Adv. Biology Summer Work

W. Spalding

H. Boyd

ASSIGNMENT # 1: LETTER OF INTRODUCTION

Welcome to Advanced Biology! We want you to be able enjoy this class and feel successful this year. We believe our job is to help you succeed the best you can. To help you we would like to get a head start on getting to know you. Your first assignment is to successfully send us a formal letter of introduction via Schoology. Please read the guidelines below and submit your letter by July 22nd, 2024.

1. Use clearly written, **full sentences**. Do not abbreviate words like you are texting to a friend. Use **spell check**!

   This is a professional communication like you would have with a college professor, so let's practice for your rapidly nearing future! (6 pts)

2. Address it to us: Mrs. Spalding and Mrs. Boyd (1 pt)

3. Make the **Subject**: "**Advanced Bio: Introduction to** <**Insert Your Name Here**>" (1 pt)
   a. (Do not include the quote marks or the brackets, just your name)

4. Begin the letter with a **formal salutation**, like "Dear Mrs. Boyd/Mrs. Spalding," (1 pt)

5. Now introduce yourself (your name) and tell me a little bit about yourself, like: (10 pt)
   - What do you like to do (hobbies, sports, music, interests, etc.)?
   - Do you have a job?
   - Tell me a little bit about your family (Mom? Dad? Guardian? Siblings? Pets?) What do your parents/guardian do for a living?
   - What are your plans for the future/next year/after graduation/career goal?
   - What was the last book you read for fun?
   - What are your strengths and weaknesses as a student?
   - Tell me something about yourself that you are proud of.
   - Why did you sign up for Advanced Biology (Parents, Interest, GPA, etc.)?
   - What are your greatest concerns about taking Advanced Biology?
   - What other time commitments will you have this year in addition to Advanced Biology?
   - Who was your 8th grade Physical Science teacher, list one thing you liked about the course?
   - Is there anything else you would like me to know about you?

6. End the e-mail with a **formal closing**: "Respectfully", "Sincerely", "Warm regards", etc. and add your name as if you signed a letter. (1 pt)

mailto:hboyd@auburnschools.org, wlspalding@auburnschools.org?subject=Introduction letter

Assignment #2

Digital Devices, Distraction, and Student Performance: Does In-Class Cell Phone Use Reduce Learning?

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Digital Devices, Distraction, and Student Performance: Does In-Class Cell Phone Use Reduce Learning?

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Abstract

The recent increase in use of digital devices such as laptop computers, iPads, and web-enabled cell phones has generated concern about how technologies affect student performance. Combining observation, survey, and interview data, this research assesses the effects of technology use on student attitudes and learning. Data were gathered in eight introductory science courses at a major university. Results show a significant negative correlation between in-class phone use and final grades, with use of cell phones corresponding to a drop of 0.36 ± 0.08 on a 4-point scale where $4.0 = \text{A}$. These findings are consistent with research (Ophir, Nass, and Wagner 2009, *Proceedings of the National Academy of Sciences*, 106, 15583) suggesting students cannot multitask nearly as effectively as they think they can. While 75% of students reported regular cell phone use, observation suggests undergraduates typically underreport the frequency of their in-class use of digital devices.

1. INTRODUCTION

With the advent of affordable digital devices, use of technology by students and instructors is increasing in college classrooms (Hoekstra 2009). The present work was motivated by an unpublished study of one large engineering class, which found that students who took notes on laptops earned a full letter grade lower than those who took notes with pen and paper (D. Sieber, personal communication). In that study, students were told about these results after each of three tests given during the semester, and when the laptop note-takers ceased taking notes by means of the technology, their test scores rose to match those of their peers.

While these data are suggestive of the negative effects of digital distractions for learning, this course used traditional lecture instruction, and recent research suggests active learning strategies may produce more effective learning overall (Crossgrove and Curran 2008; Smith *et al*. 2009). Many large science classes are now taught with Peer Instruction (Mazur 1997) and clickers (wireless student response systems), and the result is often much higher student engagement (Hoekstra 2008; Gauci *et al*. 2009; Deslauriers, Schelew, and Wieman, 2011) and the potential for greater learning (Smith *et al*. 2009). We undertook the present study to determine if the results from the engineering class would be replicated in a larger sample, particularly when clickers and Peer Instruction are used to stimulate engagement in the learning process.

2. METHODS AND RESULTS

Research was conducted over two semesters at a large state university in the western U.S. In the first semester, digital-device use was investigated in three large introductory courses for nonscience majors (N = 318;

Astronomy, Geology), and data gathering focused on students' in-class use of laptop computers. The following semester, the study focused on in-class use of cellular phones in five additional courses. All eight courses used iClickers^{TM} and Peer Instruction (sometimes called Think-Pair-Share) exercises to engage students. The instructors teaching the courses were asked to refrain from verbally discussing technology use and note-taking behavior with their students, and all aspects of the research were approved by the internal Human Subjects Review Board.

Utilizing a mixed-methods approach consisting of in-class observations, survey responses, and semi-structured interviews, we examined the effects of digital devices on student performance. Survey questions targeted demographics, student attitudes, and self-reported levels of technology use. The data were collected via a clicker polling system and then anonymously correlated with final course grades. A clicker system separate from that used by the instructor was brought into the classroom to collect our data, and students were assured of anonymity. Semi-structured interviews (N = 24) provided insight into student attitudes as related to behavior and the use of digital devices. In-class observations (N = 31 days) recorded the behavior of students and the instructors during lecture; this data permitted verification of students' self-reports in interviews and survey responses.

In two of the three courses observed in semester 1, lecture notes were posted for student reference: one before class and in the other, after. Survey responses indicate 60% of the sample (N = 316; 91.6% response rate) took notes with pen and paper, 12% took notes on a laptop computer or some other electronic device, and 28% reported no note taking. In the third course, the instructor did not post notes. Students' final grades were statistically indistinguishable across the three note-taking methods—we *did not* replicate the experience in the Engineering class that motivated this study. Our initial research therefore suggests that peer instruction and student engagement may play an important role in mitigating "digital distraction."

It is interesting to note that when we presented the results of the initial Sieber study (personal communication) to faculty members, many interpreted the results as suggesting that writing on paper, drawing arrows or diagrams, and underlining topics engage the brain in a more complete way than typing. When we presented the results to students, the response was uniformly, "the laptop users are getting distracted by Facebook or other things they can do during class." Our observations confirm that the student interpretation is more likely the correct one. However, we also learned that the laptop computer is no longer the device of choice for most students to bring to class.

Given recent national data confirming high rates of computer ownership (EDUCAUSE 2010) among undergraduates, the number of students who took notes on laptop computers was much lower than we expected. At the same time, our observation and survey data indicate very high rates of in-class cell phone use: 75% of the sample (anonymously) reported regular phone use during lecture. These data motivated an extension of the study into the subsequent semester, where we sought to isolate the effects of cell phone use on learning outcomes. Students in five additional classes (N = 392, all introductory astronomy) reported their frequency of in-class cell phone use, and these data were then correlated with their final course grades.

All survey data were kept anonymous and participation in this study was voluntary. Response rates across the five courses ranged from 96% to 98% of those in attendance on the day the data were collected, and the number of responses ranged from 44 in the smallest class to 111 in the largest. Results from the five courses (combined) are presented in Table 1 and Figure 1.

The average grade difference between students who use their phones at all and those who do not is 0.36 ± 0.08. Cell phone use is significantly correlated with reduced learning outcomes: students who reported no cell phone use earned significantly higher grades than those who used their phones during class.

Interestingly, those who use their phones reported an average frequency of three times per class period, yet the observation data suggest this frequency may in fact be much higher. Observation notes suggest the average frequency of cell phone use is closer to seven times per class period (N = 32 observations, average = 6.85 incidents of use per user, per class period), indicating that undergraduates typically underreport their frequency of in-class cell phone use. These data are drawn from a relatively small sample; as we do not have more comprehensive data on rates of cell phone use across all five courses, we focus on the differences between phone users and nonusers in the ensuing discussion.

Table 1. **Frequency of cell phone use vs class grade.**

	Self-reported frequency of cell phone use per 1 h class, across five Astronomy courses				
	Never	1–2 times/class	3–5	>5 times	All phone users
Number of students	93	175	66	58	299
Mean—all five courses	3.26	2.96	2.86	2.81	2.91
Standard deviation	0.68	0.80	0.84	0.66	0.79
Standard deviation of mean	0.07	0.06	0.10	0.09	0.05

The difference in final grades between phone users and nonusers is highly statistically significant, but causality cannot be determined from this data. It could be that students who are already more disciplined are more likely to turn their phones off during class or that students who are busier outside of class are more likely to *use* their phones in class. Still, the observation and interview data suggest many undergraduates likely overestimate their ability to multitask. If students miss some instruction while engaging with digital devices, they may end up earning lower grades overall.

This conclusion is consistent with a recent finding that Stanford undergraduates consistently overestimate their ability to multitask (Ophir, Nass, and Wagner 2009). In our interviews, students argued both for and against the ability to multitask effectively: "I could probably take notes on a computer, but I don't [because] it's really easy to be doing other things in class than taking notes." "I feel phones can definitely be a distraction if you let them, but if you're using your phone when you have a minute between taking notes or while the professor is going back and discussing something… I don't find my phone distracting [then]."

This issue will become increasingly important for teachers as more and more students come to class with Internet-capable handheld devices (EDUCAUSE 2010). On the bright side, our observation data suggest the use of clickers and peer instruction may mitigate distractions due to digital devices. We observed several occasions in which students stopped using their computers and cellular phones (for noncourse related purposes) when clicker questions were used. Yet the drive to multitask is strong, as confirmed by our interviewees: "I think I'll still bring [my laptop] to class, but I'll probably have to close all the applications except for [Microsoft] Word, that way I won't be tempted… If they're open, it's just so easy to go over there and come back." "It's just staying connected. I know if I look at my phone, there's a good chance someone's gonna want to know if I want to [meet up] after class…there's an email, I can check my horoscope. I could do something else right now."

3. DISCUSSION

This research is limited by a single institutional context; further investigation is needed to determine whether these findings apply to learning behavior in other disciplines and across educational contexts. In particular, research might address how in-class use of digital devices is detrimental to the learning of *others*, in addition to

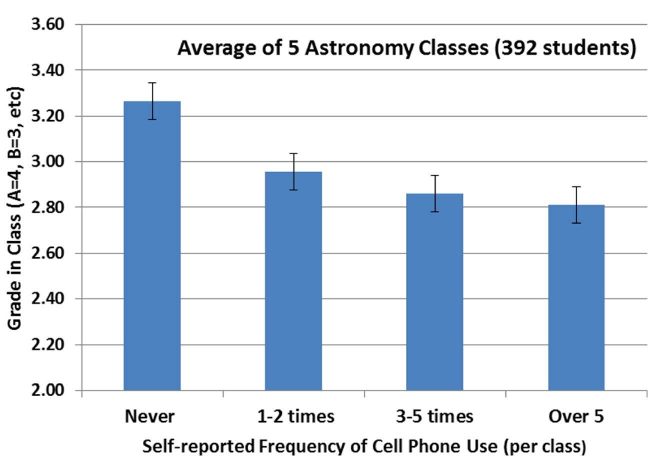

Figure 1. Self-reported frequency of cell phone use vs final grade.

affecting individual students. When asked on the survey, just 32% of this sample found cell phone use by other students distracting, but this number increased to 46% when asked about the distraction-causing potential of other students' use of laptop computers. While it seems reasonable to assume that laptops would be more likely to distract other students than cell phones (given the larger size of laptop display screens), observation confirms many more students use cell phones regularly during class than they do laptop computers.

Digital devices may be more likely to distract students in large, nonmajor courses such as the ones studied here. Future studies might seek to replicate these findings in major- and upper-level courses where class sizes are smaller and students may be more committed to doing well. Also important for teaching faculty, the survey data confirm students do not necessarily believe in-class cell phone use is disrespectful. Across the five courses, 47% of students agreed that in-class cell phone use is "somewhat disrespectful, but it depends on the instructor's policy." Many students in this generation have their cell phones with them 24 h a day, and some claimed in interviews that if a professor does not openly ban cell phone use, it is the student's right to use their phone. These data imply that in today's classrooms, there is be an even greater need than in the past for instructors to clearly state their policies concerning student use of digital devices.

Acknowledgments

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Advanced Biology Summer Work 2024 (Spalding/Boyd)

What was the Title of the Article:
Summary of article in own words of article no less than 300 words.
Identify the Following: Independent Variable, Dependent variable, Constants, Potential Errors

What was the conclusion found:
Possible implications in daily life/community:
What other topics/areas of interest that could be explored after reading this article? What further research could be done based on what you learned?

Assignment #3

Design an Experiment

You will design a simple experiment that you can complete at home. What we call kitchen science. It can be any experiment of your choice as long as no living organisms are harmed (including yourself) and it does not put anyone/thing in danger. Good experiments have replications, you must do more than one day's worth of collection. Anything less than a couple of weeks isn't much data. You will use your phone/camera/ipad to document your progress. Your experiment must be an experiment!! Not a model. Ex. How numbers of hours slept impacts the number of push-ups per day for the month of June. **Your experiment must be recorded and graphed with a conclusion. Identify the independent variable, dependent variable, and constants for your experiments.**

Use the link below to create your FlipGrid that summarizes your experiment

If you do not have access to technology you will need to make a notebook/folder with your experiment design, pictures documenting what you did, data collection, graph and charts you use to show your results, conclusion paragraph for what you found. This will need to be turned in on the first day of class.

Assignment #4

Unmanned spacecraft taking images of Jupiter's moon Europa have found its surface to be very smooth with few meteorite craters. Europa's surface ice shows evidence of being continually resmoothed and reshaped. Cracks, dark bands, and pressure ridges (created when water or slush is squeezed up between 2 slabs of ice) are commonly seen in images of the surface. Two scientists express their views as to whether the presence of a deep ocean beneath the surface is responsible for Europa's surface features.

Scientist 1

A deep ocean of liquid water exists on Europa. Jupiter's gravitational field produces tides within Europa that can cause heating of the subsurface to a point where liquid water can exist. The numerous cracks and dark bands in the surface ice closely resemble the appearance of thawing ice covering the polar oceans on Earth. Only a substantial amount of circulating liquid water can crack and rotate such large slabs of ice. The few meteorite craters that exist are shallow and have been smoothed by liquid water that oozed up into the crater from the subsurface and then quickly froze.

Jupiter's magnetic field, sweeping past Europa, would interact with the salty, deep ocean and produce a second magnetic field around Europa. The spacecraft has found evidence of this second magnetic field.

Scientist 2

No deep, liquid water ocean exists on Europa. The heat generated by gravitational tides is quickly lost to space because of Europa's small size, as shown by its very low surface temperature (–160°C). Many of the features on Europa's surface resemble features created by flowing glaciers on Earth. Large amounts of liquid water are not required for the creation of these features. If a thin layer of ice below the surface is much warmer than the surface ice, it may be able to flow and cause cracking and movement of the surface ice. Few meteorite craters are observed because of Europa's very thin atmosphere; surface ice continually sublimes (changes from solid to gas) into this atmosphere, quickly eroding and removing any craters that may have formed.

Which of the following best describes how the 2 scientists explain how craters are removed from Europa's surface?

A. Scientist 1: Sublimation, Scientist 2: Filled by water.
B. Scientist 1: Filled in by water, Scientist 2: Sublimation
C. Scientist 1: Worn smooth by wind, Scientist 2: Sublimation
D. Scientist 1: Worn smooth by wind, Scientist 2: Filled in by water.

2

Passage III

A student performed 2 studies to investigate the factors that affect the germination of peony seeds.

Study 1

Peony seeds were placed in dry containers. Some of the containers were stored at 5°C for either 4, 6, 8, or 10 weeks. The temperature and time periods were defined as the *storage temperature*and the *storage period*, respectively.

The peony seeds were divided evenly so that there were 20 sets of 25 seeds. Twenty petri dishes were then prepared. Each contained damp paper. Each set of seeds was placed in a separate petri dish. Each petri dish was maintained at 1 of 4 temperatures for 30 days. The temperature and time periods were defined as the *germination temperature* and the *germination period*, respectively. Table 1 shows the number of seeds that germinated in each dish.

In general, the results of Study 1 suggest that peony seeds that are placed in a petri dish containing damp paper are most likely to germinate when they are maintained at which of the following temperatures?

Table 1

Storage period (weeks)	Number of peony seeds that germinated when maintained at a germination temperature of:			
	13°C	18°C	23°C	28°C
0	0	0	0	0
4	0	2	0	0
6	3	8	6	0
8	7	22	18	0
10	15	24	21	1

A. 13 C
B. 18 C
C. 23 C
D. 28 C

3

Passage IV

Spent fuel (SF), a radioactive waste, is often buried underground in canisters for disposal. As it decays, SF generates high heat and raises the temperature of the surrounding rock, which may expand and crack, allowing radioactivity to escape into the environment. Scientists wanted to determine which of 4 rock types—rock salt, granite, basalt, or shale—would be least affected by the heat from SF.

The thermal conductivity (how well heat is conducted through a material) and heating trends of the 4 rock types were studied.

Study 1

Fifty holes, each 0.5 m across and 20 m deep, were dug into each of the following: a rock salt deposit, granite bedrock, basalt bedrock, and shale bedrock. A stainless steel canister containing 0.4 metric tons of SF was buried in each hole. The rock temperature was measured next to each canister after 1 year had passed. The results are shown in Table 1, along with the typical thermal conductivity of each rock type, in Watts per meter per °C (W/m°C), at 25°C. The higher the thermal conductivity, the more quickly heat is conducted through the rock and away from the canisters.

According to the results of Study 1, which of the following best describes the relationship between thermal conductivity and rock temperature? As thermal conductivity increases, the rock temperature recorded adjacent to buried SF canisters:

Table 1

Rock	Thermal conductivity (W/m°C)	Rock temperature (°C)*
Rock salt	5.70	110
Granite	2.80	121
Basalt	1.26	165
Shale	1.57	146

*All rock types had an initial temperature of 10°C.

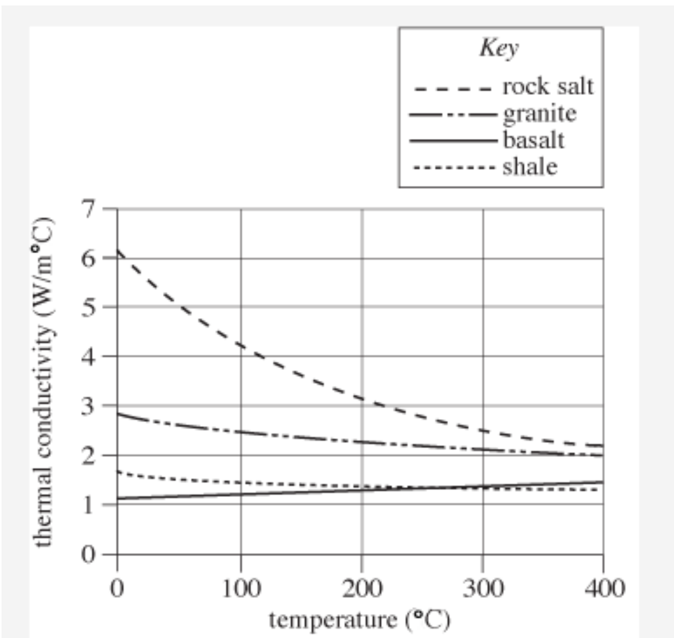
A. decreases only.
B. increase only.
C. Increase, then decrease.
D. remain the same.

4

Study 2

The scientists determined the thermal conductivity of the 4 rock types at a number of different temperatures between 0°C and 400°C. The results are shown in Figure 1.

According to Study 2, the thermal conductivity of rock salt measured at a temperature of 500°C would be closest to which of the following values?



A. 1.0 W/m°C
B. 2.0 W/m°C
C. 3.5 W/m°C
D. 4.0 W/m°C

5

Passage III

A group of students conducted three experiments to study the enzyme catalase, which is found in the cells of most organisms. Catalase increases the rate of the decomposition of hydrogen peroxide, H2O2, which can be toxic and harmful to the organism. The decomposition of hydrogen peroxide produces oxygen gas and liquid water, as shown in Equation 1:

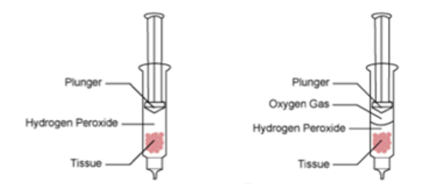
Equation 1:

$H_2O_2 (aq) \rightarrow H_2O (l) + O_2(g)$

Experiment 1

Eight tissue samples were tested to determine the relative amount of catalase in the cells of each type of tissue. Each tissue sample was placed into a syringe, and the plunger of the syringe was pushed in as much as possible without compressing the tissue sample. Equal volumes of 3% hydrogen peroxide were drawn into the syringe, and then the syringe was sealed. The syringes with tissue and peroxide were left overnight. The gas produced pushed the plunger of the syringe, allowing for a change in volume to be measured.

Which of the following conclusions are supported by the results of experiment 1?



Initial syringe containing only tissue sample and hydrogen peroxide.

Final syringe containing tissue sample, hydrogen peroxide, and gas.

The volume of the contents of each syringe was measured to determine the amount of gas produced.

Table 1

Type of Tissue	Initial Volume of Syringe Contents	Final Volume of Syringe Contents	Change in Volume of Syringe Contents
Sliced raw potato	21	43	22
Yeast	20	54	34
Raw liver	22	74	52
Raw ground meat	20	50	30
Baked potato	22	31	9
Cooked liver	21	56	35
Green leaves	20	44	24
Sliced raw carrot	23	49	26

A. Plant tissues contain more catalase than animal tissues.

B. l tissues contain about the same amount of catalase.

C. Liver contained the least amount of catalase.

D. Cooked tissues do not contain as much catalase as raw tissues

6

Passage III

Experiment 2

Factors affecting the catalase activity were studied using yeast as the source for the catalase enzyme. Small disks of filter paper were soaked in a yeast solution. Ten milliliters of 1% hydrogen peroxide solution was added to five test tubes. One change was applied to each of five test tubes, as listed in Table 2. After enough oxygen was produced by the catalase enzyme within the paper disk, the disk floated to the surface of the solution. The time required for the disk to float to the top of the solution was measured and recorded.

In experiment 2, what additional change could be tested for its effect on catalase activity?

Table 2

Applied Change	Effect on Solution	Time Required for Paper disk to Float (s)		
		Trial 1	Trial 2	Trial 3
Addition of 20 drops of acid	Increased acidity	33	32	33
Addition of 20 drops of base	Increased basicity	45	46	51
Placed into ice bath	Decreased Temperature	63	60	59
Placed into hot water bath	Increased temperature	29	28	25
Addition of 10 grams of salt	Increased salinity	40	42	45

A. Addition of sugar
B. Addition of salt
C. Change in pH
D. Change in temperature

7

Passage III

Experiment 2

Factors affecting the catalase activity were studied using yeast as the source for the catalase enzyme. Small disks of filter paper were soaked in a yeast solution. Ten milliliters of 1% hydrogen peroxide solution was added to five test tubes. One change was applied to each of five test tubes, as listed in Table 2. After enough oxygen was produced by the catalase enzyme within the paper disk, the disk floated to the surface of the solution. The time required for the disk to float to the top of the solution was measured and recorded.

Based on experiment 2, how much time is needed for enough oxygen to be produced by the yeast to make the filter paper buoyant in acidic conditions?

Table 2

Applied Change	Effect on Solution	Time Required for Paper disk to Float (s)		
		Trial 1	Trial 2	Trial 3
Addition of 20 drops of acid	Increased acidity	33	32	33
Addition of 20 drops of base	Increased basicity	45	46	51
Placed into ice bath	Decreased Temperature	63	60	59
Placed into hot water bath	Increased temperature	29	28	25
Addition of 10 grams of salt	Increased salinity	40	42	45

A. 20 seconds
B. 30 seconds
C. 40 seconds
D. 45 seconds

8

Passage III

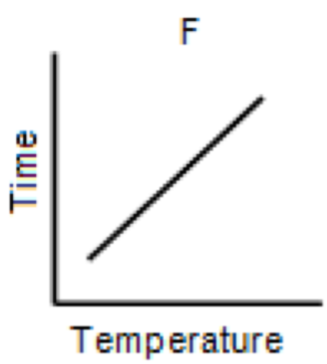
Experiment 3

Experiment 2 was repeated, but only the temperature was varied. The test tubes of hydrogen peroxide were placed into water baths of varying temperatures. The yeast-soaked paper disks were placed into the test tubes of hydrogen peroxide after the test tubes sat in the water bath for ten minutes. The time required for the paper disk to float to the surface due to the production of oxygen is shown in Table 3.

Which graph best represents the results of experiment 3?

Table 3

Temperature of Water Bath (°C)	Time Required for Paper Disk To Float (sec)
20	56
27	45
35	42
44	36
52	29
69	Did not float
73	Did not float



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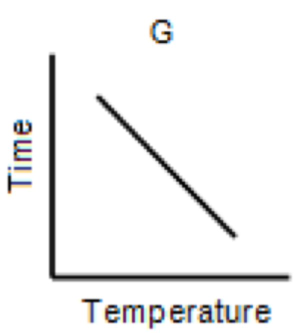

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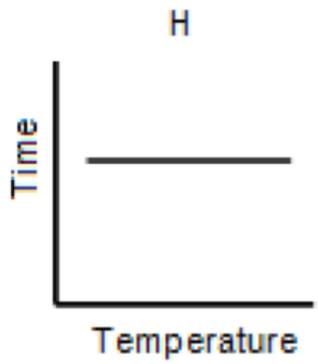

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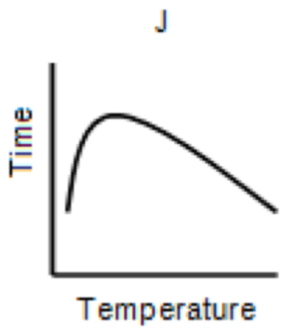

J

9

Passage III

Why were the test tubes in the water bath for ten minutes?

F. The hydrogen peroxide only begins to decompose after ten minutes.
G. To allow time to prepare other materials.
H. To allow enough time for heat to be transferred from the water to the hydrogen peroxide until the temperatures are the same.
J. There is no specific reason for this action.

10

Passage III

Hydrogen peroxide is often used as a bleaching agent. It has been suggested that hydrogen peroxide produced within the body leads to gray hair. Considering this, what food might be suggested to prevent gray hair?

A. Potatoes
B. Carrots
C. Liver
D. Dark green vegetables

11

Conflicting Viewpoints

The presence of gases in earth's atmosphere is a constant. Certain gases can absorb and hold onto heat from their environment. These gases are typically comprised of three molecules held together tenuously, which causes them to vibrate when they absorb heat. The motion of their vibrations leads to the release of their stored heat to the outside environment. The heat they release is typically quickly absorbed by other similar gases nearby. These gases remain in earth's atmosphere for a long time after being introduced. Because of this they can trap heat within the atmosphere, preventing it from leaving, by absorbing heat and releasing heat to be absorbed by other nearby similar gases.

Hypothesis 1

Gases such as methane and nitrous oxide trap heat in the earth's atmosphere. Trapping heat in the earth's atmosphere leads to a greenhouse effect, gradually increasing the temperature of the earth. This increase in the earth's temperature will lead to the melting of glaciers, increasing sea level.

Hypothesis 2

Gases such as methane but not nitrous oxide trap heat in the earth's atmosphere. The heat methane traps in the earth's atmosphere is less than the heat that escapes the earth leading to a global cooling effect, gradually decreasing the temperature of the earth. This decrease in earth's temperature will lead to the development of more glaciers, decreasing sea level.

Hypothesis 3

Gases such as nitrous oxide but not methane trap heat in the earth's atmosphere. The heat nitrous oxide traps in the earth's atmosphere is equal to the heat that escapes the earth leaving the temperature of the earth generally unchanged. The earth's environment will remain largely unchanged by the heat trapping properties of nitrous oxide.

Which hypothesis, if any, asserts that the effect on temperature of heat trapping gases is negligible?

A. Hypothesis 1
B. Hypothesis 2
C. Hypothesis 3
D. None of the above

12

Conflicting Viewpoints

The presence of gases in earth's atmosphere is a constant. Certain gases can absorb and hold onto heat from their environment. These gases are typically comprised of three molecules held together tenuously, which causes them to vibrate when they absorb heat. The motion of their vibrations leads to the release of their stored heat to the outside environment. The heat they release is typically quickly absorbed by other similar gases nearby. These gases remain in earth's atmosphere for a long time after being introduced. Because of this they can trap heat within the atmosphere, preventing it from leaving, by absorbing heat and releasing heat to be absorbed by other nearby similar gases.

Hypothesis 1

Gases such as methane and nitrous oxide trap heat in the earth's atmosphere. Trapping heat in the earth's atmosphere leads to a greenhouse effect, gradually increasing the temperature of the earth. This increase in the earth's temperature will lead to the melting of glaciers, increasing sea level.

Hypothesis 2

Gases such as methane but not nitrous oxide trap heat in the earth's atmosphere. The heat methane traps in the earth's atmosphere is less than the heat that escapes the earth leading to a global cooling effect, gradually decreasing the temperature of the earth. This decrease in earth's temperature will lead to the development of more glaciers, decreasing sea level.

Hypothesis 3

Gases such as nitrous oxide but not methane trap heat in the earth's atmosphere. The heat nitrous oxide traps in the earth's atmosphere is equal to the heat that escapes the earth leaving the temperature of the earth generally unchanged. The earth's environment will remain largely unchanged by the heat trapping properties of nitrous oxide.

According to the author of hypothesis 2, would it be possible for earth's temperature to increase if the amount of heat methane traps in the atmosphere increased?

Yes, the hypothesis claims that increasing the quantity of heat will subsequently increase the quantity of heat nitrous oxide will trap.

Yes, the hypothesis claims methane isn't currently trapping a sufficient quantity of heat

No, the hypothesis claims the sea level will decrease

No, the hypothesis claims the temperature will decrease

13

Researchers studied sprinting ability to better understand differences between individuals in performance. After completion of the first study, researchers performed two follow up studies to explore the movement economy of and physiological response to sprinting. The same five subjects were used for each study.

Study 1

Five healthy adult subjects with similar body weight and height were familiarized with the sprinting technique. Each subject was instructed to sprint as fast as they could in a linear path for 20 yards. Infrared timing gates were placed at 5 yards (G1), 10 yards (G2), 15 yards (G3), and 20 yards (G4) into the route to record timing and later extrapolate speed.

In Study 1, which subject traveled fastest between G3 and G4?

	G1 (seconds)	G2 (seconds)	G3 (seconds)	G4 (seconds)
Subject 1	0.98	1.71	2.45	3.49
Subject 2	0.88	1.63	2.42	3.51
Subject 3	0.93	1.65	2.39	3.47
Subject 4	1.24	2.01	2.88	3.94
Subject 5	1.11	1.83	2.66	3.72

Figure 1

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

14

Scientists want to see how any athlete's heart health is different from others. The scientists monitor four individual's (A, B, C and D) heart rates during sleep, rest and intense exercise. Only one athlete was tested and the data was recorded in the table below in heart beats per minute.

Which individual has the best overall fitness?

	Sleep	Rest	Exercise
A	55	62	195
B	72	76	182
C	80	89	168
D	78	83	173

A. Individual A
B. Individual C
C. Individual A and B
D. Not enough information

15

I understand that ACT prep is a regular part of Advanced Biology and is for practice purposes only.

A. Yes
B. No

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