

Undergraduate Psychology Research Methods Journal

Volume 1 | Issue 9

Article 10

5-2009

Time: Friend or Foe?

Greg Townsend
Lindenwood University

Follow this and additional works at: https://digitalcommons.lindenwood.edu/psych_journals



Part of the [Psychology Commons](#)

Recommended Citation

Townsend, Greg (2009) "Time: Friend or Foe?," *Undergraduate Psychology Research Methods Journal*: Vol. 1 : Iss. 9 , Article 10.

Available at: https://digitalcommons.lindenwood.edu/psych_journals/vol1/iss9/10

This Article is brought to you for free and open access by the Psychology, Sociology, and Public Health Department at Digital Commons@Lindenwood University. It has been accepted for inclusion in Undergraduate Psychology Research Methods Journal by an authorized editor of Digital Commons@Lindenwood University. For more information, please contact phuffman@lindenwood.edu.

Time: Friend or Foe?

Greg Townsend

The present research was conducted in order to determine whether timing a test (such as on the ACT) causes a decrease in accuracy compared to the same test given without any time limit. Participants were given two equivalent tests (Test A & Test B), one timed and the other not timed, in the four ways: 1) test A first with test B timed, 2) test A first with test A timed, 3) test B first with test A timed, and 4) test B first with test B timed. The time allowed for the timed test was eight minutes and fifteen seconds (see Appendix A). The results revealed that there was no statistical difference between scores on the timed and untimed tests.

The problem under investigation includes time and pressure. The purpose of this experiment was to find out if people perform more accurately under pressure with a time limit or without a time limit. Currently, these types of performances are used in high schools, ACT (American College Test), SAT (Scholastic Assessment Test), and college universities. The topic under study was chosen because the research is much like the ACT test and how it is entirely timed. It would be interesting to see if the fact of being timed could affect how one performs on tests by measure of accuracy. I hypothesized if someone is pressured to finish ACT-like questions (standardized) in a specific amount of time, then the timed task will cause one to lose accuracy.

There is much research on how to perform better on timed tests and any other test dealing with test anxiety. The Education Testing Service (ETS) has published a guide called *Reducing Test Anxiety*. In this guide, they state that to maximize test performance, the three things one you need to do are to prepare, stay organized, and practice (ETS, 2005). When dealing with

preparation, it is important to study areas in which you are unfamiliar with and to use strategies, as part of the studying that would reduce test anxiety. Organizing, can possible help to create clear and targeted study plans for weeks leading up to the test (ETS 2005). Finally, the third way to maximize test performance is to practice. The ETS says that practicing for the test is what practice includes. This practice includes sitting for certain periods of time, answering and studying test questions, and learning a correct pace. If these three success tools are used weeks before the test, it will help most to reduce text anxiety.

Two types of test anxieties that are seen are somatic and cognitive (Nolting, 2000). Somatic testing anxiety deals with what the individual feels; it would be physiological. On the other hand, cognitive testing anxiety is what the individual is actually thinking; it would be psychological. Some causes of these anxieties can come from grades, feeling of lack of control, being in a difficult course, and can be caused by timed tests and the fear of not finishing.

Since the study is based on the ACT, the tips the ACT offers to prepare for their test would prove to be very helpful. Some tips for taking the ACT (found on their website) include reading instructions carefully, reading each question carefully, using a good pace and to not spend too much time on a single questions or passage, pay attention to time announcements, answer easy questions then go back to answer more difficult ones, and always recheck your answers if time permits.

If speed of a performance were an integral part of a measurement, then the time limits are essential, just like testing the skill how fast one can type (Bridgeman, McBride, & Monaghan, 2004). Also, limiting time can help with expenses, as long as the time is lot limited too much as it would threaten the validity of the test. A term used when dealing with timed tests is

speededness, which “in testing refers to the effect that time limits have on test takers’ scores” (Bridgeman *et al.*, p. 1). If a test is considered speeded, then the tests’ time limits are too constrained and not allowing the test takers enough time to consider and answer the questions presented. This article also highlights research done by Brent Bridgeman, Catherine Trapani, and Edward Curley in 2003. Bridgeman, *et al.* Trapani, and Curley attempted in this study to find what the effect of fewer questions per section would do on SAT I scores. In their study, Bridgeman, *et al.* Trapani, and Curley decreased the number of questions in the SAT Reasoning Test™ section. This section of the SAT is not counted towards the final grade and is used to test new questions. In the end, it was found that allowing more time per question had a minimal impact on verbal scores yet more of an impact on math scores.

A study was conducted at Lindenwood University which dealt with standardized test performances related to test anxiety” (Judd, Merli, & Zagar, 2008). This was achieved by examining the two variables of time warning and the presence of a confederate (another test taker purposely placed there by researchers). In Judd, Merli, and Zagar’s research, they hypothesized that when the confederate was present, test takers would perform worse than those whom tested alone. Along with the previous statement, they hypothesized that test takers that receive time warnings would yield a decreased performance when compared to those not receiving any time warnings. The findings of their study found no statistical difference for either of the two hypotheses.

Finally, in Virginia, there are counties that are increasing time allowed on standardized tests. The author, Jay Mathews, states that there are 14 states, including Virginia, which allow student as much time as need for achievement tests. Robert Schaeffer, an expert who is the

public education director for the Nations Center for Fair and Open Testing (FairTest), stated that “If tests are suppose to be measuring what a student knows, not just how fast she or he can spew back answers, there’s no reason for the rigid time restrictions” (Mathews 2004). It seems that the possible future of testing may go to more allotted time, however, experts would like to do more research on how and why students use extra time.

Method

Participants

My experiment involved a total of 46 participants, 25 of them being female and 21 being male. The ages of these 46 participants ranged from 18 to 26 years old, but were all either Freshman, Sophomores, or Juniors at Lindenwood University. All participants were recruited through Lindenwood University’s Human Subject Pool (HSP) on the fourth floor of Young Hall and were enrolled in one or more of the following classes: Cultural Anthropology, Principles of Psychology, Interactive Psychology, The Family, and Basic Concepts of Sociology. Since this was done through the HSP, recruitment was done with the sign up sheets that are put up on the HSP Board after approval. Participation was strictly voluntary, however, the participants would also receive extra credit from their professors (if their professor offered it/or they were enrolled in one of the above classes).

Materials

The materials used in this study were fairly straightforward. A lot of paper was used, for items such as the demographic survey (see Appendix B), informed consent form (see Appendix C), feedback letter (see Appendix D), participant receipts (see Appendix E), answer sheet (see Appendix F), and of course, the two tests them selves (see Appendices G & H). Aside from the

materials I prepared, the HSP also booked rooms for me that included chairs and tables/desks (I used room Young 100 for all my research). Ink pens were also provided in order for the participants to fill out all of the aforementioned documents. These were used to fill out everything that was handed to the participants. There was also a 3-ring binder, which I utilized to keep all of the above materials organized and easily accessible. It would have also been much more difficult to analyze all data without the use of SPSS 16.0 (Statistical Package for the Social Sciences) and performed a paired sample t-test.

From the demographic survey, I learned that my participants consisted of 11 eighteen-year olds, 17 nineteen-year olds, 13 twenty-year olds, 2 twenty one-year olds, 1 twenty three-year old, and 2 twenty six-year olds. Of all of these ages, 32 were freshman, 9 were sophomore, 5 were junior, and 0 were senior undergraduate students attending Lindenwood University. About 35% of participants had never taken the ACT before and just over 60% of participants thought they did well or neither poorly nor well on their ACT test. Only 4% of participants actually liked taking the ACT whereas 54% disliked or had much dislike for the ACT. Finally, 46% of the participant's thought that time does constrain or affect test performance and only 11% thought that time enhances test performance.

Procedure

As the participants arrived and were seated (I waited five minutes after starting time for people to arrive. If they arrived after that time, they were not be allowed to enter the room), they found four sheets of paper on the desks; 1) Participant's Receipts, 2) Informed Consent Forms, 2) Demographic survey, and 4) Test Answer Sheet. The experimenter then introduced himself and told the participants to start to fill out the papers on their desks. Once all participants

finished filling out the papers, the experimenter collected them and passed out the first 10-question test, faced down, and instructed participants not to start until told to do so. The experimenter then explained to the participants the test would consist of questions from the following: English, Math, Reading, and Science. Participants were also instructed to try to answer all of the questions and when time is up to drop their pen or pencil and flip the test over. The previous procedures were the same for the second test as well (except they did not have to fill out all the paper work again).

Depending on which group of tests I decided to give, participants received one of four orders of tests and times; 1) Test A first with test B timed, 2) Test A first with Test A timed, 3) Test B The first test A timed, and 4) Test B first with Test B Timed. The timed tests handed out were allowed 8 minutes and 15 seconds to complete. During the timed tests, the experimenter informed the participants when there is 1 minute left and when there was 10 seconds left. When the experimenter said start, the participants flipped the test over and began. Anyone who finished early was asked to flip the test over and sit quietly for time to expire. Once everyone was finished, the experimenter walked around and picked up each test. Once they were all collected, the papers were shuffled around to keep them anonymous and then the experimenter handed out the second test, which had the same amount and same type of questions that were counterbalanced.

Once both tests were completed and collected, the experimenter debriefed the participants as to why they took these tests and what the hypothesis was. A feedback letter was then passed out that had a number on the top of it, which the participant could refer to himself or herself as if they needed to get a hold of the experimenter.

Results

My hypothesis stated that if someone were pressured to finish ACT-like questions (standardized) in a specific amount of time, then the time would cause one's accuracy to decrease. The independent variable in this research was whether or not the test was timed. After analyzing the data and performing a paired sample t-test, I found that $t_{(45)} = .143, p > .05$ and that there was no statistically significant differences in test performance between the two types of tests given (timed vs. not timed). I also ran a paired sample's t-test for the percent scored on Test A and Test B and for the score on the first test received and second test received and as expected, there was no performance difference found between Test A and B ($t_{(45)} = -1.159, p > .05$) and no order effect was found ($t_{(45)} = -.286, p > .05$).

Discussion

My hypothesis, which stated that if someone were pressured to finish ACT-like questions (standardized) in a specific amount of time, then the time would not cause one's accuracy to change, was not supported in my research. Therefore I can conclude that my original research hypothesis was false or rejected. To try to determine what could have possibly caused my research hypothesis to be false, I ran the same t-tests to determine if the tests or tests order played a role. The mean score of Test A was 50% (standard deviation = 20.1) and the mean score for Test B was 54% (standard deviation = 22.3), which shows that the two tests were not statistically different from one another. The next t-test led to a mean for the timed test of 52.4% (standard deviation = 21.41) and a mean for the untimed test of 51.9% (standard deviation = 21.14), which again shows that that there was not a statistically difference. Finally, the last t-test I ran was between the scores on the first test and the scores on the second test received

(regardless of if it was Test A or Test B). The average for the first received test was 51.7% (standard deviation = 21.22) and the average for the second test received was 52.6% (standard deviation = 21.43), which means the order the test is received does not make a statistical difference.

When going back and looking at possible confound and/or extraneous variables, there definitely were some that were apparent. I had a participant after a research day come to me and explain that no matter what for the second test, the participant would be familiar with the instructions/directions and took less time familiarizing herself with them. Also, some days the room I was in (Young 100) was extremely hot and humid. This room was also located at the entrance of the building, which allotted for much outside noise and distractions. Another issue that I really think played a role was the participants just doing my research for their extra credit. Not many participants want to take two 10-question standardized tests. I knew this so I paid attention to participants and realized that many of them just filled in answers (I believe this because some people finished the 10 questions in less that one minute). As there are other variables that played a role, these seem to be the ones that stuck out to me.

To make this a better and more efficient study, I should not have included any instructions on the Tests and verbally given them and made sure no questions needed to be asked. Also, since all of the questions came from practice questions on the ACT website, I had asked questions on the same passage for science in both tests. Although the questions were different, practice could have carried over from one test to the other (not as test order but as different questions over the same passage or graph). These are two ways I think my research could be made a little better.

However, it is very possible that time does have an effect on accuracy. A possible floor effect could have occurred in several ways. One way would be the tests being too hard (correct answers could have been luck of guessing) whereas another way a floor effect could have occurred is since some people have taken the ACT and are familiar with the test, however, some participants never took the ACT and are not familiar with the test.

This leads to what happens if we do find that time has an effect on accuracy. If this were to be the case, then we need to study where the time is affecting scores most (meaning what section and/or subject). If we can find where more time is needed and where less time is needed, then it would be possible to decrease the likelihood of time effecting accuracy.

References

- ACT, Inc., (2009). *ACT test prep: Sample tests*. Retrieved February 19, 2009 from, <http://www.actstudent.org/sampletest/index.html>
- ACT, Inc., (2009). *Tips for taking the ACT*. Retrieved February 19, 2009 from, <http://www.actstudent.org/testprep/tips/>
- ACT, Inc., (2009). *Understand your scores*. Retrieved February 19, 2009 from, <http://www.actstudent.org/scores/understand/index.html>
- Bridgeman, B., McBride, A., & Monaghan, W. (2004). *Testing and Time Limits*. Educational Teaching Service, San Diego, CA.
- Bridgeman, B., Trapani, C., & Curley, E. (2003). *Effect of fewer questions per section on SAT® I scores* (College Board Report No. 2003-2). Retrieved Oct. 19, 2004, from the College Board Web site: http://www.collegeboard.com/research/pdf/rdcbreport20032web_23502.pdf

Educational Testing Service, ETS (2005). Reducing test anxiety. *The Praxis Series*, Retrieved

March 11, 2009, from www.ets.org/praxis/testingtips.html

Judd, B, Merli, D, & Zagar, J. (2008). *Can't test this: Test performance and anxiety*.

Unpublished Manuscript, Lindenwood University.

Mathews, J. Standardized test times vary at area schools. (2004, June 1). *Washington Post*, p.

Education, B01.

Nolting, P. D. (2000). *Math study skills workbook, your guide to reducing test anxiety and*

improving study strategies. Houghton Mifflin Company.

Author Note

I would first like to thank my professor for my Advanced Research Methods Class, Dr. Michiko Nohara-LeClair. Whenever I needed any help or advice, she was there to give it. Her knowledge was a great asset to my research and APA (American Psychological Association) paper. Another person who I cannot forget to thank is Krystal Handley. She helped me organize my data and was also there to give me advice when needed. She even helped me with some of my research to make sure things went well. Thank you to you both for all the help and guidance you gave me.

If anyone would like further information on test taking tips, more hints and tips can be found on the ACT website at <http://www.actstudent.org/testprep/tips/>.

Contact Information:

Greg Townsend, (314) 605-9056, grt357@lionmail.lindenwood.edu,

LiKiTySpLiT2k6@hotmail.com, greg@bestbowlingproshops.com

Appendix A

How I Figured Time Limit

English - 3 questions

(An actual ACT English Test contains 75 questions to be answered in 45 minutes.)

45 min (2700 sec)/ 75 questions = 36 seconds per question
 36 seconds per question * 3 questions = 108 seconds = 1 min 48 sec

Math - 2 questions

(An actual ACT Mathematics Test contains 60 questions to be answered in 60 minutes.)

60 min (3600 seconds)/ 60 questions = 60 seconds per question
 60 seconds per question * 2 questions = 120 seconds = 2 min

Reading - 3 questions

(An actual ACT Reading Test contains 40 questions to be answered in 35 minutes.)

35 min (2100 seconds)/ 40 questions = 52.5 seconds per question
 52.5 seconds per question * 3 questions = 157.5 seconds = 2 min 37.5 sec

Science - 2 questions

(An actual ACT Science Test contains 40 questions to be answered in 35 minutes.)

35 min (2100 seconds)/40 questions = 52.5 seconds per question
 52.5 seconds per question * 2 questions = 105 seconds = 1 min 45 sec

1 min 48 sec +
 2 min 0 sec +
 2 min 37.5 sec +
 1 min 45 sec =

6 min 130.5 sec =

8 min 10.5 sec. to answer questions

I will give them 8 minutes and 15 seconds to finish the entire test (same for Test A and for Test B)

Appendix B

Participant Demographic Survey

Participant ID: _____ ARM- _____ Date: _____

1.) Please circle the level of college you are currently in:

Freshman Sophomore Junior Senior Other: _____

2.) Please indicate your age: _____ years

3.) Please circle your gender:

Female Male

4.) In your opinion, do you think you did well on the ACT?

1—Very Poorly

2—Poorly

3—Neither Poorly nor Well

4—Well

5—Very Well

6—I never took the ACT

7—Other (please specify):

5.) In your opinion, how do you feel about timed tests?

1—Much Dislike

2—Dislike

3—Neutral

4—Like

5—Much Like

6.) In your opinion, do you think timed tests constrains/affects your testing performance?

1—Much Constrain/Affect

2—Constrain/Affect

3—Neutral

4—Enhancement

5—Much Enhancement

Appendix C

Informed Consent Form

I, _____ (print name), understand that I will be taking part in a research project that requires me to complete a 10-question test that will be graded on accuracy. I also understand that all questions not answered will be discarded.. I am aware that my participation in this study is strictly voluntary and that I may choose to withdraw from the study at any time without any penalty or prejudice, as well as if I cannot complete the test. I understand that the information obtained from my participation will in now way be able to identify who I am and that all identifying information will be absent from the data in order to ensure anonymity. I am also aware that my responses will be used strictly for research and educational purposes. I understand that any questions I may have regarding the test shall be answered by the researchers(s) to my satisfaction. Finally, I verify that I am 18 years of age and that I am legally able to give consent. Also, I verify that if I am under the age of 18 that I have on file, with the HSP Office, a completed parental consent from that allows me to give consent as a minor.

(Signature of Participant)

Date: _____

(Signature of Researcher Obtaining Consent)

Date: _____

Student Researchers' Name(s), E-mail(s), and Number(s):
Greg Townsend – (314) 605-9056 – grt357@lionmail.lindenwood.edu

Supervisor:
Dr. Michiko Nohara-LeClair
Course Instructor
(636) 949-4371
mnohara-leclair@lindenwood.edu

Appendix D

Feedback Letter

Thank you for participating in my experiment. The test you took will be graded on accuracy. I gave each group standardized tests that were counterbalanced to be similar in which one was times and the other was not. This leaves my hypotheses to be: If someone is pressured to finish ACT like questions in a specific amount of time, then the timed task will cause one to lose accuracy. The reason I chose this is because I want to see if the ACT is actually testing what someone knows or how much they can answer correctly for their given time. I am not interested at all if you did or did not get all the questions right. I am only interested if the time will affect how many answers are right. There will be no way for anyone to identify you and your answers.

If you have any questions and/or concerns regarding any portion of this study, please do not hesitate to bring them up in the future. Contact information can be found at the bottom of this letter. If you are interested in obtaining a summary of the findings of this study at a date later than you taking the test, please make an effort to contact a number at the bottom of the page and it will be available upon the completion of the experiment.

Thank you for your time and contribution to the study.

Sincerely,

Principal Investigators:

Greg Townsend (314) 605-9056 grt357@lionmail.lindenwood.edu

Supervisor:

Dr, Michiko Nohara-LeClair (636) 949-4371 mnohara-leclair@lindenwood.edu

Appendix E

Participant's Receipt

x _____
(Participant's full name-printed)
x _____
(Signature)
x _____
(Student ID number) (Time of Class)
x _____
(Teacher's name)

(Project Number)

(Experimenter's name-printed)

(Experimenter's Signature) (date)

**Please return this form to Y407
to receive your extra credit**

Participant's Receipt

x _____
(Participant's full name-printed)
x _____
(Signature)
x _____
(Student ID number) (Time of Class)
x _____
(Teacher's name)

(Project Number)

(Experimenter's name-printed)

(Experimenter's Signature) (date)

**Please return this form to Y407
to receive your extra credit**

Please cut along dotted lines.

Appendix F

Answer Sheet

Participant ID: _____ ARM- _____ Date: _____

Make sure when you take Test A that those answers are put under the Test A answer blocks. Same goes for Test B.

Test A Answers:

- 1 A B C D E
- 2 A B C D E
- 3 A B C D E
- 4 A B C D E
- 5 A B C D E
- 6 A B C D E
- 7 A B C D E
- 8 A B C D E
- 9 A B C D E
- 10 A B C D E

Test B Answers:

- 1 A B C D E
- 2 A B C D E
- 3 A B C D E
- 4 A B C D E
- 5 A B C D E
- 6 A B C D E
- 7 A B C D E
- 8 A B C D E
- 9 A B C D E
- 10 A B C D E

Appendix G

Test AParticipant ID: ARM- Date: _____**ENGLISH**

DIRECTIONS: In the passage that follows, certain words and phrases are underlined and numbered. In most cases, you are to answer 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."

Passage - Bessie Coleman: In Flight

It was a long journey from the American ¹Southwest she'd been born in 1893, to these French skies. ²The year in which she was born was about a year ago. There hadn't been much of a future for her in Oklahoma. After ³both semesters of the two-semester year at Langston Industrial College, Coleman headed for Chicago to see what could be done to realize a dream. Ever since she saw her first airplane when she was a little girl, Coleman had known that someday, somehow, she would fly.

Questions

1. A. NO CHANGE
 B. Southwest that she'd been
 C. Southwest, where she'd been
 D. Southwest, she was
2. A. NO CHANGE
 B. It is now just about a century since the year of her birth.
 C. Just about a century has passed since the year of her birth.
 D. OMIT the underlined portion.

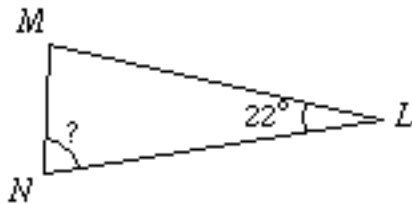
3. A. NO CHANGE
B. a year
C. a year like two full semesters
D. one year filled with two semesters
-

MATH

4. A rectangle is twice as long as it is wide. If the width of the rectangle is 3 inches, what is the rectangle's area, in square inches?

- A. 6
B. 9
C. 12
D. 15
E. 18

5. The triangle below is isosceles and is drawn to scale. What is the measure of N?



- A. 22°
B. 68°
C. 78°
D. 79°
E. 89°
-

READING

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

PROSE FICTION: This passage is adapted from Elizabeth Bishop's short story "The Housekeeper" (©1984 by Alice Methfessel).

Outside, the rain continued to run down the screened windows of Mrs. Sennett's little Cape Cod cottage. The long weeds and grass that composed the front yard dripped against the blurred background on the bay, where the water was almost the color of the grass. Mrs. Sennett's five charges were vigorously playing house in the dining room. (In the wintertime, Mrs. Sennett was housekeeper for a Mr. Curley, in Boston, and during the summers the Curley children boarded with her on the Cape.) My expression must have changed. "Are those children making too much noise?" Mrs. Sennett demanded, a sort of wave going over her that might mark the beginning of her getting up out of her chair. I shook my head no, and gave her a little push on the shoulder to keep her seated.

6. According to the narrator, Mrs. Sennett wears a hat because she:
- A. is often outside.
 - B. wants to look like a literary figure.
 - C. has thin hair.
 - D. has unique taste in clothing.

7. It is reasonable to infer from the passage that Mrs. Sennett asked "Are those children making too much noise?" (lines 11–12) because Mrs. Sennett:
- A. concerns herself about the well-being of others.
 - B. wishes to change the subject to literary figures.
 - C. cannot supervise the children without the narrator.
 - D. is bothered by the noise the children make.
8. As it is used in line 3, the word composed most nearly means:
- A. contented.
 - B. unexcited.
 - C. satisfied.
 - D. constituted.
-

SCIENCE

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

Passage I

The following table represents the concentration of ions and dissolved gases in the sediment at the bottom of an ocean. A depth of 0 centimeters (cm) represents the top of the sediment. The concentrations are expressed in parts per million (ppm). The acidity of a solution is represented on a scale known as pH. A pH of 1 is very acidic, a pH of 7 is neutral, and a pH of 14 is very basic.

Depth (cm)	Temp. (°C)	Concentration in sediment (ppm)						
		pH	SO ₄ ²⁻	S ²⁻	CO ₂	Fe ³⁺	Fe ²⁺	O ₂
0	4	7.0	7.0	0.0	1.0	4.0	0.5	2.0
5	5	6.5	5.0	2.0	1.5	3.0	1.5	1.0
10	7	6.0	3.5	3.5	2.0	2.0	2.0	0.0
15	9	5.5	3.3	3.8	3.0	0.8	3.8	0.0
20	10	5.0	3.0	4.0	1.0	0.5	4.0	0.0

*Table adapted from R.M. Atlas and R. Bartha, *Microbial Ecology: Fundamentals and Applications*. ©1981 by Addison-Wesley Publishing Company.*

9. According to the information provided in the table, the concentration of which of the following ions and dissolved gases is constant for sediment depths of 10 cm or more?

- A. Sulfide (S²⁻)
- B. Carbon dioxide (CO₂)
- C. Ferric iron (Fe³⁺)
- D. Oxygen (O₂)

10. If the trends indicated in the table were to continue, one would predict the pH of the sediments at a depth of 35 cm to be:

- A. 1.5.
- B. 3.5.
- C. 4.5.
- D. 6.0.

Appendix H

Test BParticipant ID: ARM- Date: _____**SCIENCE**

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

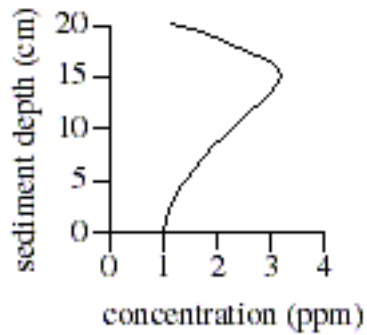
Passage I

The following table represents the concentration of ions and dissolved gases in the sediment at the bottom of an ocean. A depth of 0 centimeters (cm) represents the top of the sediment. The concentrations are expressed in parts per million (ppm). The acidity of a solution is represented on a scale known as pH. A pH of 1 is very acidic, a pH of 7 is neutral, and a pH of 14 is very basic.

Depth (cm)	Temp. (°C)	Concentration in sediment (ppm)						
		pH	SO ₄ ²⁻	S ²⁻	CO ₂	Fe ³⁺	Fe ²⁺	O ₂
0	4	7.0	7.0	0.0	1.0	4.0	0.5	2.0
5	5	6.5	5.0	2.0	1.5	3.0	1.5	1.0
10	7	6.0	3.5	3.5	2.0	2.0	2.0	0.0
15	9	5.5	3.3	3.8	3.0	0.8	3.8	0.0
20	10	5.0	3.0	4.0	1.0	0.5	4.0	0.0

Table adapted from R.M. Atlas and R. Bartha, Microbial Ecology: Fundamentals and Applications. ©1981 by Addison-Wesley Publishing Company.

1. The graph below best represents the relationship between concentration and sediment depth for which of the following ions and dissolved gases?



- A. Ferrous iron (Fe^{2+})
- B. Oxygen (O_2)
- C. Carbon dioxide (CO_2)
- D. Sulfate (SO_4^{2-})

2. A certain type of bottom-dwelling microorganism thrives under the following environmental conditions: low concentrations of Fe^{2+} , high concentrations of O_2 , and a neutral pH. Based on the table, at which of the following sediment depths would one most likely find this microorganism?

- A. 0 cm
- B. 5 cm
- C. 10 cm
- D. 15 cm

READING

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

HUMANITIES: This passage is adapted from the article "Japan's Tansu: Cabinetry of the 18th and 19th Centuries" by Rosy Clarke (©1985 by W.R.C. Smith Publishing Company).

The Japanese, always pressed for room on their island empire, have long been masters at utilizing space. This is especially evident in the native handmade Japanese cabinetry known as tansu, produced from
5 about 1750 to 1900. A prolific range of wooden tansu was created for a variety of needs, and a diverse group of pieces emerged, ranging from small, portable medicine chests to giant trunks on wheels.

Prior to Japan's Edo Period (1603-1867), ownership of furniture was limited to the nobility. Primarily,
10 these were black-and-gold lacquered pieces of Chinese inspiration. But with the demise of Japan's feudal society and the rise of a moneyed merchant class by the mid-Edo Period, furniture in Japan took on its own
15 personality, as craftsmen enjoyed the freedom to create original designs that combined function and beauty.

Today, examples of these skillfully constructed chests tell us much about the lifestyle and accoutrements of people during the Edo Period and the Meiji Era
20 (1868-1912).

1. The author claims that by studying examples of handcrafted Japanese tansu that are still available today, scholars can learn about which of the following?
 - I. How mass production first began in Japan
 - II. How Japanese industrialists developed shortcuts in building furniture
 - III. How the Japanese lived during the Edo Period and the Meiji Era
 - A. II only
 - B. III only
 - C. I and II only
 - D. I, II, and III
 2. The passage suggests that the Japanese tansu had changed by the mid-Edo Period in which of the following ways?
 - A. It reflected increased creative freedom of the craftsmen.
 - B. It became a symbol of status and wealth for the nobility.
 - C. It became less important to the merchant class.
 - D. It became much larger.
 3. According to the passage, the Chinese influence on Japanese furniture-making is reflected in which of the following characteristics of some Japanese furniture?
 - I. The use of space
 - II. The black and gold lacquer
 - III. The use of paulownia wood
 - A. II only
 - B. III only
 - C. I and II only
 - D. I, II, and III
-

MATH

1. If 60% of the weight of a 2,200-pound car should be supported by the rear tires, how many pounds should be supported by the rear tires?

- A. 120
- B. 600
- C. 1,200
- D. 1,320
- E. 1,600

2. A rock group gets 30% of the money from sales of their newest compact disc. That 30% is split equally among the 5 group members. If the disc generates \$1,000,000 in sales, how much does one group member receive?

- A. \$30,000
 - B. \$50,000
 - C. \$60,000
 - D. \$200,000
 - E. \$300,000
-

ENGLISH

DIRECTIONS: In the passage that follows, certain words and phrases are underlined and numbered. In most cases, you are to answer 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."

Passage – The Joy of Running

I keep in shape by running on an indoor track several times a week. There are many advantages to running as a ¹sport, of which the top two advantages are: I never have to reserve a court or find teammates; ²teammates are usual in many sports; I can run at my ³convenience and I can set my own pace. Just running is, however, rather boring, so I've made it interesting by watching the other runners.

Questions

1. A. NO CHANGE
 B. sport, of which a few of the many advantages are:
 C. sport, which I will now list:
 D. sport:
2. A. NO CHANGE
 B. those who play tennis do have to worry about courts;
 C. although running is hard on one's feet;
 D. I need only shoes for equipment;
3. A. NO CHANGE
 B. convenience, and;
 C. convenience; and
 D. convenience and,