perhaps the ability to
- 60 experience the oxytocin feedback loop is what set dogs apart from wolves and allowed for their domestication.

(Based on information found at source: Marlin et. al. (April 23, 2015). Oxytocin enables maternal behaviour by balancing cortical inhibition. *Nature 520*, 499–504; Nagasawa et. al. (April 17, 2015). Oxytocin-gaze positive loop and the coevolution of human-dog bonds. *Science 348*(6232), 333-336.)

39. As used in line 2, "unfathomable" most nearly means

- (A) O special.
- (B) \bigcirc secretive.
- (C) 🔘 unexplainable.
- (D) O touching.
- **40.** It can most reasonably be inferred that female mice without pups have neural displays that cause the mice to
 - (A) \bigcirc be more aggressive toward others.
 - (B) \bigcirc maximize self-preservation.
 - (C) \bigcirc be unable to distinguish the sound of calling pups.
 - (D) O have abnormally low oxytocin levels.

(A) \bigcirc a mother's gaze stimulates an infant's brain to release oxytocin.

(B) \bigcirc a wolf does not show signs of an oxytocin feedback loop with a human.

 $({\rm C}) \ \bigcirc \$ the oxytocin feedback loop allowed dogs to be domesticated.

(D) \bigcirc domesticated dogs experience oxytocin levels higher than wolves.

- **46.** Which choice provides the best evidence for the answer to the previous question?
 - (A) Lines 42 43 ("Research...oxytocin.")
 - (B) O Lines 49 52 ("The dogs...periods.")
 - (C) O Lines 57 59 ("Results ... pairs.")
 - (D) 🔘 Lines 59 61 ("Kikusui...domestication.")
- **47.** Dr. Kikusui's conclusion that the oxytocin feedback loop enabled the domestication of dogs is based on what assumption?
 - (A) \bigcirc Pet wolves are not domesticated.
 - (B) \bigcirc Wolves cannot experience the feedback loop.
 - (C) \bigcirc Dogs are innately different than wolves.
 - (D) \bigcirc All dogs experience the feedback loop.

PSAT WRITING AND LANGUAGE



Directions: Read each passage. You will then be asked a series of questions. Some will ask about how to revise the passage so that it better expresses ideas, and others will ask about how to edit portions of the passage to correct grammar, sentence structure, and usage errors.

For each question, choose the answer that best improves the writing quality or makes the writing adhere to standard written English conventions. Some questions include a "NO CHANGE" option. Select "NO CHANGE" if you think the best choice is to leave the selection as is.

Questions 1-11 are based on the following passage.

Why We Enjoy Music

Classical music makes children sleepy. Punk rock music energizes the angsty teenager. Old-time swing makes grandparents smile. Given the vast array of musical genres, it can be difficult to identify just what elements of music make it enjoyable to some but <u>hard to handle</u> to others.

Deconstructing music into its most basic parts <u>reveal</u> further insight to this issue. Two elements that make music enjoyable are rhythm and melody. Rhythm can be described as music's living pulse. <u>It beats, it keeps time</u>. It is the reason we clap along with a pop-rock chorus or tap our feet to a Sousa march. It breathes as if alive—as if listeners could meet, get to know, and <u>miss it</u>. For these reasons, rhythm is closely associated with the heart, the organ through which blood circulates to all parts of the body. <u>Similar to how a heart beats in a chest</u>, rhythm is a constant force in music.

<u>Otherwise</u>, melody is music's signature, created by the pleasantry of the sound and the progression of notes. While they can provide the beat, clanks on a metal pan or <u>random and unplanned</u> plunks on a piano can't provide a melody. However, the repeated sweetness of a bird's morning hymn can provide a melody. Melody relates to the ear. The ear reacts to tone like a tongue does to taste: Some sound waves are simply delicious to the ear while others are distasteful. <u>It is no wonder listeners often respond viscerally to music.</u> (8)

Responses to a musical selection, then, depend on the individual. It seems as though the music one enjoys most is that which is best suited to <u>his</u> <u>personality</u>. Because of differing physical, economic, social, political, and mental backgrounds, humans are naturally inclined to different rhythmic and melodic tendencies. The complexity of a Bach symphony may be lost on a toddler, but <u>its</u> repetitive sweetness and clear pace may emulate a sense of rocking in his mother's arms. A frustrated young person connects with the energetic pulse, fast guitar riffs, and lyrically-accessible chorus of a punk rock song. The octogenarians delight in the polka playing on the record player, listening <u>closely</u> as the tune follows its quick and sprightly four-four time.

Adapted from (Source)

- 1. <u>hard to handle</u>
 - (A) 🔘 NO CHANGE
 - (B) O unpleasant
 - (C) O difficult to grasp
 - (D) O poorly received

2. <u>reveal</u>

- (A) O NO CHANGE
- (B) O revealed
- (C) 🔘 reveals
- (D) 🔘 revealing
- 3. It beats, it keeps time.
 - (A) 🔘 NO CHANGE
 - (B) \bigcirc It beats, but it keeps time.
 - (C) \bigcirc It beats; it keeps time.
 - (D) \bigcirc It beats, and keeping time.

- 7. random and unplanned
 - (A) 🔘 NO CHANGE
 - (B) 🔘 random
 - (C) 🔘 randomly unplanned
 - (D) O played at random
- **8.** Which option provides the best conclusion to paragraph 3 and transition to the next paragraph?

It is no wonder listeners often respond viscerally to music.

(A) 🔘 NO CHANGE

(B) \bigcirc Changing the tone is as easy as adding salt to a dish to make it taste better.

(C) \bigcirc Because the ear is connected to other parts of the body, hearing music can have adverse effects on the listener.

(D) \bigcirc DELETE the underlined portion

9. <u>his personality</u>

- (A) 🔘 NO CHANGE
- (B) (B) their personality
- (C) \bigcirc his or her personality
- (D) Ones personality

10. its

- (A) O NO CHANGE
- (B) 🔘 it's
- (C) 🔘 its'
- (D) 🔘 their
- **11.** Which option best matches the style and tone already established in the final paragraph?

<u>closely</u>

- (A) 🔘 NO CHANGE
- (B) \bigcirc with slight disappointment
- (C) O nonchalantly
- (D) 🔘 joyfully



4. <u>miss it.</u>

- (A) 🔘 NO CHANGE
- (B) 🔘 be missing
- (C) 🔘 missed
- (D) 🔘 be missed

5. Similar to how a heart beats in a chest,

- (A) 🔘 NO CHANGE
- (B) \bigcirc Like a heart in a human chest,
- (C) \bigcirc Similar to a human heart,
- (D) 🔘 Like a heartbeat,

6. Otherwise,

- (A) 🔘 NO CHANGE
- (B) O However,
- (C) O Similarly,
- (D) 🔘 Next,

Questions 12-22 are based on the following passage.

Susan LaFlesche Picotte: Omaha Doctor

The Dr. Susan LaFlesche Picotte Memorial Hospital is located in <u>Walthill</u>, <u>Nebraska a town</u> situated on the Omaha Indian Reservation in the northeastern portion of the state. This National Historic Landmark is a one and one-half story frame building that was constructed in 1912-13 to serve as a facility for the practice of Dr. Picotte, <u>the first American Indian woman to</u> <u>practice medicine in the United States.</u> The hospital's primary function was to serve Picotte's <u>people the Omaha Indians.</u> Although Dr. Picotte's tenure at the hospital was brief—<u>she died two years after it was opened</u>—the hospital represents Picotte's legacy of providing health care for American Indians.

Picotte was born on the Omaha reservation, which is now Thurston County in northern Nebraska. She was raised by her father, Chief Joseph LaFlesche (Iron Eye), the last recognized chief of his tribe and advocate for Indian <u>circulation</u> with white society. He taught her to be independent, educated, and adaptable to a changing Indian society, and her decision to attend medical school exemplifies these traits. In Picotte's time, formal medical training was rare for women, especially Indian women. Nevertheless, in 1889, <u>Picotte graduated from the three-year medical program at the</u> <u>Woman's Medical College of Pennsylvania at the top of her class.</u>

In 1890, she <u>excepted</u> a position as a physician at the government boarding school on the Omaha reservation, and upon becoming the senior physician a short time later, she acquired health care for <u>1,244 members of</u> the Omaha tribe that were living on the reservation at the time. Picotte's activism was not confined to the hospital, either. Within her community, she acted as a teacher, social worker, advisor, interpreter for Christian church services, and was appointed as a missionary for her tribe by the Presbyterian Board of Home Missions. She also served as an advocate for Omaha Indian rights and was a dedicated temperance activist.

[1] In January 1913, Picotte's lifelong dream to have a hospital to care for her people became a reality. [2] The \$8,000 project, funded by a variety of sources, was the first hospital for an Indian reservation not funded by government money. [3] The building contained two general wards, five private wards, a maternity ward, operating room, kitchen, reception room, and two bathrooms. [4] Since then, it has served in numerous capacities. [5] It is presently used as a museum with exhibits on the history of church missions, the Omaha and Winnebago tribes, and Susan Picotte. [6] <u>These</u> <u>facilities served patients until the 1940s.</u> [7] The former hospital is also used for various community functions <u>that stand</u> today as a reminder of Picotte's important role in the lives of American Indians in Nebraska and the nation. (21)

(Adapted from Source)

18. excepted

- (A) O NO CHANGE
- (B) O excepts
- (C) O accepted
- (D) O accepts
- **19.** <u>1,244 members of the Omaha tribe that were living on the reservation at the time.</u>
 - (A) 🔘 NO CHANGE
 - (B) \bigcirc 1,244 tribal members who lived on the reservation.
 - (C) \bigcirc many Omaha families living on the reservation.
 - (D) \bigcirc all Omaha families at the time.
- **20.** Which of the following provides the best topic sentence for this paragraph?

In January 1913, Picotte's lifelong dream to have a hospital to care for her people became a reality.

(A) O NO CHANGE

(B) ○ It was difficult to raise money, but Picotte was able to build a hospital in January 1913.

(C) \bigcirc The hospital that was built in 1913 served many of the Omaha people.

(D) ○ Initially, Picotte was unsure she would be able to raise all of the money needed to build the hospital.

- **21.** For the sake of cohesion in this paragraph, sentence 6 should be placed
 - (A) \bigcirc where is it now.
 - (B) \bigcirc after sentence 3.



12. Walthill, Nebraska a town

- (A) 🔘 NO CHANGE
- (B) 🔘 Walthill, Nebraska, a town,
- (C) 🔘 Walthill Nebraska, a town
- (D) 🔘 Walthill, Nebraska, a town
- **13.** The writer is considering deleting the underlined portion. Should the phrase be deleted?

the first American Indian woman to practice medicine in the United States.

(A) \bigcirc Yes, because it repeats information already stated in the passage.

(B) \bigcirc Yes, because it distracts from the description of the hospital.

(C) \bigcirc No, because it reinforces the historical importance of the passage.

(D) \bigcirc No, because it establishes the time period of the essay.

14. people the Omaha Indians

(A) O NO CHANGE

- (B) \bigcirc people: the Omaha Indians.
- (C) \bigcirc people, and the Omaha Indians.
- (D) opeople; the Omaha Indians.
- **15.** The writer is considering deleting the underlined portion. Should the phrase be deleted?

she died two years after it was opened

- (A) \bigcirc Yes, because it adds unnecessary detail to the paragraph.
- (B) $\bigcirc\,$ Yes, because it does not specify what years the hospital was opened.

(C) \bigcirc No, because it specifies a claim made earlier in the sentence.

(D) $\hfill O$ No, because it emphasizes how closely connected Picotte was to the hospital.

16. circulation

- (A) 🔘 NO CHANGE
- (B) O integration
- (C) 🔘 dissipation
- (D) O mingling
- 17. <u>Picotte graduated from the three-year medical program at the</u> <u>Woman's Medical College of Pennsylvania at the top of her class.</u>
 - (A) 🔘 NO CHANGE
 - (B) \bigcirc Picotte graduated from the three-year medical program at

the top of her class at the Woman's Medical College of Pennsylvania. (C) \bigcirc Picotte graduated from the three-year medical program at

the Woman's Medical College at the top of her class of Pennsylvania.

(D) \bigcirc Picotte graduated at the top of her class from the three-year medical program at the Woman's Medical College of Pennsylvania.

- (C) 🔘 after sentence 4.
- (D) \bigcirc after sentence 2.

22. that stand

- (A) O NO CHANGE
- (B) O that stands
- (C) \bigcirc which stand
- (D) O and stands



President Obama's Policy on Foreign Oil

The United States's dependence on foreign oil has decreased every single year since President Barack Obama took office. In fact, in 2010, the country imported fewer than 50 percent of the oil our nation consumed-the first time that's happened in 13 years-but this is predicted to rise again.



(Source)

We're relying less on imported oil for a number of reasons, one of them being that production has increased here in the United States. In fact, America is producing more oil today than at any time in the last eight years. As part of their strategy to increase safe, responsible oil production in the United States, President Obama has opened millions of new acres for oil and gas exploration, and we now have more working oil and gas rigs than the rest of the world combined.

However, Americans can usually expect lower prices at the gas pump. That's because drilling for more oil here at home won't effect the price of gas on its own. It is, unfortunately, not that simple. Oil is bought and sold across countries and continents in a world market. In the short term, it's subject to price spikes when there's unstable uncertainty along the global supply chain, as it's difficult to predict what will happen on the market. Demand and supply work together. Also, growing demand in countries like India, Brazil, and China, which tripled the number of cars on the road in the last five years, will drive prices even higher over the long term.

Therefore, we have to do more than drill now to bring down prices for the future. Relying on the fossil fuels of the last century won't be enough. Demand keeps increasing. We need an all-out, all-of-the-above strategy that develops every available source of American energy. This includes everything from tapping our offshore oil supplies and vast natural gas reserves, to investing in clean energy resources like wind and solar power, and to developing new technologies that help us use less energy altogether, when driving our cars, running our appliances, and powering our buildings.

This is the strategy President Obama has been pursuing since he took office, but there's still more that can be done to ensure self-sufficiency as a nation, specifically when it comes to our energy use. We need to put the right incentives in place to encourage a clean energy future, not just continue to drill domestically.

(Adapted from Source)

23. United States's

- (A) O NO CHANGE
- (B) O United States
- (C) 🔘 United State's
- (D) O United States'

24. fewer than

(A) 🔘 NO CHANGE

28. effect

- (A) NO CHANGE
- (B) be effecting
- (C) O affect
- (D) O result in

29. unstable uncertainty

- (A) 🔘 NO CHANGE
- (B) \bigcirc certain instability
- (C) 🔘 stability or instability
- (D) instability or uncertainty
- 30. Which option provides the best example of the claim made in the preceding sentence?

Demand and supply work together.

(A) O NO CHANGE

(B) \bigcirc It's important to follow news reports overseas to stay up to date about demand.

(C) \bigcirc We can see prices jump overnight if there's enough demand on the other side of the globe.

(D) \bigcirc As more people use gas, we need to find an alternative source.

31. Which choice most effectively combines the sentences at the underlined portion?

be enough. Demand

- (A) \bigcirc be enough, especially as demand
- (B) \bigcirc be enough, demand
- (C) \bigcirc be enough; and demand
- (D) \bigcirc be enough, so demand

32. altogether, when driving our cars,

- (A) 🔘 NO CHANGE
- (B) \bigcirc altogether when driving our cars,
- (C) \bigcirc altogether, when driving our cars
- (D) \bigcirc altogether when driving our cars

33. not just continue to drill domestically.

- (A) 🔘 NO CHANGE
- (B) \bigcirc and revise the \$4 billion in annual taxpayer subsidies paid
- to oil and gas companies.
- (C) \bigcirc so we don't pay so much at the gas station.
- (D) \bigcirc and help other countries pursue this as well.



- (B) \bigcirc less than
- (C) O fewer then
- (D) \bigcirc less then

25. but this is predicted to rise again.

- (A) O NO CHANGE
- (B) \bigcirc and the trend continued in 2011.
- (C) \bigcirc indicating Americans are using less oil.
- (D) but dependence seems to be plateauing while Obama is in office.

26. their

- (A) 🔘 NO CHANGE
- (B) 🔘 his
- (C) 🔘 our
- (D) 🔘 its
- 27. Which of the following best introduces the topic of this paragraph?

However, Americans can usually expect lower prices at the gas pump.

- (A) 🔘 NO CHANGE
- (B) Therefore, Americans should expect consistently high prices at the gas station.
- $(\mathrm{C}) \bigcirc \mathrm{Despite}$ all this, Americans are still paying more at the gas pump.
- (D) \bigcirc However, Americans are not using gas-efficient cars, so we end up paying more at the gas station.

Questions 34-44 are based on the following passage.

A Land Sculpted By Ice

In the <u>high frozen regions</u> of the Alaska Range, snow and ice are the main forms of precipitation. In the past, most of the snow and ice remained <u>behind</u>, <u>very little</u> melting occurred. Snow and ice accumulated and got deeper and deeper, year after year, until the mass of ice that formed was so thick it compressed under its own weight. Gravity caused this ice to flow through stream valleys as glaciers. <u>Gravity is also what causes Earth's tectonic plates to move and converge, creating trenches and ridges.</u>

Glaciers are rivers of ice. The glaciers found today in the Denali National Park in Alaska are increasingly small <u>chunks</u> of their former selves, but all around there is evidence of how they dominated the landscape. During past ice ages, most recently about 10,000 years ago, glaciers covered the Alaska Range and much of Alaska in ice. All of south-central Alaska <u>is buried</u> in ice numerous times, and the shape of the land in this area comes from the carving forces of glaciers and the debris they leave behind.

Glaciers are often fed by more snow and ice precipitating and accumulating at higher elevations. If ice builds up at its source, a glacier may flow at rates ranging from several feet per year to several feet per day. As a glacier flows downhill, it grinds away at its beds with tremendous force. It picks up rocks from its <u>bed</u>. It grinds some to a fine powder called silt and plucking up larger pieces. When the glacial ice melts, the silt is carried along in the meltwater <u>and deposited</u> downstream as outwash. Streams flowing from melting glaciers are often milky-colored. The silt in the water is called glacial flour, and the silty water is described as glacial milk. The larger pieces get left behind as "erratics" or in unsorted deposits forming ridges or hills called "moraines." Erratics are rocks that are foreign to the surrounding terrain. They differ from the types of rock naturally found where they are deposited.

Although glaciers are solid ice, they also consist of small lakes called

40. and deposited

- (A) 🔘 NO CHANGE
- (B)
 and deposits
- (C) \bigcirc to be depositing
- **41.** Which choice most effectively introduces the topic of the final paragraph?

Although glaciers are solid ice, they also consist of small lakes called "kettle lakes."

(A) O NO CHANGE

(B) \bigcirc This movement of glaciers forms the rough yet lake-filled landscape found in Denali today.

(C) \bigcirc Glaciers can be both under and above the Earth's surface, which form the Alaskan landscape.

(D) \bigcirc Because they are in motion, glaciers have the power to erode landscapes.

42. Having been embedded in ice,

(A) 🔘 NO CHANGE



"kettle lakes." <u>Having been embedded in the ice</u>, the glacier grinds away at bedrock, forming the jagged ridges and deep U-shaped valleys found in the range. Large blocks of ice can be stranded in the moraines left behind by retreating glaciers. When <u>they</u> finally melt, a water-filled depression known as a kettle lake develops. This carving action of ice forms many of the elongated lakes in the upper Susitna Valley to the south of Denali's mountains, <u>which are dated to be over 8,000 years old</u>.

(Adapted from Source)

34. high frozen regions

- (A) \bigcirc NO CHANGE
- (B) O high, frozen regions
- (C) 🔘 high, frozen region's
- (D) 🔘 high, frozen regions'
- 35. behind, very little
 - (A) 🔘 NO CHANGE
 - (B) behind very little
 - (C) O behind; very little
 - (D) O behind and very little
- **36.** The writer is considering deleting the underlined portion. Should the underlined portion be deleted?

Gravity is also what causes Earth's tectonic plates to move and converge, creating trenches and ridges.

(A) \bigcirc Yes, because it distracts from the main focus of the paragraph.

(B) \bigcirc Yes, because it repeats information already found in the passage.

(C) O No, because it provides information necessary to the understanding of the paragraph.

(D) \bigcirc No, because it provides an example of a claim made earlier in the paragraph.

37. chunks

- (A) 🔘 NO CHANGE
- (B) 🔘 bits
- (C) O small portions
- (D) 🔘 remnants

38. is buried

- (A) 🔘 NO CHANGE
- (B) have been buried
- (C) \bigcirc are buried
- (D) O has been buried
- **39.** Which choice effectively combines the sentences at the underlined portion?

bed. It grinds

- (A) 🔘 bed, grinding
- (B) \bigcirc bed, and grinds
- (C) \bigcirc bed by grinding
- (D) \bigcirc bed; while grinding,

- (B) \bigcirc Embedded with rocks,
- (C) \bigcirc Covering the entire glacier with rocks,
- (D) \bigcirc Because they are embedded with rocks,

43. <u>they</u>

- (A) O NO CHANGE
- (B) (B) the moraines
- (C) 🔘 the ice blocks
- (D) the glaciers
- **44.** Which choice best edits the underlined portion below so it provides evidence that the elongated lakes were created by glaciers?

which are dated to be over 8,000 years old.

(A) O NO CHANGE

(B) \bigcirc and examination of a map reveals that they are all oriented in the direction that the ice was moving.

- (C) \bigcirc so glaciers are no doubt the cause of their formation.
- (D) \bigcirc and divers have found samples of century-old rock at the bases of these lakes.

PSAT MATH



Directions: This exam contains both multiple-choice questions and student-produced response questions. For multiple choice questions, solve each problem and choose the best answer from the choices provided. For student-produced response questions, solve the problem and enter your answer in the grid provided.

Notes

- 1. For questions 1-17, calculators are not permitted. For questions 18-48, you may use a calculator.
- 2. All values and variables represent real numbers unless otherwise mentioned.
- 3. Figures are drawn to scale unless otherwise specified.
- 4. All figures are coplanar unless otherwise mentioned.
- 5. The domain of any function f(x) includes all real numbers unless otherwise mentioned.

Reference



- 1. Andrew is hosting a party and books a catering company that charges \$14.95 per person plus a \$40 cleanup fee. He has a coupon for a 15% discount off the entire cost of the booking. Which of the following models Andrew's total cost, in dollars, of catering his party for *p* people?
 - (A) \bigcirc 0.85(14.95*p*) + 40
 - (B) \bigcirc 0.85(14.95p + 40)
 - (C) $\bigcirc 0.15(14.95 + 40)p$
 - (D) $\bigcirc 0.15p(14.95 + 40)$

2.

1 pound of flour = 3 cups of flour 1 pound of sugar = 2 cups of sugar

Harper volunteered to make batches of cookies, c, and brownies, b, for her team's award banquet. She wants to make at least two batches of brownies and more cookies than brownies. Each cookie batch uses $\frac{1}{3}$ cup of sugar and 1 cup of flour, while each brownie batch uses 1 cup of sugar and $\frac{1}{4}$ cup of flour. If she has a 4-pound bag of sugar and a 5-pound bag of flour, which system of inequalities models the number of batches Harper should make?

(A)
$$c > b$$

 $b \ge 2$
 $\bigcirc \frac{1}{3}c + b \le 8$
 $c + \frac{1}{4}b \le 15$
(B) $b \ge 2$
 $\bigcirc \frac{1}{3}c + b > 5$
 $c + \frac{1}{4}b > 4$
(C) $c > b + 2$
 $\bigcirc \frac{1}{3}c + b < 15$
 $c + \frac{1}{4}b < 8$
(D) $c > b + 2$
 $\bigcirc \frac{1}{3}c + \frac{1}{4}b \le 15$
 $c + b \le 8$

shmoop



shmoop

Lines *l*, *k*, and *m* above divide the *xy*-plane into seven regions as shown. Which regions should be shaded to show the solution to this system of equations?

 $y \geq \frac{1}{4}x - 3$ $y \leq -\frac{1}{2}x + 1$ (A) O II and III $(B) \bigcirc \ I \ \text{and} \ V$ (C) O VI and VII (D) O I and VI If 3(2x-5) = 4(6-x), then what is $\frac{3}{4}$ in terms of x? 8. (A) 2x-5(A) $= \frac{1}{6-x}$ (B) $= \frac{6-x}{2x-5}$ (C) $= \frac{5-2x}{x-6}$ (D) $= \frac{x-6}{5-2x}$ 9. $2^{3k} = 1,073,741,824$ Which of the following is the value of k? (A) 🔘 8 (B) 🔘 9 (C) 🔵 10 (D) 🔵 11 10. x + ay = bx + cy = dFor the system of equations above, $a \neq b \neq c \neq d$. What is the value of *y*? 11. For all real numbers, $x \ge -4$, $f(x) = \sqrt[5]{(x+4)^2} - \sqrt[5]{x+4}$. Which of the following is an equivalent form of f(x)? (A) $\bigcirc f(x) = \sqrt[5]{x+4}(x+5)(x+3)$ (B) $\bigcirc f(x) = \sqrt[5]{x+4}$ $(C) \odot f(x) = x\sqrt{x+4} + 3\sqrt{x+4}$ (D) $f(x) = \sqrt[5]{x+4} - x^2 - 2$ 12.





The diagram above shows a cross section of The Great Pyramid of Giza and the location of the Queen's Chamber within its walls. The Queen's Chamber is located in the center of the pyramid at a height equal to $\frac{3}{20}$ the height of the pyramid. Which of the following expressions represents the height of the Queen's Chamber in feet?

13. $g(x) = \sqrt[4]{x}$

If $g(h(x)) = (x-1)^2$ and $f(g(x)) = \frac{\sqrt{x}}{\sqrt[4]{x-1}}$, which expression below is h(f(x))? (A) $\bigcirc \frac{(x-1)^{16}}{(x-1)^8 - 1}$ (B) $\bigcirc \left(\frac{\sqrt{x} - \sqrt[4]{x} + 1}{\sqrt[4]{x} - 1}\right)^2$ (C) $\bigcirc \frac{x-1}{\sqrt{x-1} - 1}$ (D) $\bigcirc \left(\frac{x^2}{x-1} - 1\right)^8$

14. $S(t) = -16t^2 + 128t$

In the function above, S is the altitude in feet of a model rocket t seconds after launch. How many seconds, to the nearest second, does it take for the rocket to reach its maximum height?

x	$\int f(x)$	+		•
÷	<	\leq		\geq
>	$\left[\begin{array}{c} \underline{a} \\ \overline{b} \end{array}\right]$	ab	(<i>a</i>)	<i> a </i>
\sqrt{a}	$\left[\begin{array}{c} a \\ \sqrt{b} \end{array}\right]$	π	<u>i</u>	sin
cos	tan	arcsin	arccos	arctan



$$\frac{3x-2y}{4} = 1$$
$$\frac{ax-6y}{5} = 1$$

For what value of *a* will the system above have no solution?

x f(x)	
÷ <	
$>$ $\frac{a}{b}$	$\boxed{a^b} (a) [a]$
\sqrt{a} \sqrt{a}	π <i>i</i> sin
\cos \tan	arcsin arccos arctan

16. f(3) = 5g(4) = c

h(-1) = 4

If $(f \circ g \circ h)(-1) = 5$ and *f* is a one-to-one function, then what is the value of *c*?

x f(x) + -	·
\div < \leq =	2
$> \boxed{\frac{a}{b}} \boxed{a^b} \boxed{(a)}$	<i>a</i>
$\boxed{\sqrt{a}} \boxed{\frac{a}{\sqrt{b}}} \pi \qquad i$	\sin
\cos \tan \arcsin \arccos a	rctan

17. The rational expression $\frac{3x^3y^{-2}z^a}{x^2y^{-4}z^2}$ simplifies into a monomial of degree 2. What is the value of *a*?

x f(x)	
÷ (<	
$>$ $\frac{a}{b}$	$\boxed{a^b} (a) a $
\sqrt{a} \sqrt{a}	π <i>i</i> sin
\cos \tan	arcsin arccos arctan

18.

You may now take out a calculator and use it to solve questions 18-48.

The park rangers at a wild life reserve in the Everglades regularly tag and measure alligators. The mean length of the 18 alligators they've tagged so far this month is 9 feet 11 inches. Today they tagged three more alligators. If the lengths of these alligators raised the month's mean to 10 feet 3 inches, what is the mean length, to the nearest inch, of the three alligators tagged today?

(A) \bigcirc 10 feet 1 inch

(B) \bigcirc 10 feet 7 inches

(C) O 12 feet 3 inches





Diego's mom lent him money for a new tablet. He agreed to perform x hours of chores to pay off his debt of y dollars. The graph above models this transaction on the xy-plane. Based on the graph, which of the following statements is true?

- (A) \bigcirc The initial loan amount of \$80 will be paid off after 400 hours of chores at a rate of -\$10 per hour.
- (B) \bigcirc The initial loan amount of \$400 will be paid off after 80 hours of chores at a rate of -\$5 per hour.
- (C) \bigcirc The initial loan amount of \$400 will be paid off after 80 hours of work at a rate of \$10 per hour.
- (D) \bigcirc The initial loan amount of \$80 will be paid off after 400 hours of chores at a rate of \$5 per hour.

23. 1 mile = 5,280 feet

1 mile \approx 1.609344 kilometers



Animal	Top Speed
Black mamba	29.33 feet per second
Brown bear	21.7 miles per hour
Roadrunner	32 kilometers per hour

The chart above lists the top speeds of three land animals. What is the correct order of the animals from slowest speed to fastest speed?

(A) 🔘 Roadrunner, Black mamba, Brown bear

(B) 🔘 Brown bear, Black mamba, Roadrunner

(C) 🔘 Black mamba, Roadrunner, Brown bear

(D) 🔘 Roadrunner, Brown bear, Black mamba



(Source 1)(Source 2)

The scatterplot above displays the life expectancy at birth and per capita gross domestic product for 54 countries in 2014. Which statement most closely describes the correlation and relationship between life expectancy at birth and the per capita GDP?

- $^{(A)}$ \bigcirc The data is negatively correlated and the relationship is linear.
- (B) \bigcirc The data is positively correlated and the relationship is linear.
- (C) \bigcirc The data is negatively correlated and the relationship is logarithmic.
- (D) \bigcirc The data is positively correlated and the relationship is logarithmic.



The scatterplot above compares the average heart rates and longevity of 15 different animals.

25. Points *A* and *B* on the scatterplot are both outliers. *A* represents the heart rate and longevity of chickens while *B* is the data for humans. Which statement below accurately describes these outliers?

- **26.** Based on the data trend, which statement below is true about an animal with longevity, *l*, and its heart rate *h*?
 - (A) \bigcirc If 0 < h < 100, then 70 < l < 90
 - (B) \bigcirc If h > 300, then l > 10
 - (C) If 50 < h < 100, then 5 < l < 30
 - (D) \bigcirc If l < 50, then h < 50



(A) \bigcirc Humans and chickens both have faster-than-expected heart rates based on their average longevity.

(B) \bigcirc Humans and chickens both have slower-than-expected heart rates based on their average longevity.

(C) \bigcirc Human heart rates are faster than expected, and chicken heart rates are slower than expected, based on their average longevities.

(D) \bigcirc Human heart rates are slower than expected, and chicken heart rates are faster than expected, based on their average longevities.

Questions 27 - 29 refer to the following information.

Results of Homecoming Dance Theme Poll

	Theme A	Theme B	Theme C	Total
Freshmen	10	19	22	51
Sophomores	19	15	12	46
Juniors	21	14	23	58
Seniors	18	24	14	56
Total	68	72	71	211

The table above displays the results of a randomly sampled poll the student council at Metro High conducted to select a theme for this year's homecoming dance. The council used the results to infer the preferred theme for the entire student body, which is composed of 250 freshmen, 210 sophomores, 180 juniors, and 150 seniors.

27. From the data, how many students from all four classes are projected to vote for Theme C?

- (A) 🔘 266
- (B) O 272
- (C) 🔘 254
- (D) 🔘 211
- **28.** When using these data to make predictions, which class should have the most accurate results?
 - (A) 🔘 Freshmen
 - (B) O Sophomores
 - (C) 🔘 Juniors
 - (D) O Seniors



- **29.** The student council decided to poll some more students. If they poll three random seniors in the hall, what is the probability that none of them had already voted?
 - (A) 🔘 0.246
 - (B) O.373
 - (C) 🔘 0.627
 - (D) 0.243



Which of the following is an equation for the polynomial above?

(A) $\bigcirc y = (x - a)(x - d)(x - f)$ (B) $\bigcirc y = (x - a)(x - c)(x - d)(x - f)$ (C) $\bigcirc y = (x + b)(x - e)$

(D)
$$y = (x + a)(x + b)(x + c)(x - d)(x - e)(x - f)$$



Which of the following equations represents the line graphed in the xy-plane above?

(A) $\bigcirc \frac{y}{6} + \frac{x}{9} = 1$ (B) $\bigcirc \frac{3y-2x}{18} = 1$ (C) $\bigcirc y = \frac{-3}{2}x + 9$ (D) $\bigcirc 3x + 2y = 12$

C

Cost and Revenue for <i>q</i> units of Toasters					
q	50	100	150	200	250
C(q)	\$5,725	\$6,025	\$6,325	\$6,625	\$6,925
R(q)	\$1,200	\$2,400	\$3,600	\$4,800	\$6,000

In economics, the cost for manufacturing goods, C(q), as well as the revenue for selling them, R(q), are functions of the quantity of units produced and sold, q. The table above displays the costs and revenue for manufacturing and selling q units of toasters.

32. C(q) = mq + b

The equation above is the linear cost model, in which m represents the costs per unit produced and b represents the fixed costs. What is the linear cost function for producing q toasters?

(A) \bigcirc C(q) = 300q + 5725

- (B) \bigcirc C(q) = 300q + 5425
- (C) \bigcirc C(q) = 6q + 5425
- (D) \bigcirc C(q) = 6q + 5725

33. P(q) = R(q) - C(q)

Most business decisions are made based on the profit function P(q), shown above. Profit is the revenue minus the costs. For what values of q will P(q) > 0?

- (A) \bigcirc 50 < q < 250
- (B) $\bigcirc q > 0$
- (C) $\bigcirc q > 250$
- (D) $\bigcirc q \ge 302$





Note: Figure not drawn to scale.

In the figure above, the perimeter of the rectangle is 14 centimeters, and the perimeter of the triangle is 9 centimeters. What is the value of x?

 $(A) \bigcirc 4$ $(B) \bigcirc -1$ $(C) \bigcirc -3$ $(D) \bigcirc -3$

(D) 🔵 3

Questions 35 and 36 refer to the following information.

To date, scientists have discovered 99 different genera of dinosaurs from the Jurassic era. The table below shows the modern day location of each discovered genus.

Continent				
	Early Jurassic 205 - 180 million years ago	Mid Jurassic 180 - 159 million years ago	Late Jurassic 159-144 million years ago	Total
Africa	5	2	8	15
Antarctica	1	0	0	1
Asia	6	11	11	28
Australia	0	1	0	1
Europe	5	x	11	У
North America	4	2	21	27
South America	0	Z	1	4
Total	21	26	52	99

35. Three numbers, *x*, *y*, and *z*, are missing from the table. Determine the values of *x*, *y*, and *z*.

(A) $\bigcirc x = 4, y = 20, z = 6$

(B) $\bigcirc x = 6, y = 22, z = 4$

(C)
$$x = 7, y = 23, z = 3$$

(D)
$$\bigcirc x = 9, y = 25, z = 1$$

36. One-third of all the discovered Jurassic dinosaurs were carnivores. If 28.57% of the discovered Early Jurassic and 38.46% of the discovered Mid Jurassic dinosaurs were carnivores, what percentage of the discovered Late Jurassic dinosaurs were carnivores?

(A)	\bigcirc	17.00%

(B)	\bigcirc	32.97%

(C)	\bigcirc	32.699	2

(D) 🔘 33.33%



- **37.** A kiosk at the Musical Instruments Museum allows visitors to view and listen to different instruments from around the world. The selection includes 27 wind instruments, 55 percussion instruments, and 17 string instruments. Users may select specific instruments or choose to have the program select one at random. Josef randomly selects instruments 5 times in a row. If the program is designed not to repeat any instruments during a single session, what is the probability that at least one of the instruments was a wind instrument?
 - (A) O 0.1956
 - (B) O.2727
 - (C) O 0.7273
 - (D) 0.8044

38.	Country	Area
	Vatican	0.44 km ²
	Monaco	2 km ²
	Nauru	21 km ²

The three smallest countries in the world are the Vatican, Monaco, and Nauru. Which statement below accurately compares the area of Monaco to the other two countries?

(A) \bigcirc Monaco is 354.55% bigger than the Vatican and 90.48% smaller than Nauru.

(B) \bigcirc $\,$ Monaco is 78% bigger than the Vatican and 90.48% smaller than Nauru.

- (C) \bigcirc Monaco is 78% bigger than the Vatican and 950% smaller than Nauru.
- (D) \bigcirc Monaco is 354.55% bigger than the Vatican and 950% smaller than Nauru.

39. $y = -3x^2 + 5x + c$

For what values of c will the graph of the equation above have two x-intercepts?

40. If
$$\frac{2(x+1)-5(x-4)+3}{6} = a+5$$
, what does $x + b$ equal?
(A) $\bigcirc \frac{3b-6a-5}{3}$
(B) $\bigcirc -2 - \frac{5b}{3}$
(C) $\bigcirc -2a+10-b$
(D) $\bigcirc \frac{-3x-6a-7}{6}$

Questions 41 and 42 refer to the following information.

42. Which of the following models the side length, *s*, of each 500 gram cube as a function of its density, *d*?



 $(D) \bigcirc \frac{18}{18}$



45. $v(t) = -32t + v_0$

The velocity of a falling object is given by the function above, in which -32 feet/second² is the acceleration due to gravity and v_0 is the initial velocity. If a baseball is thrown from the top of a stadium at an initial velocity of 58.6 feet/second, after how many seconds will the velocity reach 18 feet/second? (Round your answer to the nearest thousandth.)

x f(x)	
÷ <	
$>$ $\frac{a}{b}$	$ \boxed{a^b (a) a } $
\sqrt{a} \sqrt{a}	π <i>i</i> sin
\cos \tan	arcsin arccos arctan

46. Sara needs to create a 21% acid solution to study the effects of acid rain on tomato growth. She starts with 20 milliliters of a 25% acid solution then adds a 15% solution to dilute it. How many milliliters of the 15% acid solution should she add to form the 21% acid solution? (Round your answer to the nearest milliliter.)

x $f(x)$	+ - ·
÷ <	
$>$ $\frac{a}{b}$	$\boxed{a^b} (a) [a]$
\sqrt{a} \sqrt{a}	π <i>i</i> sin
\cos \tan	arcsin arccos arctan



Note: Figure not drawn to scale.

A hotel plans to install a new paved area around its 12-foot-by-20-foot swimming pool. The paved area will consist of a sidewalk of uniform width around three sides of the pool and an extended sun deck area on the fourth side, as shown in the illustration above. The length y of the sun deck will be three times the width x of the sidewalk. If the paved area is twice the pool area, what is the length of the sun deck area to the nearest tenth of a foot?

x $f(x)$ +	- ·
\div < \leq	
$>$ $\frac{a}{b}$ a^{b}	(a) a



\sqrt{a}	$\left[\begin{array}{c} a \\ \sqrt{b} \end{array} \right]$	π	i	sin
COS	tan	arcsin	arccos	arctan



The frequency distribution chart above displays responses to a survey, in which participants were asked how many times they had moved in their lifetimes. However, the data for participants who've moved 10 or 11 times is missing from the chart. If the data is bimodal at 10 and 11 and the mean is 10.3, how many participants moved 10 times?

x f(x)	+	-)(•
÷ <		=)(2
$>$ $\frac{a}{b}$		(<i>a</i>)	<i>a</i>
\sqrt{a} \sqrt{a}	π	<i>i</i> (sin
cos tan	arcsin	arccos	arctan