Time of Day and Cognitive Performance

An Honors Thesis (HONRS 499)

by

Tricia Hey and Courtney Smith

Thesis Advisor

Dr. Lambert Deckers

Lambert Deckers

Ball State University

Muncie, IN

April 25, 2000

Graduation on May 6, 2000
<table>
<thead>
<tr>
<th></th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Acknowledgements</td>
</tr>
<tr>
<td>2</td>
<td>Abstract</td>
</tr>
<tr>
<td>3</td>
<td>Introduction</td>
</tr>
<tr>
<td>4</td>
<td>Method</td>
</tr>
<tr>
<td>5</td>
<td>Results</td>
</tr>
<tr>
<td>7</td>
<td>Discussion and Conclusion</td>
</tr>
<tr>
<td>10</td>
<td>References</td>
</tr>
<tr>
<td>12</td>
<td>Appendix A</td>
</tr>
<tr>
<td>18</td>
<td>Appendix B</td>
</tr>
</tbody>
</table>
Acknowledgements

We would like to thank Dr. Deckers for all his help, we would definitely never have gotten through this without you! Also, thanks to Casey Campbell, Laneshia Casey, and Gretchen Hendrickson for gathering our data with us. A special thanks to Cooksey and Dr. Joanne Edmonds for giving us ideas, approving our topic, and just being there when we needed you!
Abstract

It is apparent that some individuals perform better on certain tasks as the day progresses. Folkard (1975) found that as arousal increases throughout the day, so does performance on immediate processing tasks. We tested this theory by administering anagrams and sample GRE questions to ninety-nine participants. Our results were similar to Folkard's results. Anagram solving performance significantly increased from 8 a.m. to 2 p.m; thus showing, that it may be beneficial for a student to take classes later in the day as opposed to earlier in the day.
Introduction

In every day life one can observe loss of concentration, error in specific performance, drowsiness, and many other behavioral changes as a result of the change in time of day. Throughout our college careers it has been our experience that we are more alert and responsive in our mid-day classes as compared to our earlier ones. We have found that our arousal is higher later in the day, leading to better attention and performance. As the day progresses further, we have observed that our arousal seems to decrease after the lunch period, and then arousal increases again around the evening until it is time to go to bed.

Beyond anecdotal evidence, prior research conducted by Clements, Hafer, and Vermillion (1976) measured arousal in university classes that met at different times of day ranging from eight in the morning to nine at night. They found that arousal steadily increased until approximately 2 in the afternoon, after which there was a marked decrease. It is because of these observations that one can conclude that there is an apparent time of day where one performs tasks at an optimal level. Browne (1949) ran a study on the performance of telephone operators at various times of day and found that compared to the afternoon, subjects did significantly worse in the morning and later in the evening, as measured by the number of errors committed. Simon Folkard (1975) found that performance on different types of tasks is better at a certain time of day. His studies on short-term memory suggest that performance improves slightly from early to mid-morning, and then shows a decrease over the rest of the day. However, performance on immediate component processing tasks, such as anagram solving, improves as the day progresses.

These differences may be attributed to the increase and decrease in one’s arousal throughout the day. One’s arousal is directly affected by internal factors such as body temperature and sleeping patterns (Thayer, 1989). These circadian rhythms cause arousal to increase up to a critical point and then decrease in the late afternoon. It has been
theorized that wakefulness is highest in mid-afternoon due to the existence of a specific circadian sleep/wakefulness rhythm (Gates, 1916). If we combine the time of day and arousal studies, then we can conclude that performance is linked to arousal. It appears that as arousal increases, then performance also increases. Further increase in arousal, however, will lead to a decline in performance (Hebb, 1995). This relationship suggests that is why arousal is highest at mid-day, which is the time when performance is the best.

Our Hypothesis

We hypothesize that as the day progresses, performance on cognitive tests will increase. Our prediction is based upon the studies cited above. Participants were given a series of problem solving tasks including anagram solving, analytical, and mathematical questions at one of four different times a day. Folkard believed that performance should improve due to increased processing speed with increasing arousal up to a critical point when memory capacity has been reduced by the increase in arousal that it is no longer capable of keeping up with the processing rate (1975). Anagram solving involves immediate processing, while math questions as well as analytical problems rely more on memory. If accuracy is seen primarily dependent on one’s memory capacity, rather than on the processing capacity, then it follows that as arousal increases through the day, accuracy should decrease; thus, the increase in anagram solving may be attributed to the fact that it does not include a memory component.

Method

Participants

Our sample (N=99) consisted of thirty-eight men and sixty-one women enrolled in introductory psychology at Ball State University. Their participation in this experiment was a partial fulfillment of course requirements. The mean age of the
participants was 20.28 years of age. Participants signed an informed consent statement prior to their participation.

**Materials**

To rate the participants' mood, two mood evaluations were administered by experimenter. They were the State-Trait-Cheerfulness-Inventory Survey (STCI-18, Ruch, Kohler, Deckers, & Carrell, 1994) and the Positive and Negative Affect Scale (PANAS, Watson, et al., 1988). A set of ten sample Graduate Record Exam (GRE) questions were administered to measure cognitive performance. A data sheet was given to participants that included the participants' sex, age, year in school, and the number of hours of sleep that the participant had received from the previous night. The data sheet also included the time of day the test was administered and what the climate was like for that particular time and day.

**Procedure**

This experiment was administered at four different times a day (8 a.m., 10 a.m., 12 p.m., and 2 p.m.) Participants were first given a data sheet, which included demographic information about them. The participants then completed the two different mood scales. Next, the participants were given twenty minutes to complete the sample GRE questions and anagrams. After the experiment was over, the experimenter thanked the participants and debriefed them. The tests were scored for the number of questions answered correctly and the number of anagrams solved accurately.

**Results**

Our research found that for the anagram solving task there was a significant time of day effect, while there was slight influence on the sample GRE question scores. We also found that women scored significantly better on the anagram solving section than did our male participants. Finally, we found that students who signed up for the 12 p.m. or 2 p.m. testing times were more likely to show than those in the 8 a.m. and 10 a.m. testing
brackets. We also looked at mood and time of day using the PANAS scale, but no significant results were found; therefore, this data was not analyzed further.

Figure 1 and Table 1 (Appendix A) shows the data for time of day and the performance on anagram solving for the four different testing times. At 8 a.m. there was a mean number of 26 anagrams solved with a standard deviation of 4.6. At 10 a.m. there was a mean number of 28.52 anagrams solved with a standard deviation of 5.03. During the 12 p.m. testing time participants had a mean score of 29.85 anagrams with a standard deviation of 4.64. Finally, our 2 p.m. participants had a mean score of 30.68 with a standard deviation of 3.38. We found the correlation between these scores and times to be significant (r=.32, p<.001). Thus, as time of day increased, anagram scores increased as well. The lowest number of anagrams were scored at our 8 a.m. testing time and the highest were achieved at our 2 p.m. time. An analysis of variance indicated that means were significantly different (F=3.87, p<.05). Overall subjects had a mean score of 29.21 with a standard deviation of 4.59.

Figure 2 and Table 2 (Appendix A) illustrates the relationship between sex and anagram solving. Males had a mean score of 27.89 with a standard deviation of 5.2, while the mean for the women was 30.03 anagrams correctly solved with a standard deviation of 4 (F=5.29, p<.05). To compute a correlation, we coded women as 2 and men as 1. The resulting correlation was found to be significant (r=.23, p<.05), which simply means that women solved more anagrams than our male participants solved.

Finally we examined the show rates of participants who signed up and then actually participated in our experiment. We found that it was more difficult to recruit people for the 8 a.m. testing session. As is shown in Table 1, only about half as many people participated in the experiment at the 8 a.m. time than at any other testing time. Figure 3 (Appendix A) shows the percentage of participants who actually showed up for their experimental appointment. We found that at 8 a.m. 53.3% of those who signed up actually showed, while at 10 a.m. 47.6% showed. At 12 p.m., 92.6% of the participants
showed, and at 2 p.m. the numbers went back down to 84%. Thus not only were people less likely to sign up for the 8 a.m. testing time, they were also less likely to show up if they did.

Discussion and Conclusion

Our results support our hypothesis that students will perform better on cognitive tests later in the day as opposed to earlier times. For instance, students solved more anagrams later in the day than they did earlier in the day. While we found a slight correlation between the GRE questions and time of day, the results were not significant. Folkard (1975) attributes this improvement in performance to increased processing speed, which in turn increases arousal as the day progresses up to a critical point. As the day progressed participants’ arousal increased, allowing them to solve anagrams more accurately later in the day. The difference between the anagrams and GRE questions may be attributed to Folkard’s results showing that participants’ performance on memory tasks vary throughout the day. The GRE questions rely more heavily on memory components than do anagram solving. Our findings that women scored significantly better than men may be attributed to the fact that women tend to be more verbal than men. This difference may also be attributed to the number of women participants, which was twice the sized of the sample of men participants. Finally, we found that participants were more likely to show at the 12 p.m. and 2 p.m. time slots for the experiment than at 8 a.m. and 10 a.m. This finding in part may be explained by arousal theory, which states that as the day progresses up to a critical point, arousal also increases. Because of increased arousal, a person would be more likely to attend to a commitment, and therefore show up for an experiment. However, arousal theory alone does not explain our findings.

Recent research on arousal theory shows that time of day may not influence other variables that are thought to contribute arousal (Smith & Jones, 1992). Other variables
that we did not test that may have had an effect on our findings are the number of hours the subjects have been awake as well as if they eaten prior to participating in our experiment. Koulack (1997) found that people perform differently as a function of both how long the participants had slept the night before the test as well as how long they had been awake before being tested. Our study did test for a correlation in performance and number of hours of sleep, but found no significant relationship between the two variables. This phenomenon known as “the post-lunch dip” was also not tested. Thus, the result of poor anagram performance at 8 a.m. is not due to lack of sleep. Previous studies have also shown that there is an effect of eating on performance. However, Christie and McGrearty (1979) found that tasks that last a short period of time do no often show this effect. Because our participants were only given twenty minutes to complete their questions, whether they had eaten or not eaten prior to the experiment most likely did not have any effect on their performance.

Our study also lacked the consideration of individual differences among subjects. Participants may have been either a morning or evening type of person, or they may have been extroverted or introverted (Folkard, 1983). Introverts have a slightly higher body temperature in the morning than do extroverts, which is why introverts are considered to be more aroused than extroverts. The reverse is true in the evening; introverts tend to have a slightly lower body temperature in the evening than do extroverts. Colquhoun (1960) found that performance of introverts was better than that of extroverts at 10 a.m., and extroverts performed better at 3 p.m. The number of introverts and extroverts may have skewed our results.

Another factor that was overlooked in our study is the accountability of activity before a task is performed may alter performance due to interference and facilitation (Fergusen, 2000). Negative transfer is one interference that may play a role in poor performance. Participants who studied math problems that were different from the math questions in our experiment may have interfered with their performance on the latter.
While some prior activity may cause a decrease in performance, some prior activity may facilitate performance. If a participant had recent practice in anagram solving, they could have an increased score.

Our study did not test subjects past 2 p.m., which is around the critical point where arousal decreases that was found by Folkard (1975). Thus we found a steady increase without the dip in performance and consequent rise later in the day that been found by previous experimenters (Smith, 1987). We also had a low number of participants at 8 a.m. as compared to our other three testing times, which may be due to the fact that college students simply have different sleep cycles than most of the population and most often try not awake that early in the morning. This would account for the low percentage of participants showing up earlier in the day.

Overall, our study may be of use to students who want to perform their best on exams by showing them that mid-afternoon is the peak of their performance and therefore the optimal time to schedule their classes. However, students should keep in mind that research has shown that different academic subjects are learned better at different times. Colquhoun (1960) found, as did Folkard (1975), that short-term memory decreases in the afternoon. He found that students may have trouble relating pieces of information and learning new concepts in the afternoon; however, he also found that student’s pay more attention to the meaning of ideas later in the day. We may conclude that the best time to teach or learn a subject depends on the nature of the subject and how it is taught.
References


Appendix A
Figure 1. Mean number of anagrams solved at the four different testing times.
<table>
<thead>
<tr>
<th>Time of Day</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 a.m.</td>
<td>13</td>
<td>26</td>
<td>4.6</td>
<td>13</td>
<td>31</td>
</tr>
<tr>
<td>10 a.m.</td>
<td>29</td>
<td>28.52</td>
<td>5.03</td>
<td>17</td>
<td>37</td>
</tr>
<tr>
<td>12 p.m.</td>
<td>26</td>
<td>29.85</td>
<td>4.64</td>
<td>23</td>
<td>39</td>
</tr>
<tr>
<td>2 p.m.</td>
<td>31</td>
<td>30.68</td>
<td>3.38</td>
<td>25</td>
<td>36</td>
</tr>
<tr>
<td>All Cases</td>
<td>99</td>
<td>29.21</td>
<td>4.59</td>
<td>13</td>
<td>39</td>
</tr>
</tbody>
</table>

Table 1. Time of Day and Anagrams Solved
Figure 2: Sex Differences in the Correct Number of Anagrams Solved

Sex and Anagrams Solved

Number of Anagrams Solved Correctly
<table>
<thead>
<tr>
<th>Sex</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>38</td>
<td>27.89</td>
<td>5.2</td>
<td>13</td>
<td>37</td>
</tr>
<tr>
<td>Female</td>
<td>61</td>
<td>30.03</td>
<td>4</td>
<td>18</td>
<td>39</td>
</tr>
<tr>
<td>All Cases</td>
<td>99</td>
<td>29.21</td>
<td>4.59</td>
<td>13</td>
<td>39</td>
</tr>
</tbody>
</table>

Table 2. Sex and Number of Anagrams Solved
Time of Day and Percentage of Shows

Figure 3. Percentage of Subjects that Participated in Experiment After Signing Up
Appendix B
INFORMATION FOR SUBJECT AND INFORMED CONSENT

This psychological research project is called "Mood and Problem Solving." Your task will be to fill out two questionnaires that measure your current mood states. This will be followed by completing some problem solving tasks and by rating some cartoons for how funny they are to you. This entire task of filling out two psychological scales, solving problems, and rating cartoons will take about 35 minutes of your time. You will receive one hour of credit toward fulfilling General Psychology (PSYSC 100) course requirements for participating. You will be fully debriefed at the conclusion of this session.

You will not write your name on the scales, the problem sheets, and the cartoon rating sheets. All the data will be kept completely anonymous.

There is little risk for participating in this study although you may find the questions invade your privacy and that the problems may be difficult to solve. However there are several benefits that can be expected from participating in this study. You will gain first hand information about psychological research, about your moods and how they are measured. You may also gain some insight into your own behavior, such as the relationship between moods, problem solving and humor.

Participation in this study is voluntary and you are free to withdraw your consent and to discontinue participation in this study at any time without prejudice from the investigator. You will still receive the one hour of credit toward fulfilling course requirements for General Psychology (PSYSC 100).

Please feel free to ask any questions of the investigator before signing the consent form and beginning the study, and at any time during the study. For one's right as a research subject, the following persons may be contacted: Ms. Sandra Smith, Coordinator of Research Compliance, Office of Academic Research and Sponsored Programs, Ball State University, Muncie, IN 47306, (765) 285-1600 or the chairperson of the Institutional Review Board.

-------------------------------
Informed Consent Statement

I, __________________________ agree to participate in the psychological study called "Mood and Problem Solving." I have had the study explained to me and any questions I may have had were answered to my satisfaction. I have read this description and give my consent to participate. In understand that I will receive a copy of this Informed Consent form to keep for future reference.

Participant's Signature ___________________________________________ Date __________________________

Principal Investigator
Lambert Deckers
Department of Psychological Science
Ball State University
Muncie, IN 47306-0520
(765) 285-1706
DATA SHEET

TIME OF DAY________

DAY OF THE WEEK________

WEATHER (cloudy, sunny, snowing, rain, temperature)

NUMBER OF HOURS OF SLEEP________

EXPERIMENTER________

NUMBER OF ANAGRAMS SOLVED________

SCORE ON GRE STORY QUESTIONS________

TIME WORKING ANAGRAMS + GRE QUESTIONS________

SUM OF FUNNINESS ON
p. 1____
p. 2____
p. 3____

SCORES ON STCI-S-18
cheerfulness_____ 
seriousness_____ 
bad mood______

PANAS
positive mood score_____
negative mood score_____
PARTICIPANT INFORMATION SHEET

SEX:  M   F

AGE:_________

YEAR IN SCHOOL_________

TIME YOU WENT TO BED LAST NIGHT_________

TIME YOU WOKE UP TODAY_________
Instructions: The following statements refer to your current mood and mental state. Please try as much as possible to describe your current feelings and state of mind by circling one of the four alternatives. Please use the following scale:

1. strongly disagree  2. moderately disagree  3. moderately agree  4. strongly agree

For example:

I have an even temper.............1  2  3  4

If you strongly agree with this statement, that is, if you have an even temper at this moment, circle 4. If you strongly disagree, that is, if you are not having an even temper at all, circle 1. If you have difficulty answering a question, pick the solution that most applies.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I feel gloomy</td>
<td>1</td>
<td>2  3  4</td>
</tr>
<tr>
<td>2. I am set for serious things</td>
<td>1</td>
<td>2  3  4</td>
</tr>
<tr>
<td>3. I am cheerful</td>
<td>1</td>
<td>2  3  4</td>
</tr>
<tr>
<td>4. I have important things on my mind</td>
<td>1</td>
<td>2  3  4</td>
</tr>
<tr>
<td>5. I am in a crabby mood</td>
<td>1</td>
<td>2  3  4</td>
</tr>
<tr>
<td>6. I am sad</td>
<td>1</td>
<td>2  3  4</td>
</tr>
<tr>
<td>7. I am ready to have some fun</td>
<td>1</td>
<td>2  3  4</td>
</tr>
<tr>
<td>8. I have a serious mental attitude</td>
<td>1</td>
<td>2  3  4</td>
</tr>
<tr>
<td>9. I could laugh at the drop of a hat</td>
<td>1</td>
<td>2  3  4</td>
</tr>
<tr>
<td>10. I am peeved (annoyed)</td>
<td>1</td>
<td>2  3  4</td>
</tr>
<tr>
<td>11. I’m walking on air</td>
<td>1</td>
<td>2  3  4</td>
</tr>
<tr>
<td>12. I regard my situation objectively and soberly</td>
<td>1</td>
<td>2  3  4</td>
</tr>
<tr>
<td>13. I am amused</td>
<td>1</td>
<td>2  3  4</td>
</tr>
<tr>
<td>14. I am in a serious frame of mind</td>
<td>1</td>
<td>2  3  4</td>
</tr>
<tr>
<td>15. I am in a thoughtful mood</td>
<td>1</td>
<td>2  3  4</td>
</tr>
<tr>
<td>16. I feel dejected</td>
<td>1</td>
<td>2  3  4</td>
</tr>
<tr>
<td>17. I am delighted</td>
<td>1</td>
<td>2  3  4</td>
</tr>
<tr>
<td>18. I feel grouchy</td>
<td>1</td>
<td>2  3  4</td>
</tr>
</tbody>
</table>

Please check to see that you have answered every statement.

©Ruch, Köhler, Deckers, & Carroll, 1994
This scale consists of a number of words that describe different feelings and emotions. Read each item and then circle the appropriate answer. Indicate to what extent you feel this way right now, that is, at the present moment. Use the following scale to record your answers.

<table>
<thead>
<tr>
<th>Item</th>
<th>Very Slightly or Not at All</th>
<th>A Little</th>
<th>Moderately</th>
<th>Quite a Bit</th>
<th>Extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. interested</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2. distressed</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3. excited</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4. upset</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5. strong</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6. guilty</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7. scared</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8. hostile</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9. enthusiastic</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>10. proud</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>11. irritable</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>12. alert</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>13. ashamed</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>14. inspired</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>15. nervous</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16. determined</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>17. attentive</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>18. jittery</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>19. active</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>20. afraid</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
STOP

DO NOT TURN THE PAGE

WAIT FOR FURTHER INSTRUCTIONS
The following questions are a set of two related words. Choose the answer that best expresses the relationship in the original set of words.

1. CRINGE:FEAR
   a. gasp:breath     b. think:conclusion     c. yawn:boredom
   d. enhance:nobility     e. announce:reaction

2. PLANT:FERTILIZER
   a. animal:food     b. rose:thorn     c. harvest:plenty
   d. season:hunting     e. restaurant:menu

3. BOAST:VANITY
   a. gloat:satisfacion     b. write:novel     c. primp:humility
   d. apologize:profit     e. mail:photograph

4. ECSTASY:PLEASURE
   a. hatred:affection     b. condemnation:approval     c. rage:anger
   d. difficulty:understanding     e. privacy:invasion

5. ACCIDENTAL:INTENTION
   a. voluntary:requirement     b. anticipated:performance
   c. interesting:feeling     d. practical:knowledge     e. insane:correction

6. If x = 2, what is the value of x + 2x - 2?
   a. -2     b. 0     c. 2     d. 4     e. 6

7. If (2 +3)(1 + x) = 25, then x =
   a. 10     b. 8     c. 1     d. 4     e. 5

8. If x + y = 3, then 2x + 2y =
   a. 2/3     b. 1/2     c. 2/3     d. 6
   e. Cannot be determined from the information given

9. Diana spent 1/2 of her allowance on a book and another $3.00 on lunch. If she still had 1/6 of her original allowance, how much is Diana's allowance?
   a. $24     b. $18     c. $15     d. $12     e. $9

10. Waking at a constant rate of 4 miles per hour, it takes Jill exactly one hour to walk home from school. If she walks at a constant rate of 5 miles per hour, how many minutes will the trip take?
    a. 48     b. 54     c. 56     d. 72     e. 112
Unscramble the letters to make a word. Write the solution on the line.

CTA______
TPI______
ETN______
ONT______
WNO______
MIH______
NYA______
EWN______
YDA______
ANM______
ATPR______
DMAE______
TMSO______
AEMS______
SUDE______
IEGV______
AFEC______
TLSA______
ENDE______
ATCF______
TESLA______
IGTHN______
AETKN______
OEYNM______
GENBA______
ECLAP______
TWEAR______
NMUHA______
ONNWK______
UESHO______
NDUTER______
EEROBF______
AYASWL______
BDNIEH______
TCOAIN______
EMNMTO______
ILSACO______
NDGIRU______
LOHCOS______
UBPCLI______